Florida's Wildlife Legacy Initiative

Comprehensive Wildlife Conservation Strategy

Florida Fish and Wildlife Conservation Commission

Planning for the Future for Florida's Wildlife

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Foreword

Florida is home to an amazing array of fish, wildlife, and the habitats in which they live and thrive. With over 700 terrestrial animals, more than 200 freshwater fish, more than 1,000 marine fish, numerous other aquatic and marine vertebrates, and many thousands of terrestrial insects and other invertebrates, Florida literally is teeming with wildlife. These multitudes of species are dependent upon the highly productive natural systems of Florida, ranging from the tropical coral reefs of the Keys and the magnificent Everglades "river of grass" to the awe-inspiring array of first magnitude springs and quiet beauty of the rolling sand hills. Florida also is home to more than 17 million people, 1,250 golf courses, 370,000 hotel rooms, and has a gross state product of more than $490 billion. At first glance, it would seem that these two worlds would be incompatible, but the impressive thing about Florida is that there is room for both humans and wildlife; it just takes careful action to find the appropriate balance. This type of considered coexistence is what Florida's Wildlife Legacy Initiative and Comprehensive Wildlife Conservation Strategy are all about.

The goal of the Initiative is to sustain the vast and wonderful fish and wildlife resources of the state for the enjoyment and use of our citizens and visitors through implementation of a sound comprehensive strategy, development and expansion of cooperative partnerships, and strategic use of State Wildlife Grants to leverage greater resources. The aim is to achieve this goal proactively through a voluntary, incentive-based process that clearly identifies what needs to be done and enables action by those best suited to undertake it.

With creation of the State Wildlife Grants Program, Congress has challenged each state and territory to craft a comprehensive strategy that conserves the broad array of wildlife and habitats within its boundaries. This effort is a pioneering undertaking at the national level that has been years in the making. Starting with early nongame endeavors and growing into wildlife diversity programs and the Teaming With Wildlife coalition, these efforts have culminated in the State Wildlife Grants Program and the comprehensive strategies being developed and implemented across the country. Although a national effort, strategies are being developed by each state and territory individually so that they will be tailored to the unique resources and circumstances of each. Florida has enthusiastically embraced this challenge by developing Florida's Wildlife Legacy Initiative.

The Florida Fish and Wildlife Conservation Commission (FWC) is committed to a transformation that will take us from being a good wildlife conservation agency to being a great one. Having a comprehensive strategy that builds a common blueprint for conserving our fish and wildlife provides a path for all of Florida to follow on a similar quest for excellence in stewardship of our natural resources. While the effort needed is great and challenges must be overcome, the benefits of achieving continued improvement are profound. Only through striving to achieve and through successful partnering at all levels can we reach our full potential. I encourage and challenge everyone to stay engaged and assist us in this effort to develop and implement the best strategy possible. As we travel this course, we will continue to review the strategy, evaluate effectiveness, and revise it as part of our ongoing update process. Whether we succeed or fail at this endeavor will be determined less by how much the FWC alone can do, and more by how

effective we all become at building the meaningful partnerships that will be needed to take advantage of the often elusive but very tangible conservation opportunities at hand and on the horizon.

The incredible resources that support our magnificent fish and wildlife also support fishing and hunting, nature viewing, recreational activities, boating, and commercial enterprises. The combined revenues from these activities exceed $25 billion in value annually, helping to form the foundation of Florida's economy. There is no denying that the economic prosperity, quality of life, and satisfaction of Floridians and the large number of visitors to our great state all are dependent upon a healthy environment. Florida's Wildlife Legacy Initiative and comprehensive strategy are geared toward finding the delicate balance between human needs and the needs of our fish and wildlife resources.

Kenneth D. Haddad
Executive Director

Executive Summary

The primary support and focus for wildlife conservation and management within the United States historically has come from state hunting and fishing interests and Federal Assistance programs for game species under the Pittman–Robertson, Dingle–Johnson, and Wallop–Breaux Acts. Additionally, the Endangered Species Act has provided support to recover federally threatened and endangered species. Although these programs have been successful, the majority of wildlife species have unmet conservation needs and many are at risk of becoming imperiled. Waiting until a species is on the verge of extinction and then trying to recover it is costly and results in the inevitable loss of some species. To encourage a new conservation paradigm and work towards managing species before they become imperiled, the U. S. Congress created the State Wildlife Grants Program. This program is dedicated to a holistic approach that includes all species, but is centered on conservation of species that have not fallen under historical efforts. As a requirement of participating in the State Wildlife Grants Program, the Florida Fish and Wildlife Conservation Commission (FWC) has joined the other 55 states, territories, and district by committing to develop a Comprehensive Wildlife Conservation Strategy (Strategy) for the state.

To meet the intent of the State Wildlife Grants Program, the FWC has created Florida's Wildlife Legacy Initiative (Initiative). The goal of the Initiative is to develop a strategic vision for conserving all of Florida's wildlife. The three main objectives of the Initiative are: (1) to create partnerships for wildlife conservation across the State of Florida; (2) to support partnership building and use of the Strategy by making funding available through Florida's State Wildlife Grants Program; and (3) to develop and implement Florida's Strategy. Thousands of experts and stakeholders have participated and provided input to meet these objectives. These partners, including representatives from other state and federal agencies, organizations, businesses, and individuals, have been integral throughout the Strategy development process.

As discussions and work have progressed on planning, development, and implementation of Florida's Wildlife Legacy Initiative, several major premises have been employed and incorporated throughout the Strategy:

- The goal of Florida's Strategy is to build a blueprint and action plan for conserving the vast array of wildlife that makes Florida such a unique place to live and visit. This blueprint should be compatible with human needs and not preclude recreational or other use of wildlife resources and landscapes.

- Florida already has developed and implemented significant wildlife resource management tools and programs. The Strategy has been designed to build upon these efforts in a cumulative manner, identify gaps and further needs, and create a comprehensive vision for coordinating efforts across the state.

- Florida's Strategy uses a habitat category approach to arrange wildlife species and habitats, and the conservation threats and actions needed to conserve them, into meaningful and manageable categories. By taking actions that sustain the health and integrity of the habitat categories, the broad array of wildlife that lives within each will be conserved and maintained.

- The Strategy encompasses the entire state and therefore is too broad for any one individual, group, or agency to develop and implement. Coordination and cooperation among federal and state agencies, local governments, Native American tribes, non-governmental organizations, private entities, and individuals is essential.

- A non-regulatory approach is paramount to create partnerships for implementation of actions needed to conserve wildlife. The Strategy focuses on voluntary and cooperative efforts providing a starting point to develop non-regulatory mechanisms. The Strategy is not regulatory in nature and is not intended to be used in a regulatory manner.

- Meeting the needs of wildlife will mean a healthier environment for future generations of Floridians. Florida faces a huge challenge to meet the needs of an expanding human population while conserving wildlife resources.

- Education has played a vital role in conservation of Florida's wildlife and other natural resources. Support for conservation education is needed to promote awareness, responsible action and behavior.

- The Strategy should clearly meet or exceed the eight elements required under the State Wildlife Grants Program and federal guidance.

The Strategy is organized in chapters, which follow a progression of thought and content development. The Introduction, Approach, and State of the State form the beginning section of the Strategy. The Introduction briefly outlines what the effort is and provides context for how it has been undertaken in Florida. The Approach summarizes the processes that were carried out in order to develop the Strategy, including organizational structure and methods specific to each Strategy requirement. The State of the State provides a discussion of Florida's natural resources, including economics, wildlife species, and conservation resources.

Florida's Strategic Vision forms the central section of the Strategy and synthesizes a strategic view for wildlife conservation at the statewide-level. Priority conservation issues are addressed in this chapter, including species, habitats, threats, actions, data gaps, monitoring tools, and conservation challenges. Species form the basis for Florida's entire endeavor and focus should continually be placed back upon them as the Strategy is implemented and reviewed. Several habitats have been highlighted for their importance and generally were associated with coastal, wetland, upland pine, reef, and submerged aquatic vegetation areas. Major statewide threats identified include: habitat loss and fragmentation, degradation of water resources, incompatible fire management, invasive plants and animals, and management of the physical environment (e.g., dams, shoreline hardening, dredging, etc.). Major statewide actions developed to abate these threats include: development of incentive-based programs for conservation, acquisition of important lands

and waters, coordination of conservation efforts, public education, and development of a cooperative conservation effort. Priority data gaps to be filled focus on improved habitat mapping capability, filling species information needs, improving understanding and methodology for marine systems, and initiation of more efforts related to genetic diversity issues. Monitoring and adaptive management are focused on species, habitat, threat, and overall Strategy levels and will be critical to documenting success and refining efforts. Lastly, key conservation challenges such as partnership development, information management, and public awareness must be met and overcome for efforts to be successful.

The chapters on Species of Greatest Conservation Need (SGCN), Habitats, and Multiple Habitat Threats and Conservation Actions form the final and most extensive section of the Strategy. The SGCN chapter identifies 974 species of interest and lists their status and trends. The Habitats chapter describes 45 terrestrial, freshwater, and marine habitat categories that comprise the state of Florida. These habitat category descriptions include information on their status and trends, associated SGCN, related threats, and conservation measures needed. Additionally, the chapter Multiple Habitat Threats and Conservation Actions lists threats that apply to greater than five habitats and the suite of actions to abate each threat. Last, the Strategy contains Acknowledgements, References/Literature Cited, a Glossary of Acronyms, a Glossary of Terms, and four Appendices.

Florida's Strategy is a strategic vision of the integrated conservation efforts needed to sustain the broad array of wildlife in the state. More detailed operation-level plans will be needed to complete many of the actions identified in the Strategy. Such plans should be developed by the appropriate entities whose interest, authority, or responsibility encompass each action. Although the Strategy is not intended to be a work or management plan for the FWC or any other organization, support provided by the State Wildlife Grants Program will enable coordination and implementation of many projects through Florida's Wildlife Legacy Initiative. The Strategy is a work in progress that will continually be updated, revised, and improved based on the input and deliberations of all those interested in wildlife conservation. Working together, Floridians can shape a future that is filled with the wonderful wildlife resources that define this great state and provide for the enjoyment, recreation, sustenance, and livelihood of its citizens and visitors.

Introduction

Historically, wildlife management has focused on game species, primarily because those species have dedicated funding sources from fees and taxes paid by hunters and anglers. In recent decades, threatened and endangered species have received funding from the Endangered Species Act; however, the recovery of listed species has been costly and the number of listed species has doubled in the past 10 years. As the number of species reaching imperiled status increases, it has become clear that a more comprehensive approach needs to be taken for wildlife conservation. The U.S. Congress has helped address this need by creating the State Wildlife Grants Program under the U.S. Fish and Wildlife Service. The program was developed with support from the Teaming With Wildlife Campaign, a bipartisan coalition with the goal of expanding funding for state wildlife conservation. The State Wildlife Grants Program has provided funding to states and territories to support cost-effective conservation aimed at averting future wildlife declines and keeping common species common. Funds appropriated under the State Wildlife Grants Program are apportioned according to a formula that takes into account each state's land area and population.

As a requirement for participating in the State Wildlife Grants Program, each state and territory has created a Comprehensive Wildlife Conservation Strategy (Strategy) for conservation of a broad array of fish and wildlife. Throughout the development process, the objectives were to identify species of greatest conservation need and their habitats, and to develop high-priority conservation actions to abate problems for those species and habitats. These objectives have been developed in a prudent effort to prevent declines before species become imperiled thereby saving millions of tax dollars. In addition, the matching requirement has encouraged partnerships and cooperation among conservation partners.

Requirements

Through the State Wildlife Grants Program legislation, Congress has identified eight required elements for each state's Strategy. Strategies must identify and provide for:

(1) Information on the distribution and abundance of species of wildlife, including low and declining populations as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of Florida's wildlife;

(2) Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1);

(3) Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;

(4) Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions;

(5) Proposed strategies for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions;

(6) Descriptions of procedures to review the State Strategy at intervals not to exceed 10 years;

(7) Strategies for coordinating the development, implementation, review and revision of the State Strategy with Federal, state, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats; and

(8) Provisions to ensure public participation in the development, revision and implementation of projects and programs.

Florida's Wildlife Legacy Initiative

The Florida Fish and Wildlife Conservation Commission (FWC) has created Florida's Wildlife Legacy Initiative (Initiative) in order to meet the intent of the State Wildlife Grants Program. The goal of the Initiative has been to develop a strategic vision for conservation of all of Florida's wildlife. The three main objectives of the Initiative have been: (1) to create partnerships for wildlife conservation across the State of Florida; (2) to support partnership building and use of the Strategy by making funding available through Florida's State Wildlife Grants Program; and (3) to develop and implement Florida's Strategy.

Partnership Development

The FWC has committed to building partnerships by working with a broad array of public and private entities with an interest in wildlife management and conservation. Florida's Wildlife Legacy Initiative has not intended to be used as the basis or support for new or expanded regulations but has been a non-regulatory effort designed to create partnerships for on-the-ground implementation of actions needed to conserve wildlife. Partners, including representatives from other state and federal agencies, organizations, businesses, and individuals, have been integral throughout the Strategy development process. Partners have contributed information about species, habitats, threats, and conservation actions. The Strategy has been a stimulus to engage partners to strategically think about their individual and coordinated roles in conservation efforts throughout Florida. Cooperative implementation of the Strategy has strengthened existing partnerships and has forged new opportunities to expand existing resources for wildlife conservation.

Florida's State Wildlife Grants Program

The purpose of Florida's State Wildlife Grants Program (Grants Program) has been to fund projects that benefit Florida's wildlife and their habitats through implementation of the Strategy. In

conjunction with matching support from other sources, the Grants Program has been an important resource for wildlife conservation efforts in Florida. Projects funded under the Grants Program have included data gaps, conservation actions, and partnership-building opportunities identified in the Strategy or through its development. Certain actions or identified needs contained in the Strategy have been limited or restricted from receiving State Wildlife Grant funds under the federal guidance (e.g. education and law enforcement). In addition, the federal guidelines have directed states to consider the relative level of funding available for species. Under the Grants Program, game, sport fish, or endangered species projects have not been excluded but they have not been given priority because those species already have federally dedicated funding sources. The Grants Program has focused on multiple-species or habitat-level projects aimed at keeping common species common and preventing future declines in wildlife populations. Additional information about the Grants Program has been posted at http://myfwc.com/wildlifelegacy/grantfunding.

Comprehensive Wildlife Conservation Strategy

The Strategy has set a plan of action for conserving all of Florida's fish and wildlife. The Strategy has been written with the intent to be used by anyone with an interest in wildlife conservation. Although the FWC has led the Strategy development process, hundreds of scientific experts and stakeholders have provided input throughout the document. The Strategy has addressed conservation issues, management needs, and implementation priorities. The Strategy has been designed to be adaptive through the process of development, implementation, monitoring, and adjusting future efforts. As part of Strategy implementation, the FWC has led efforts to ensure that the Strategy will be regularly reviewed to guarantee its long-term success.

Definition of Wildlife

The Strategy has encompassed the broad array of Florida's native wildlife including vertebrate and invertebrate species in aquatic (i.e., freshwater, estuarine, and marine) and terrestrial habitats. Wildlife has been defined as "any species of wild, free-ranging fauna including fish." Wildlife also has included "fauna in captive breeding programs the object of which is to reintroduce individuals of a depleted indigenous species in a previously occupied range" (FWC 2002b).

Habitat-based Approach

Traditionally, wildlife conservation efforts have been conducted with a species-by-species approach; since the Strategy has listed more than 900 targeted species, this traditional approach has not been feasible. In addition, implementation of actions on an individual species basis alone would fail to protect Florida's diverse wildlife and their habitats. Since many of the factors that threaten these species have been contributed to their habitat, it has been practical and advantageous to take a habitat-based approach within the Strategy. This approach must be balanced with species-specific efforts when needed to effectively address conservation of species.

Habitats have been categorized to tactically represent Florida's terrestrial, freshwater, and marine ecosystems. The objective has been to represent Florida's diverse habitats in a spatially explicit manner. This approach, however, has not accounted for the interaction and interdependency of terrestrial, freshwater, and marine habitats. Dividing Florida's landscape into

habitat categories may present limitations in the future but this strategic-level approach has been imperative for initiating a comprehensive approach to conserve Florida's wildlife.

Non-regulatory Approach

The focus of the Strategy has been conservation of wildlife through voluntary and cooperative efforts. Controversial issues that affect wildlife have been identified by many experts and citizens, and these issues have challenged the interests of many stakeholders who would resist further regulation. But the Strategy has not proposed regulatory responses, nor has the FWC intended for it to be used to support new regulations. Instead, the Strategy has provided a starting point to explore these issues and the opportunity to cooperatively develop non-regulatory action. Actions have been proposed in the form of incentive programs, public-private partnerships, improved coordination of existing activity within and among agencies, and private citizen action. The Strategy also has been the stimulus to develop new, previously unrecognized voluntary actions for wildlife and habitats. The success of this approach has been dependent upon the support of numerous partners and their willingness to participate. By articulating and encoding the legitimacy of non-regulatory actions, the Strategy can become the basis for cooperative and incentive-driven actions for wildlife conservation.

Accountability

The Strategy has been developed for all of the state's wildlife; thus, implementation has required a large cooperative effort. Partners have been encouraged to implement actions from the Strategy if the actions have aligned with their authority, mission, and goals. The Strategy has conservation actions that typically fall under the jurisdiction of the FWC, other agencies, or organizations, and many of those parties have been listed as potential partners for those actions. The FWC has not intended for the inclusion of those parties to imply their accountability for implementing the actions. Success of the Strategy has been dependent upon voluntary cooperation of partners from diverse interests in Florida's wildlife conservation.

Florida's Approach to Meeting the Eight Required Elements

The Florida Fish and Wildlife Conservation Commission (FWC) adopted a theme of partnership and public cooperation in the development of this Strategy. The wide array of partners, stakeholders, and the public who participated, as well as the conservation planning resources used to develop this Strategy, represent the best professional resources and knowledge available on Florida's wildlife and habitats, threats and conservation actions (see Chapter Acknowledgments; Chapter References/Literature Cited; Appendix D. GIS Data Table).

Timeline and Development Process

In 2001, under the Wildlife Conservation and Restoration Program (WCRP) Congress challenged each state wildlife agency with the task of creating a Comprehensive Wildlife Conservation Strategy by October 1, 2005 (see Chapter Introduction). The FWC as the steward of the Strategy for Florida committed to the development of a Strategy in a March 2002 letter to the U.S. Fish and Wildlife Service (USFWS) (Florida Fish and Wildlife Conservation Commission 2002).

The task of developing Florida's Strategy was assigned to the FWC State Wildlife Grants Issue Team, which is comprised of representatives from multiple units of the agency. This approach allows all the FWC staff to play a role in the overall guidance of the Strategy's development and implementation. Although the FWC exhibits a typical organizational structure, it strives to operate with a high level of teamwork across divisional lines.

Early in the process the FWC hired the consulting firm Dynamic Solutions Group (DSG) which specializes in issue resolution to: facilitate collection of public input, coordinate compilation of the Strategy, and ensure the FWC meet the federal submission deadline. Florida initiated its planning and development efforts in July 2004 (See Figure 1. Timeline of Florida's Strategy Development Process). The entire Strategy development process was performed over a 14-month period from July 2004 to September 2005. The development timeline and process is summarized as follows:

In August, the eight required elements were e-mailed to stakeholders in a letter of introduction and background. Also in August, DSG developed and e-mailed a Questionnaire to help refine a proposed list developed by FWC and other experts of Species of Greatest Conservation Need (SGCN), and habitat categories within the state.

After a series of Regional Staff and Public Meetings in October, the Science Workshop I was held in Gainesville in November. A multitude of experts, organizations, public and other stakeholders examined results of the Questionnaire and synthesized the best available information on species and habitats into conclusions and recommendations for the Strategy. The FWC assessed

these recommendations, and as a result the list of habitats, habitat conditions, SGCN, and SGCN assigned to habitats ultimately began to stabilize in early January 2005 (See Required Element 1 and 2 below).

In February and March 2005 The Nature Conservancy (TNC) further refined and built upon these results by convening a series of six conservation Threats Workshops, and in April another series of six conservation Actions Workshops. The FWC partnered and contracted with TNC in order to ascertain and prioritize the most important conservation actions needed to abate the greatest threats to Florida's SGCN and habitats (See Required Elements 3 and 4 below).

On June 3, 2005, the first draft of the Strategy was posted on the web for public and stakeholder review. To assist public understanding and commenting, on June 9 the FWC offered the agency's first ever online Virtual Workshop. This interactive online presentation provided an opportunity for people around the country and across the state to participate by computer and learn about Florida's Strategy. The FWC opened its five regional offices and a Tallahassee venue for the public to participate in the Virtual Workshop and to meet and ask questions of the FWC staff.

On June 18 and 19, in addition to the website and Virtual Workshop, the FWC hosted the Science Workshop II and public Open House in Tampa to receive further feedback and recommendations on the first draft. Taking into consideration the stakeholder recommendations and internal review, the FWC and DSG revised the second draft of the Strategy which was posted to the web on July 18.

A similar process was followed for the review of the second draft. A recommendation and general comment period for stakeholders and the public ran from July 18 through August 1. Recommendations were collated by DSG and then passed on for review to the FWC. On August 8 and 9 decisions were made and DSG integrated these into the third draft and the Strategy.

On August 24 a third draft was released for internal review by the FWC. Following a 10-day review period, the FWC staff again made final decisions on the received recommendations. Finally, on September 15 the Strategy was submitted to the USFWS.

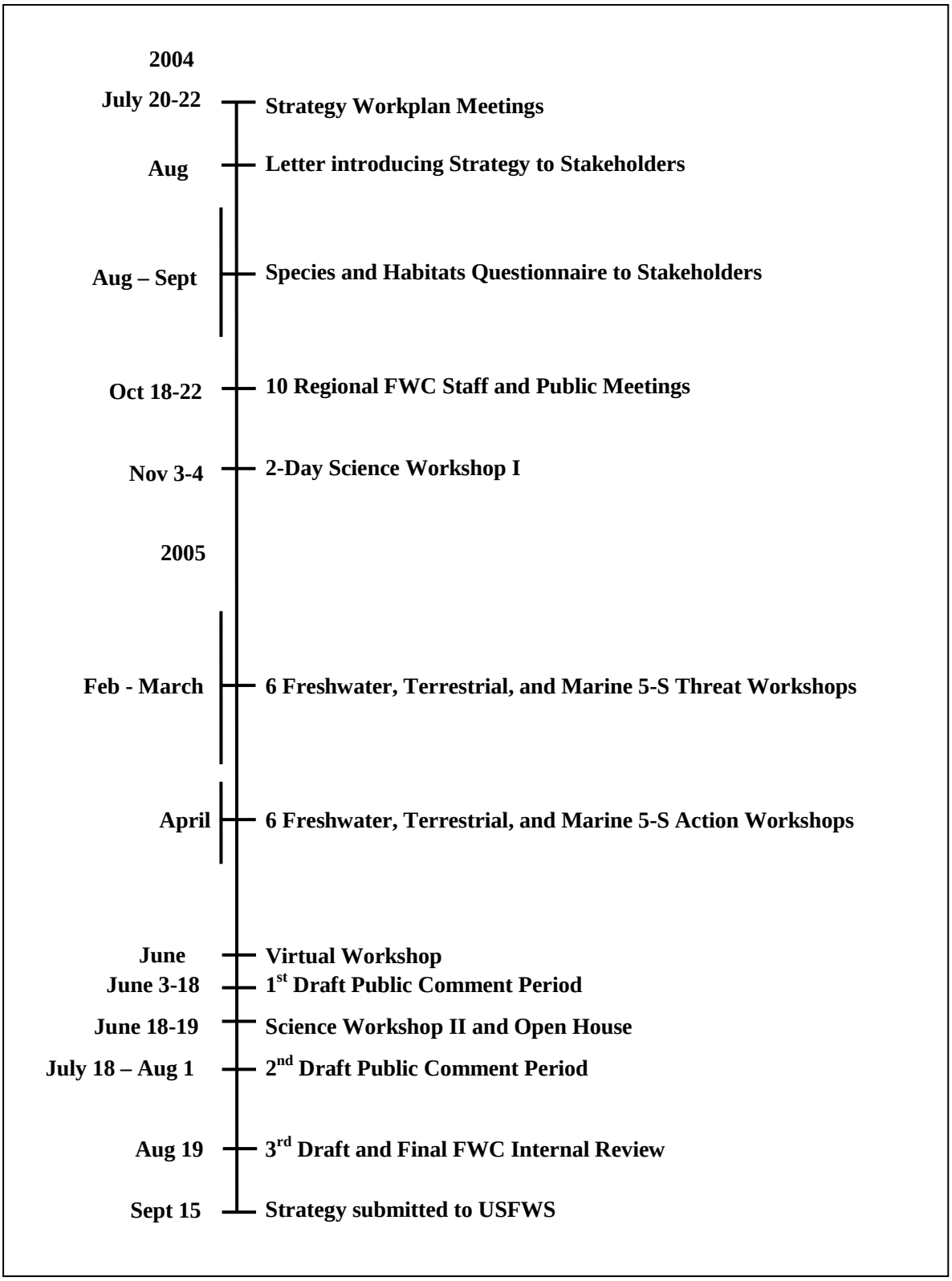


Figure 1. Timeline of Florida's Strategy development process.

The following are the federally required eight elements for developing the Strategy and the approach taken by Florida to meet each:

Required Element 1

Information on the distribution and abundance of species of wildlife, including low and declining populations as the state deems appropriate, that are indicative of the diversity and health of the state's wildlife.

General Process

All native wildlife species in Florida were considered in the selection of SGCN (i.e., freshwater, marine, and terrestrial birds, mammals, fish, amphibians, reptiles, and invertebrates). The FWC's experts and key species experts outside of the agency developed taxa-specific criteria to propose an initial list of SGCN and habitat categories with descriptions (see criteria below). Using the SGCN lists, a Questionnaire addressing species and habitats was e-mailed out to approximately 900 individuals known to be knowledgeable about habitats and taxa throughout the State of Florida. The objective was to receive the best available information about Florida's natural resources. The result of this Questionnaire was a further refined list of SGCN, information about species population status and trends, species associations with habitats and the condition of the identified habitats.

Approximately 250 stakeholders attended a November 2004, Science Workshop I in Gainesville to review and refine the results of the Questionnaire. Participants helped identify and refine and the list of proposed SGCN. Participants provided recommendations on species' additions, deletions, abundance (population status and trends) and distribution data by habitat. They also identified and prioritized conservation threats and conservation actions for the habitat categories.

A finalized list of 974 SGCN (See Chapter Species of Greatest Conservation Need) was developed from the FWC and other experts using their professional judgment and knowledge to accept or reject the recommendations.

Criteria

The criteria used to identify Florida's SGCN varied by taxon - mammals, birds, reptiles, and amphibians; freshwater fish; marine fish; and invertebrates.

Mammals, Birds, Reptiles, and Amphibians

To generate the SGCN list for mammals, birds, reptiles, and amphibians, the Florida Natural Areas Inventory (FNAI) and the FWC's Species Ranking (Florida Fish and Wildlife Conservation

Commission unpublished data; Millsap et al. 1990) lists were combined. Fish species were removed and considered using alternate criteria (see *Freshwater Fish* below).

Mammals, birds, reptiles, and amphibians were proposed as SGCN if they met any of the following criteria:

1. A species' FNAI score was above S3. 'S3' means that a species is either very rare or local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.

2. A species was listed as protected by the U.S. Fish and Wildlife Service (USFWS), or listed by Florida as Endangered, Threatened, or Species of Special Concern.

3. The FWC's Species Ranking biological score was greater than or equal to 22. The boundary of 22 was based upon the mean ranking score of all taxa in the FNAI's S3 category.

Note: If a conflict was identified for a species ranked in both the FNAI and the FWC's Species Ranking System, preference was given to the FNAI rank.

A species was removed from the SGCN list if it met either of the following criteria:

1. The species is known or believed to be extinct (except the Ivory-billed woodpecker, recently rediscovered in Arkansas).

2. The species is known or believed to be extirpated from the wild in Florida (e.g., red wolf and Bachman's warbler).

Freshwater Fish

Freshwater fish SGCN were derived from the FWC list of freshwater fishes that occur in Florida. The master list was further refined using (1) a checklist of native freshwater fish, (2) a list of exotic species, (3) all locatable university museum records (e.g., Florida State Museum, Tulane University, etc.), (4) records obtained in the field by the FWC staff, and (5) records from the published literature. The freshwater fish list included state and federally listed species, rare species (Gilbert, 1992), species included in the FWC's Species Ranking System (Millsap et al. 1990), and FNAI rankings of G1, G2 and/or S3 and above. Fish species were removed if they were determined to be more common than previously thought based upon a statewide survey of rivers (Bass et al. 2004).

Marine Fish

To develop the list of marine fish SGCN, existing lists were compiled from the USFWS, FWC, FNAI, International Union for the Conservation of Nature and Natural Resources (IUCN), Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora (July 2002), the American Fisheries Society (Musick et al. 2000), species identified as conservation

targets by The Nature Conservancy (Laura Geselbracht, personal communication), and those species identified by the Florida Committee on Rare and Endangered Plants and Animals (FCREPA).

Invertebrates

Estuarine/marine, freshwater, and terrestrial invertebrates were proposed as SGCN if a species met the following criteria:

1. A FNAI State Rank of S3 or higher, regardless of Global Rank.

2. If no FNAI State Rank was assigned or if the species was assigned by FNAI as State Not Ranked (SNR), then it was identified by FCREPA, Taylor et al. 1996, Moler 2004, or Bick 2003 as endangered or threatened.

3. Listed as protected by the USFWS or state.

Note: Due to the lack of considerable information on invertebrates, the best professional judgment was used when finalizing the list of invertebrate SGCN. In addition, these guidelines were followed: (1) if the FNAI State Rank was State Historic (SH) or State Extinct (SX); or (2) if the species was considered Accidental (A) in Florida (i.e., not part of the established biota), the species was excluded from the list, and (3) when a species was recognized as needing further taxonomic study (e.g., Bahama swallowtail); or (4) when a species was recognized as requiring further surveys to determine whether the species is extinct (e.g., certain caddisfly species), the species was considered for the list.

Required Element 2

Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in Required Element 1.

General Process

Maps representing the State of Florida for terrestrial, freshwater, and marine ecosystems were developed to identify the locations of 45 habitats categories (See Habitat Approach below). The technical Questionnaire (described above) was used to initially assign SGCN to habitat categories and to determine the relative condition and trend of the habitat categories. The Questionnaire results were then reviewed and habitat categories refined by participants of the November 2004 Science Workshop I. Further review of this information was provided by contacting species and habitat experts and the Strategy draft review process described above (See Timeline and Development Process) The descriptions of locations and relative condition of habitats was further refined in the Threat and Action Workshops (See Required Elements 3 and 4 below).

Habitat Approach

The Strategy lists 974 species with great conservation needs. Taking a species-based approach would not be economically, logistically, or scientifically feasible in this comprehensive statewide effort. Since many of the factors that threaten these species are connected to their habitat, it is practical and advantageous to take a habitat-based approach within the Strategy. Florida has chosen to develop and implement a conservation Strategy based upon 45 habitat categories to represent the breadth of the state's communities with the goal of addressing the needs and concerns of the entire landscape of Florida. The 974 SGCN are associated with each (See Chapter Habitats).

One goal of the Strategy is to represent Florida's diverse habitats in a spatially-explicit manner; therefore, habitats have been categorized to represent Florida's terrestrial, freshwater, and marine ecosystems. Several state and private organizations have developed classification systems to describe the diverse landscapes that occur in Florida. Some of the systems have incorporated Geographic Information System (GIS) data. The classification systems use different perspectives: natural plant and animal communities, existing land cover, and land use. However, there is no single, accepted statewide comprehensive habitat classification system for Florida. As a result, several different map data layers and classification systems were used to represent and describe all of the habitat categories for the Strategy, including FNAI, Water Management District Land Use Land Cover, the FWC's Florida Vegetation and Land Cover 2003, as well as numerous other individual GIS data layers (See Appendix D. GIS Data Tables). The following is a brief description of these various classification systems and how they were used to develop Florida's Strategy.

One widely used classification system is the FNAI Natural Communities of Florida (See http://www.fnai.org/descriptions.cfm). Beginning in 1981, TNC helped Florida establish the FNAI to identify the state's natural communities, to single out noteworthy examples of each, and to locate populations of rare and endangered plant and animal species (Whitney et al. 2004). The FNAI system recognizes 82 natural community types in Florida, contained within six categories: Terrestrial communities, Palustrine communities, Lacustrine communities, Riverine communities, Subterranean communities, and Marine/estuarine communities. Although GIS land cover and point data themes of FNAI's system are available for many of Florida's public conservation areas, coverage does not yet exist for most private properties (which comprise 70 percent of the state's land area). The FNAI system also does not address human-modified environments. For this Strategy, the FWC determined that the habitat categories need to be mappable for the entire state. The FNAI classification system therefore was incorporated into the Strategy as part of the GIS data layers used to develop the freshwater and terrestrial statewide maps (See Appendix D. GIS Data Tables). The Strategy's habitat categories were also cross referenced with the FNAI system for further clarification and comparison purposes (See Chapter Habitats).

Another very widely used classification system is the Florida Land Use Land Cover Classification System (FLULCCS). This classification system was created by the Florida Department of Transportation, and has been used by Florida's five water management districts to develop the Water Management District Land Use Land Cover. The Water Management District system represents a comprehensive, statewide, detailed polygon coverage based on a large number

of specific land use/land cover classes encompassing urban, rural, and natural land classes (Jue et al. 2001). The degree of detail in this system exceeded the needs of statewide maps for the Strategy; for example, FLULCCS discriminates between low-rise and high-rise multiple dwelling units. Therefore the FLULCCS system was selectively incorporated into the Strategy as part of the GIS data layers used to develop the statewide maps (See Appendix D. GIS Data Tables).

The basis for the Strategy's statewide maps is the FWC's Florida Vegetation and Land Cover 2003, which is based upon the 2003 Landsat Enhanced Thematic Mapper satellite imagery (Stys et al. 2004). This classification system identifies 43 vegetation and land cover types broken down into 26 natural and semi-natural vegetation types, 16 types of disturbed lands, and one water class. This classification system most closely approached the Strategy's needs for a statewide habitat classification system. Elements of other systems were incorporated into the final 45 habitat categories, particularly in the freshwater and marine realms (as described below).

The 45 habitat categories in Florida's Strategy are represented on three statewide maps; Florida Comprehensive Wildlife Conservation Strategy (CWCS) Freshwater Habitat Categories 2005, Florida CWCS Terrestrial Habitat Categories 2005, and Florida CWCS Marine Habitat Categories 2005 (See Chapter Habitats, Figure 7, 8, 9 respectively). Nine habitat categories are presented on the freshwater map, 22 on the terrestrial, and 12 on the marine. These maps represent the most comprehensive GIS data available. However, due to lack of sufficient GIS data, two marine habitat categories (Pelagic and Subtidal Unconsolidated Marine/Estuary Sediment) are not depicted. Due to the expansiveness of the GIS data sets used and resolution in this document, three maps were used instead of a single map to help delineate individual habitat categories.

The terrestrial categories were derived primarily from the FWC 2003 land cover (Stys et al. 2004). The Water Management District data were combined with the FWC layers for the creation of some of the data that incorporated land use as well as vegetation type, such as the Industrial/Commercial Pineland habitat category. The nine freshwater habitat categories were derived from a combination of FNAI descriptions, best available data, and professional scientific recommendations. Freshwater streams and riverine systems as well as sinkhole habitats are addressed on a limited basis by both FNAI and Water Management District codes. Florida's marine ecosystems are not fully addressed by the FWC, the FNAI or Water Management District classification systems. Eleven of the Strategy's 14 marine habitat categories were derived from *The System for Classification of Habitats in Estuarine and Marine Environments for Florida* (Madley et al. 2004). Three other habitat categories (i.e., Artificial Structure, Inlets, and Pelagic) were added to more completely represent all marine areas in Florida.

Despite the fact that the marine, terrestrial, and freshwater categories are separated for mapping purposes, the Strategy recognizes the ecological nexus between terrestrial and aquatic resources. Many species of Florida's wildlife (e.g., the five sea turtles) depend upon a variety of habitat categories to satisfy their life history requirements. These suites of habitats do not always stay within the bounds of our broader groupings (terrestrial, freshwater, and marine). For example, the habitat categories Beach/Surf Zone and Coastal Tidal River or Stream are represented on more than one statewide map. Threats and conservation actions were determined with consideration given to both the marine and terrestrial ecosystems for the habitat category Beach/Surf Zone.

Required Elements 3 and 4

Descriptions of problems which may adversely affect species identified in Required Element 1 or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.

Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.

The FWC initially assessed the current status of Florida wildlife by utilizing the species and habitat Questionnaire (See Timeline and Development Process and Required Element 1 above). The Questionnaire provided a baseline from which to evaluate the status and trend of SGCN and condition and trend of habitat categories in the Strategy. By utilizing this information, the FWC was able to organize and focus planning of the Science Workshop I in November (See Figure 1.). At the workshop, participants were grouped by expertise in marine, freshwater and terrestrial ecosystems. Throughout the two day workshop the experts worked to develop and prioritize the most important habitat-specific problems and corresponding actions. The Science Workshop I was the primary platform from which the conservation threats and actions section of the Strategy expanded (see Chapter Habitats and Chapter Multiple Habitat Threats and Conservation Actions).

Following the Science Workshop I, the FWC staff conducted an intense plan review of existing habitat and species-specific management plans to evaluate what threats and actions were already being addressed throughout the state (See Required Element 5 below). When the FWC contracted with TNC in early 2005 to further develop the threats and actions portion of the Strategy, this plan review information along with the Science Workshop I results were utilized by TNC in their planning process and Threat and Action Workshops.

Identification of Conservation Threats and Actions

The FWC contracted and partnered with TNC due to their long history of conservation and cooperation within the state. TNC has a dedicated and qualified staff knowledgeable of the diverse land management, ecological issues and problems facing Florida today. Furthermore, TNC was a natural fit for the threats/actions task considering that their established 5-S conservation planning process has a history of producing meaningful and useful results that are applicable to natural resource conservation internationally (See http://www.nature.org/wherewework/).

Threat Analysis and Identification Using TNC's 5-S Process

Workshops were conducted by TNC across the state (See Figure 1). Threats to each habitat were addressed separately in a two-day workshop in north, central, and south Florida. Workshop participants had expertise in certain taxa or habitats in the region covered by that workshop. Workshop participants were introduced to TNC's planning process with respect to threats (Low 2003). Each group conducted the threats analysis process on the habitats present in that region (regardless of threat origins–local, state, regional, national, or international).

Two of the "S's" in TNC's 5-S conservation planning process are directly applicable to articulation of threats to Florida's wildlife habitats. This process divides "threat" into two parts:

1. Stress–the factor that destroys, degrades, or impairs habitats by impacting habitat size, condition, or configuration in the landscape, and
2. Source–the proximate cause of the stress.

For example, altered water quality is a stress to many aquatic systems. This may be divided into stressors caused by contaminants or toxins, and those caused by excess nutrients. Excess nutrients in the water can lead to higher demands for dissolved oxygen and support high densities of certain plant species. Both can result in "Stresses" to the habitat, including die-off of aquatic species, contributing to changes in species composition, changes in primary production, and changes to the physical structure of the aquatic habitats. However, the nutrients altering water quality might be from several different "Sources", such as fertilizers from lawns or agricultural operations, wastes from animal feed lots, septic systems, sewage treatment facilities, or suburban runoff. Understanding the sources that contribute to the greatest proportion of the particular stress helps to focus and prioritize actions that should be undertaken to abate the threat (Low 2003).

In the workshop setting, participants identified the major stresses to the Strategy's habitat categories and ranked them. Stresses considered in this process are in Appendix C. Stress and Sources of Stress Categories. Workshop participants considered stresses that are either current (including current legacies of past stresses; e.g., the continuing stress produced by drainage ditches constructed many years ago) or those likely to occur in Florida over the next 10 years under current circumstances and management. Participants ranked the stresses relative to the potential severity of damage to the habitat and the geographic scope of that damage. A combination of the two rankings was used to determine an Overall stress rank. Only those stresses that had an Overall rank of "Very High" or "High" were further addressed in the source of stress analysis. The prioritization of stresses provides critical information and allows managers to focus available resources on the most threatening stresses. However, for completeness, all the stresses and rankings identified in the workshops are presented in the habitat categories (See Chapter Habitats).

When highly ranked stresses were identified for a habitat, the experts explored the sources of those stresses and selected from a list of potential sources developed prior to the workshops. Several additional stresses were added based on input from workshop participants. Use of consistent terminology for stresses and sources allowed the results to be summarized across habitats and regions, thereby easing the development of both a multiple-habitat and a single-habitat assessment of threats. Subsequent to TNC workshops and prior to inclusion in the Strategy, some stresses and sources were added and ranked by the FWC, based on public input.

Sources of stress were ranked in terms of the degree to which they contribute to the stress and the irreversibility of the stress caused by the source. Multiple sources often contribute to a particular stress, and because a single source may contribute to several stresses, examination and ranking of sources helps to further focus attention to the most critical conservation actions. Actions should be focused on sources that (1) are most responsible for particular stresses and (2) will have long-term impacts on the habitat if allowed to progress (Low 2003).

The final step in the assessment of stresses and sources is a synthesis of the individual stress and source analyses. Overall stress and source of stress rankings are combined to derive an Overall Threat Rank. TNC has developed an Excel workbook that automatically calculates the rankings of individual stresses and sources and overall threat ranking. The Overall Threat Rankings of sources of stress across habitats (Tables 2-4 in Chapter. Florida's Strategic Vision) were determined by integrating regional data on sources of stress within and among habitats. This integration is accomplished automatically using an Excel-based consolidation tool developed by TNC (see CAP Toolkit in the "Library" section at http://www.conserveonline.org).

The threats sections for each individual habitat category presented in the Chapter. Habitats, includes a table of the stresses identified, with the Overall stress ranking developed by experts, followed by a sources of stress table with rankings and the stress(es) to which the sources contributed. Those sources that were ranked as Overall Threat Rank "Very High" or "High" (Tables 2-3 in the Chapter Florida's Strategic Vision) were used to develop the conservation actions component of the Strategy for the terrestrial and freshwater habitats. Only those sources that were ranked as Overall Threat Rank "Very High" (Table 4 in Chapter. Florida's Strategic Vision) were used to develop the conservation actions component of the Strategy for the marine habitats. As a result, only the most critical threats were evaluated for potential action.

Strategic Action Identification and Ranking Using the 5-S Process

The actions component of the Strategy corresponds to the fourth "S" in TNC's 5-S conservation planning process: strategic actions. TNC addressed action identification similarly to the process for threat identification. Again, six two-day workshops were convened and distributed across Florida to facilitate attendance (See Figure 1.). Rather than divide workshops geographically, as was done for threats, for actions TNC divided workshops by sources of stress (threats) and invited participants with expertise in the appropriate threat. Overall Threat Rank "Very High" and "High" ranked threats were identified at the statewide scale (for multiple habitats), and also at the habitat-scale (for up to five habitats).

The participants covered several multiple-habitat and habitat-specific threats at each workshop. Workshop participants were introduced to the Strategy and TNC's planning process with respect to strategic actions. Each action was linked to a desired outcome generated either from the threats discussion in previous workshops, or from the experts in the actions workshops. Information from the plans that had been reviewed by the FWC staff prior to the workshops and from the Science Workshop I was introduced to the discussion where relevant.

Each highly ranked source of stress resulted in the generation of as many as 40 actions. The actions were ranked by workshop participants for feasibility, and for benefits likely to improve habitat conditions for Florida's SGCN. First, the workshop participants ranked feasibility in terms of the availability of a likely individual and/or institution to lead implementation of the action, and the relative ease and constituency support for that implementation. Standardized rules giving equal weight to both components were used to generate an Overall feasibility rank. Second, participants ranked benefits in terms of both the contribution a particular action would make in abating the threat under discussion, and the degree to which the action would improve the institutional environment for threat abatement or catalyze implementation of complementary actions. Again,

both components were combined with equal weight to develop an Overall benefit rank. Finally, an order of magnitude estimate was obtained from the participants for the cost of implementing the action (start-up and application for five years). Because the participants were unable to complete ranking during some of the workshops, participants were asked to provide ranks individually. TNC used those ranks to assist with completion of the rankings.

Feasibility and benefit ranks were combined to generate an Overall Rank of priority for each of the actions. In the Chapter. Multiple Habitat Threats and Conservation Actions and individual habitat chapters in the Chapter. Habitats, actions are presented for each threat by category and ranking, from highest to lowest Overall Rank of priority with redundancy minimized. Estimated cost-level is presented, along with the benefit and feasibility rankings that generated the Overall Rank of priority order.

While these rankings have been developed to identify the most effective conservation actions, they do not identify the optimal sequence for implementation. Further, some types of action (e.g., research) often received lower prioritization than actions that more immediately and directly addressed the threat (e.g., active management). As a result, the rankings presented provide a useful initial analysis of the actions, but may be modified based on additional criteria.

Over 140 experts participated statewide in identifying threats and actions (Gordon et al. 2005). Workshop participants operated under the FWC's recommendation that the Strategy be developed in such a manner that it could serve to guide and help coordinate natural resource conservation statewide and be implemented cooperatively and voluntarily across state, federal, or municipal agencies and private organizations. It was made clear to workshop participants that the Strategy is not intended to be a regulatory document. However, some workshop participants regularly recommended actions addressing regulations or policy as being necessary to meet the goals of the Strategy (Gordon et al. 2005). After the workshops TNC edited the actions that had been recorded to improve their clarity and conciseness, and minimize redundancy, but not to modify the original intent or substance of the actions. TNC also incorporated actions that had been articulated during the Threats Workshops and those that were sent post-workshop by the experts. Subsequent to submitting the Strategy to the USFWS, the FWC has reviewed and edited the conservation actions to meet the non-regulatory, incentive-based actions objective.

Although efforts have been made to fact-check the conservation actions developed for each threat, the FWC acknowledges that errors of fact or omission may still exist and welcomes any feedback regarding such errors. Comments received in this regard will be incorporated into a later version of the Strategy as appropriate (See Element 7 and 8 below; and Chapter. Florida's Strategic Vision).

Required Element 5

Proposed plans for monitoring species identified in Required Element 1 and their habitats, for monitoring the effectiveness of the conservation actions proposed in Required Element 4, and for adapting these conservation actions to respond appropriately to new information or changing conditions.

Adaptive Management

Simply put, adaptive management is "learning by doing" (Aldridge et al. 2004); it is the adjustment or modification of conservation actions to achieve a desired conservation goal. In practice, adaptive management is a rigorous process that should include sound planning and experimental design with a systematic evaluation process that links monitoring to management (Wilhere 2002, Aldridge et al. 2004). Adaptive management requires flexibility for implementation, but should be fitted over a fundamentally sound, well-planned design.

An adaptive management process produces the strongest inference and most reliable results when experimental design components are incorporated into the monitoring process. Adaptive management is most rigorously applied in an active format when components of experimental design (i.e., controls, replication, and randomization) are included in the monitoring process (Walters and Hilborn 1978, Wilhere 2002). Incorporating valid statistical analyses of results will further enhance the value of the adaptive management process. However, in some situations, rigorous experimental design procedures can be relaxed without invalidating monitoring results. In a passive format (Walters and Hilborn 1978, Wilhere 2002), adaptive management can involve applying a conservation action at a site, observing the results and adjusting the action in the future if warranted.

Monitoring

Monitoring and performance measures are important, but often overlooked elements of conservation planning. Monitoring provides the critical link between implementing conservation actions and revising management goals. Monitoring is the systematic, repeated measurement of environmental characteristics to detect changes, and particularly trends, in those characteristics. Monitoring provides essential feedback, the data needed to understand the costs, benefits, and effectiveness of planned conservation actions and the management projects undertaken to address them (Wilhere 2002).

Performance Measures

Performance measures include qualitative or quantitative measures used to provide an estimate or index of the characteristic of interest, and to chart the overall progress of conservation actions towards achieving specific goals. Successful monitoring programs provide natural resource professionals with valuable feedback on the effectiveness of conservation actions that have been undertaken and make it possible to implement a more flexible adaptive management approach. An adaptive management approach ultimately will be more efficient and effective when it tracks inputs, incorporates an effective monitoring program that integrates performance measures, and evaluates results against desired goals.

Implementing Adaptive Management, Monitoring and Performance Measures

The Strategy serves as the guiding framework in this adaptive management process; it serves as the underpinning for the integration of (management) projects conducted to fulfill conservation actions that are planned to resolve conservation threats to the SGCN or the habitats they occupy. Based on evaluations of project results, the conservation actions are revised (if necessary), and the process is repeated.

A well-developed monitoring protocol is also one of the principal, required criteria for the Strategy. The plans for proposed adaptive management, monitoring and performance measures were developed through literature reviews and the FWC staff meetings. Overall, a results-based approach is incorporated into the Strategy, for which effective monitoring is an integral component. Florida will monitor conservation actions, species, habitats, major threats and the Strategy itself. Details can be found in the Chapter Florida's Strategic Vision, Monitoring and Performance Measures section. Florida's monitoring plans are briefly summarized below, and include:

Species

- Track the status and trend of species, as well as monitor the implementation of conservation actions on a species by species basis, and where possible at a statewide level by using and improving upon an existing species ranking system (Millsap et al. 1990). Currently, Florida's species ranking system addresses a total of 668 vertebrate taxa. A high priority monitoring action is to update the ranking system with all SGCN and fill species data gaps to further develop, undertake and assess for success additional practical and effective conservation measures.

Habitats

- Use Geographic Information Systems (GIS) to more effectively plan management actions and to monitor changes to habitats at the landscape scale, regionally and locally throughout the state. Florida can measure the percentage of area protected in terrestrial and freshwater habitat to assess successful implementation of the Strategy and monitor terrestrial habitat conversion. Use of this technology as a performance measures will make it possible to produce reasonably accurate quantitative assessments.

- Improve data layers of Florida's habitats to more adequately identify conservation targets and set or adjust monitoring and performance measures accordingly.

- Take steps to expand the use of GIS to monitor habitats and more effectively integrate and coordinate conservation actions at the landscape level and other levels.

- Develop methods to monitor habitat conditions and quality as statewide performance measures.

Threats

- Develop and improve upon conservation actions that address the most critical multiple-habitat threats to capture habitat category level responses and evaluate and determine whether implementation of high priority conservation actions is successful.

Incorporated into those threats are issues related to the overall success of the Strategy. Monitoring the effectiveness of the Strategy will necessarily entail monitoring the success of conservation actions directed toward abating those threats. As for species and habitats, performance measures are used to quantify and evaluate the success of conservation actions identified to address these statewide threats.

Strategy

- Monitor and evaluate at multiple levels – projects, conservation actions, and threat performance measures. Together with reporting procedures, they will be applied to provide feedback on the effectiveness of the Strategy as it is implemented.

Ultimately, the Strategy serves as a tool that can be used by all conservation partners to guide the development and implementation of habitat management activities by both public and private land managers. Many monitoring mechanisms will be implemented outside the realm and knowledge of the FWC. To ensure that goals for individual conservation actions and statewide conservation goals remain consistent, it will be necessary to maintain effective communication among all those who develop and implement projects, those who set statewide conservation goals, and those who review and evaluate the Strategy. The challenge will be to develop and maintain the communication channels so that the state's citizens and natural resource managers can benefit from the information.

In general, future goals for monitoring within the Strategy will include further development of databases for compiling and tracking data. Compilation of this information in a searchable database form will assist future adaptive management efforts to improve protocols for monitoring projects and revise conservation actions undertaken, as appropriate. Continued stakeholder and partnership involvement in the implementation and revision of this Strategy will help ensure the best application of data gained though all monitoring efforts.

Required Element 6

Descriptions of procedures to review the Comprehensive Wildlife Conservation Strategy at intervals not to exceed 10 years.

The FWC's formal review plan for Florida's Strategy is a recurring five-year cycle of assessment to monitor the effectiveness of the Strategy during implementation. The assessment includes evaluation of the Strategy at multiple levels. Annual project review, with final project reports and evaluations will be based on performance measures appropriate to each project.

Conservation action review will be based on assessment of all projects implemented under each action on an annual basis and on species, habitat, and threat performance measures tracked every five years. Strategy review will be based on assessment of all projects, actions, and performance measures. This cumulative review of contributions to meet the Strategy's performance measures will provide a meaningful report on the Strategy's effectiveness (See Chapter Florida's Strategic Vision, Figure 6.).

Even with the more formal five-year review, the Strategy is intended to be a flexible, living document and will be subject to continual revision and update as data gaps (species, habitats, and mapping) are filled, tracking methods are developed and enhanced, new information arises, and stakeholder and public input is received. Less formal Strategy updates may be produced at intervals shorter than the periods stated above in response to these matters or as newly emerging issues and needs arise. When determined to be necessary, such Strategy updates may be submitted to the U.S. Fish and Wildlife Service (USFWS) for review and comment.

Required Elements 7 and 8

Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Comprehensive Wildlife Conservation Strategy with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats.

Provisions to ensure public participation in the development, revision, and implementation of projects and programs. Congress has affirmed that broad public participation is an essential element of this process.

The public and federal, state, and local agencies and Indian tribes were invited to participate throughout the Strategy's development process. Early in the process, the FWC developed a contact list to facilitate awareness and participation in Strategy development. This list was developed from pre-existing databases of statewide and regional stakeholders and partners, and augmented by numerous suggestions from those and other stakeholders, the FWC, other agency's staff, and the public. Significant efforts were made to update the contact information (e-mail and physical addresses, telephone and facsimile numbers, titles and affiliations, etc). The contact list, containing over 1,900 entries, was utilized for all statewide Public Service Announcements, and various Strategy workshops (See Required Element 1, 2 and 3 above). Individuals on the contact list were contacted via e-mail, and press contacts were also notified so announcements could be made by a variety of media around the state.

Efforts were made to reach a broad cross-section of stakeholders with interest or expertise in Florida's natural resources to ensure that stakeholder groups with special interests in wildlife, habitats, recreation and resource management in Florida had the opportunity to provide input to drafts of the Strategy. For example, particular effort was made to contact and inform academic and research interests with specialized knowledge of Florida species and habitats. The contact list also included many large organizations representing both conservation, commercial, and recreational user groups, other state and local agencies (e.g., Water Management Districts, county

governments), private consultants, representatives of building industries, real estate, tourism, agriculture, forestry, marine industries, commercial and recreational fishermen, boaters, and citizen groups. Contact with conservation groups included national organizations with interests and offices in Florida and numerous state and local conservation organizations.

Special attention was given to communicate with tribal leadership and tribal members to encourage participation in the Strategy's development. The FWC's Executive Director sent letters to the Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida. Staff made follow-up contact by telephone and e-mail, and also coordinated with the federal tribal liaison but were unsuccessful in appealing to the tribes attentions.

Additional special attention was given to state and federal agencies. A letter from the FWC's Executive Director to 18 agencies (e.g., USFWS, Florida Division of Forestry, Florida Natural Resource Conservation Service, U.S. Army Corp of Engineers, National Forests in Florida, Florida Department of Health and Consumer Services, and Florida Department of Community Affairs, Water Management Districts, Florida Department of Environmental Protection, Florida Department of Transportation, Florida Army National Guard, National Park Service and others). The letter included, from the second draft Strategy, examples of statewide conservation actions that specifically identified an agency or were perceived by the FWC to potentially affect an agency. Agencies were solicited with the intent to further engage participation in Strategy development and as a platform for building partnerships and implementing the Strategy.

Florida's Strategy is largely comprised of the suggestions and comments of those persons and groups who either attended workshops or responded to questionnaires and drafts. Over 500 groups and individuals attended the workshops between November and June 2005, and more than 5,000 written comments were received on the two drafts of the Strategy. The FWC staff was a core resource for information and advice, particularly research staff, regional biologists, designated taxa experts, and wildlife managers. These individuals provided input through their job function in the FWC and in many cases as participants in the workshops. The list of workshop participants and submitted comments indicates the number and diversity of stakeholder inputs integrated into this Strategy (See Chapter Acknowledgements). A summary of the opportunities and results of stakeholder and public participation in the Strategy's development follows:

- The FWC held a kick-off press conference and developed e-mail announcement, news releases for radio, newspaper, and television coverage, and distributed flyers. News releases and e-mail announcements soliciting public input accompanied the start of the comment periods for the two drafts and the submitted Strategy.

- The web site, http://myfwc.com/wildlifelegacy/ was used to post meeting and workshop notices, drafts of the Strategy, the FWC employee contact information, and to provide a mechanism for public comment on the Strategy.

- A public outreach and an internal outreach strategy document was developed by FWC staff. A lead FWC staff member was identified to focus on stakeholder outreach – proactively communicating via e-mail and phone to solicit questions and input to drafts.

- Seven Commissioners, appointed by Florida's Governor, has oversight of the FWC rules, policies, activities and priorities. As part of the FWC's commitment to develop Florida's Strategy the Commission reviewed and approved the Strategy development process, timeline and submission approach at their February 2005 meeting. At the June 2005 Commission meeting the second draft of the Strategy was presented for their review, and the Commissioners again approved the timeline and procedures for submitting the Strategy to the USFWS. Each of these meetings was open to the public with opportunity to comment.

- By letter, the FWC's Executive Director requested participation of employees of federal, state, and local agencies, and Indian tribes for input into the Questionnaire for development of SGCN and habitats and associated information; and repeated the request to state and federal agencies for input to conservation actions in the second draft of the Strategy.

    - Letters to 18 federal and state agencies resulted in five responses with line-specific comments on the second draft Strategy.

- The FWC contracted with Dynamic Solutions Group to host five Regional Public five FWC Staff Workshops in 2004, two technical Science Workshops (November 2004 and June 2005) for stakeholders, and an Open House event.

    - Approximately 160 people participated in the Regional Public Workshops.

    - The two Science Workshops and Open House resulted in nearly 350 participants.

- The FWC contracted with The Nature Conservancy for 12 expert workshops to develop threats and conservation actions for terrestrial, freshwater and marine ecosystems.

    - Over 140 experts participated in these workshops.

- The FWC hosted an online Virtual Workshop to telecast information about Florida's Wildlife Legacy Initiative and the Strategy development process and opened its five regional offices and a venue in Tallahassee to participants.

    - The Virtual Workshop and associated announcements resulted in over 30,000-hits to the Strategy review and comment web site and in a two-week review period generated a 140-page document of nearly 2,000 line-specific comments on the first draft of the Strategy.

- The FWC conducted another, two-week public review periods on the second draft Strategy emphasizing input to the proposed threats and conservation actions.

    - DSG compiled a 200-page document of over 3,000 general and line-specific comments and recommendations. E-mail and news releases announcements generated over 40,000-hits to one of two review and comment web sites.

- The FWC met with four stakeholder groups to specifically address their concerns and to take recommendations to drafts of the Strategy.

Coordinating Implementation

The future of the Strategy's success will be dependent upon the willingness and ability of partners and stakeholders to continue to update and implement it. As stewards of the Strategy the FWC has followed a rigorous development process based on input from experts, stakeholders, and the public. The FWC is committed to maintaining this approach throughout the Strategy's implementation, review and revision (See Chapter Florida's Strategic Vision). The FWC's new program, Florida's Wildlife Legacy Initiative will provide an opportunity to continue to shape the future of wildlife in Florida. While the FWC is the designated lead for Florida, the Strategy is meant for the entire state. It is too broad and encompassing for any one individual, group, or even agency to develop or implement.

The FWC created Florida's Wildlife Legacy Initiative (See Chapter Introduction) to promote long-term awareness of the Strategy. There are three main components of the Initiative: (1) Strategy development, revision and implementation, (2) partnership development, and (3) Florida's State Wildlife Grants Program. To assure that the Strategy is a "living document" with broad input and up-to-date technical information, the Initiative will facilitate a public review period of the submitted draft Strategy from September 16 through December 16, 2005. Further appropriate steps to revise the Strategy will be determined based upon these recommendations. State Wildlife Grant funds have also been committed to a fall 2006 stakeholder and public conference to develop partnerships and facilitate revision of the Strategy.

The FWC will continue to utilize e-mail announcements and the web site http://myfwc.com/wildlifelegacy/ to maintain awareness by our partners and stakeholders in the implementation, review and revision process.

State of the State

Florida's People and Economy

In the last 50 years Florida's population has grown from less than three million people to more than 17 million. Florida ranked fourth in U.S. population (U.S. Census Bureau 2000), but Florida's population density is approximately double that of the most populous state, California. Florida's most densely populated urban areas include Miami, Orlando, Tampa, and Jacksonville. The 2030 population projection for Florida is an 80 percent increase to 28.7 million people (U.S. Census Bureau 2000). Based on this forecast, Florida would rank third in population at that time.

Florida's economy is increasingly recognized as tied to its natural and human-created amenities. Florida's current economic growth is not primarily due to the traditional bases of growth such as agriculture, resource extraction, and manufacturing (Kiker and Hodges 2002). However, despite declines over the past century, agriculture and forestry are still major uses of the landscape and continue to contribute to Florida's economy.

Tourism is the largest industry in Florida and contributes $53 billion a year to the state's economy. Seventy-one million visitors are drawn to Florida each year from across the United States and many foreign countries. Visitors come to see the many entertainment attractions in Florida and to enjoy Florida's moderate climate and abundant natural resources, including clear waters, world-class beaches, coral reefs, parks, rivers, and lakes.

Wildlife-related recreation in Florida, including fishing, hunting, and wildlife watching activities, accounts for $7.2 billion spent on trips and equipment. In 2001, over three million persons engaged in fishing and wildlife watching activities in Florida and over 200,000 of the three million participated in hunting. For comparison, total wildlife-based recreation expenditures in the U.S. were in excess of $96 billion (U.S. Fish and Wildlife Service and U.S. Census Bureau 2002).

Florida's economy and its communities also strongly benefit from money and jobs created by industries based on natural resources, which include a $17 billion forestry industry, a $6.6 billion fishing industry, and a $14.6 billion boating industry. Florida seaports form another important part of the state's economy; the seaports support a $35 billion cargo and trade industry, with 288,000 jobs, and a $20 billion cruise ship industry, which embarks almost half of the nation's cruise passengers each year.

Florida's Climate and Landscape

(Adapted from Hoctor 2003)

Florida is an ecologically diverse region ranging in climate from the temperate to the sub-tropical. It is relatively flat with a maximum elevation in the north of approximately 330 feet (100 meters), and much of the state below elevations of 100 feet (30 meters).

Northern Florida is within the southern temperate zone and consists of broad alluvial riparian habitats, and upland flats and ridges once dominated by longleaf pine communities. The central peninsula consists of broad flatlands once dominated by longleaf and slash pine, dry and wet prairies and sandy ridges with scrub and sandhill communities harboring numerous rare and endemic species (Myers 1990). The southern tip of the peninsula, though heavily modified by development, still contains tropically-influenced hammocks, swamps, rocklands, and marshes of the Big Cypress Swamp, Everglades, and the Florida Keys.

Rivers originating in the southern Appalachians and Piedmont are an important ecological component in north Florida that harbor increasingly rare mollusk and fish species. Lakes are very common in the Florida peninsula, and Lake Okeechobee in south Florida is one of the largest lakes in North America. Numerous springs are also characteristic of the vast limestone regions of north and central Florida. Springs, limestone caves, and sinks support many rare aquatic invertebrates (Deyrup and Franz 1994). Estuarine ecosystems include productive salt marsh communities in the northern half of the state, mangrove communities in the southern half of the peninsula and seagrass communities statewide.

The Gulf of Mexico and Atlantic Ocean significantly influence a climate that is generally warm and humid. Summer thunderstorms are frequent, and lightning-caused fires are an extremely important ecological process that has shaped many upland and wetland communities for millennia (Myers and Ewel 1990). Rains vary from highly seasonal patterns in south Florida with heavy rains occurring mainly in the summer to more even year-round rainfall in northern Florida. North Florida's rainfall is more frequent in winter due to the influence from continental frontal systems (Chen and Gerber 1990).

Freezes occur every year in north Florida but are extremely rare in south Florida. Freeze events have a strong influence on the range of tropical species up the Florida peninsula. Tropical species range farther north along the coasts, which are better buffered from freeze events than interior areas because of the warm waters of the Atlantic and Gulf of Mexico (Harris and Cropper 1992).

Florida's Wildlife

Florida's wildlife is a mixture of southern temperate, neotropical, and southwestern species. Sea level rise and fall have been a dominating biogeographic force. For example, the Florida scrub-jay, Florida mouse, eastern diamondback rattlesnake, and gopher tortoise are all closely related to species found in western North America, as a result of semiarid habitat that stretched into Florida

during the much lower sea levels of the early Pleistocene periods (Webb 1990). Tropical species have colonized Florida by flying across the Gulf of Mexico or by riding Gulf Stream currents and include numerous plants, wading bird species, and raptors such as the snail kite and short-tailed hawk (Rodgers et al. 1996). In fact, Florida is a premier birding destination due to the various tropical species that can only be seen or are best seen here (Kale and Maehr 1990). Temperate species include the red-cockaded woodpecker, and various amphibians, fish, and mollusk species (Gilbert 1992; Moler 1992; Deyrup and Franz 1994; Rodgers et al. 1996).

Florida has 755 known native terrestrial vertebrates including frogs, snakes, lizards, mice, and birds (Florida Fish and Wildlife Conservation Commission, 1999; Florida Fish and Wildlife Conservation Commission, 2002a; Moler 1999; Deyrup and Franz, 1994). In addition, at least one-thousand marine fish species inhabit Florida's nearshore waters, which encompass about one fourth of all the fish species known in the western hemisphere north of the equator. Florida has approximately 30,000 species of terrestrial invertebrates and thousands more in aquatic and marine systems (Whitney et al. 2004). Several species of marine vertebrates including whales, dolphins, sea turtles, and the Florida manatee inhabit Florida's waters.

Eleven vertebrate species and/or subspecies are believed to have been extirpated or driven to extinction since the arrival of Europeans in Florida, including the red wolf, Caribbean monk seal, bison, Goff's pocket gopher, Chadwick beach cotton mouse, pallid beach mouse, ivory-billed woodpecker, Carolina parakeet, passenger pigeon, dusky seaside sparrow, and Bachman's warbler.

Endemic Species

An endemic species is a native species that is limited to a particular geographical area. Florida has 147 or more endemic vertebrate species and subspecies, including three mammal species and 38 subspecies, nine birds with distinct ranges and 17 with overlapping ranges, 16 or more reptiles, 10 or more amphibians, and 11 fishes (+16 in single stream systems whose upstream reaches are in Georgia and Alabama) (Muller et al. 1989).

The number of endemic marine invertebrates is unknown, but there are 410 known terrestrial and freshwater invertebrates, including seven mollusks; 28 crabs and relatives; six stone flies and relatives; six dragonflies, damselflies, and relatives; 42 grasshoppers, crickets, and relatives; one mayfly; 193 beetles and relatives; 14 caddisflies and relatives; and 17 butterflies and moths (Muller et al. 1989).

The Condition of Our Resources

Land Use

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) conducts a National Resources Inventory (NRI) approximately every five years. This report is a key resource on the status, condition, and trends of soil, water, and land. According to the 1997

National Resources Inventory (NRCS 2000) the total surface area of Florida is 37,535,030 acres (15,189,888 hectares), including water areas (Figure 2.). The vast majority of the state is characterized as nonfederal rural lands ('nonfederal' referring to all lands in private, municipal, state, or tribal ownership).

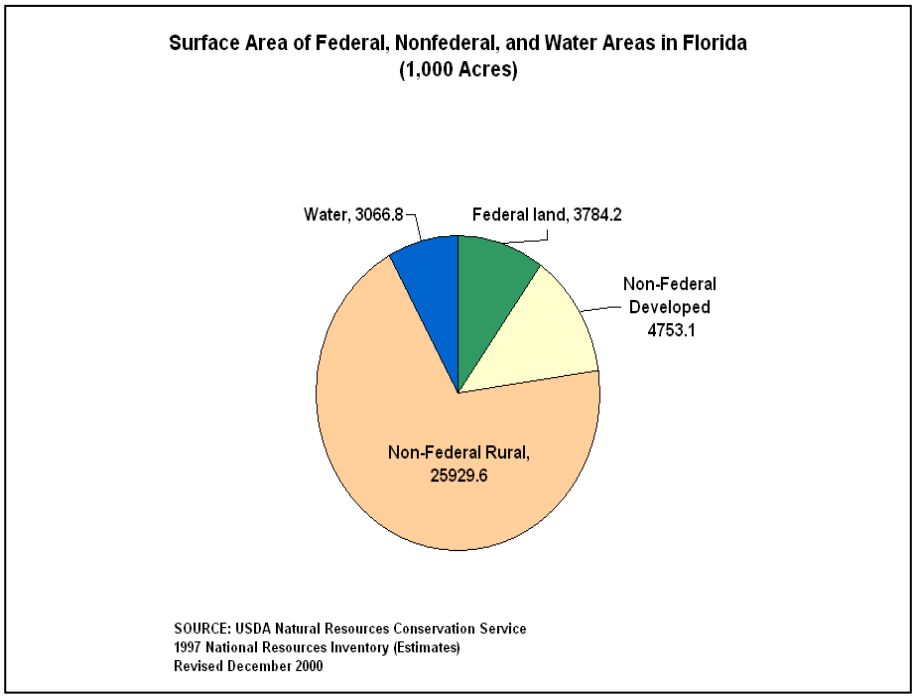


Figure 2. Surface Area of Federal, Non-Federal, and Water Areas in Florida (NRCS 2000).

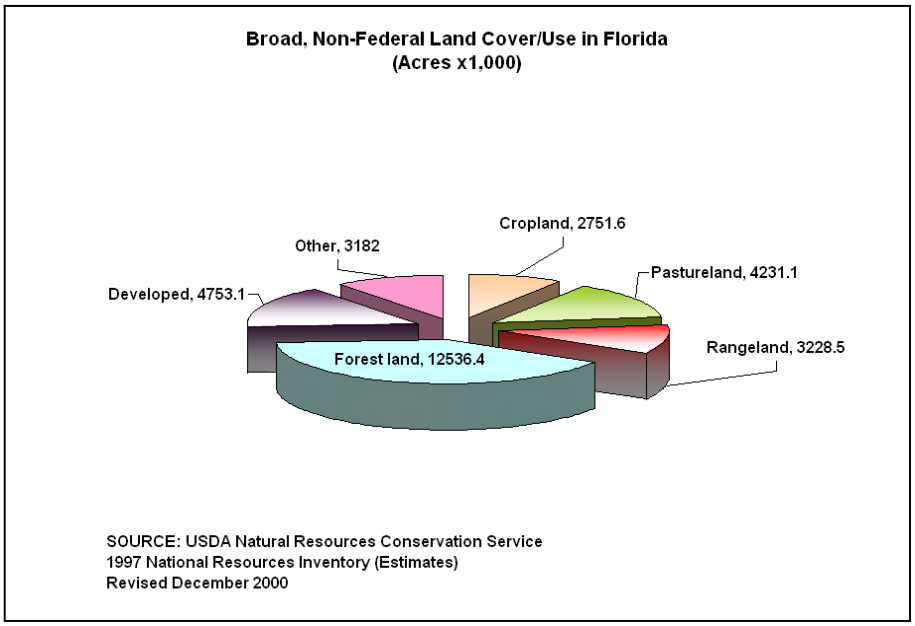


Figure 3. Broad, Non-Federal Land Cover/Use in Florida (NRCS 2000).

Protected Species

In Florida, there are 57 animals federally listed as endangered or threatened species, or experimental non-essential by the U.S. Fish and Wildlife Service (USFWS) under the federal Endangered Species Act (16 U.S.C. 1531 to 5143). In Florida, the whooping crane is the only experimental non-essential designated animal. Additionally, there are 24 recovery plans for animals in Florida. A recovery plan typically addresses a single species, but in Florida some plans include multiple species; for example, beach mice species are grouped together into a single recovery plan and the South Florida Multi-Species Recovery Plan covers 15 species (USFWS 1999). Threatened and endangered animal and plant information is available on the USFWS web site at http://endangered.fws.gov/wildlife.html#Species.

The Florida Fish and Wildlife Conservation Commission (FWC) lists 118 state endangered, threatened, and species of special concern animals. Four of these have approved management plans: the red-cockaded woodpecker, the flatwoods salamander, the Miami blue butterfly, and the Panama City crayfish (though final action on the classification of the crayfish has not occurred). These species management plans can be viewed at http://wildflorida.org/imperiled/plans.htm. The number of state and federally protected animals ordered by taxonomic group can be found in Table 1.

Table 1. Summary of Official Lists of Florida's Endangered Species, Threatened Species and Species of Special Concern.

Status Designation	Fish	Amphibians / Reptiles	Birds	Mammals	Invertebrates	Total
FWC						
Endangered	3	6	8	20	4	41
Threatened	2	10	10	4	0	26
Special Concern	10	13	18	6	4	51
Subtotal	15	29	36	30	8	118
USFWS[a]						
Endangered	2	5	5	18	6	36
Threatened	1	8	5	2	4	20
XN[b]	0	0	1	0	0	1
Subtotal	3	13	11	20	10	57

[a] United States Fish and Wildlife Service
[b] Experimental Non-Essential

Game Species

Game species include animals found in Florida's terrestrial, freshwater, and marine ecosystems that are hunted or fished. Florida's game species are migratory game birds including ducks, geese, common moorhen, coots, snipe, rails, woodcock, mourning doves and white-winged doves, and resident game birds, including quail and wild turkeys. Resident game mammals include

deer, gray squirrels, wild hogs and rabbits. The American alligator is not a game species, but it is harvested.

The general status of terrestrial game species in Florida is closely tied to habitat conditions and availability. Some species have relatively narrow habitat requirements such as those dependent upon frequently burned grassland communities. The northern bobwhite, for example, has declined 66 percent throughout its range between 1980 and 1999 (Dimmick et al. 2002). The fox squirrel has declined and is no longer listed as a game species.

Migratory game bird numbers are highly influenced by habitat quality and availability on the breeding grounds, which for most species occur outside Florida, although three species of ducks commonly nest in Florida. However, loss and degradation of suitable habitat in Florida has likely contributed to declining numbers of many of the more than 20 species of migratory waterfowl that over-winter here.

Abundant freshwater and saltwater fishing opportunities have contributed to Florida's designation as the "Fishing Capital of the World" (http://fishingcapital.com/), aided by 700 world-record fish catches (seven times more than any other state). Popular marine game fish species include common snook, red drum and spotted sea trout. From Florida's three million acres of freshwater lakes and 12,000 miles (19,312 kilometers) of streams and rivers, over 250 different species of freshwater fishes have been collected. This includes several rather rare native fishes as well as 73 species not native to the United States.

Nongame Wildlife

The status of nongame wildlife in Florida was determined from the ranking of 668 native vertebrate taxa according to biological vulnerability (Millsap et al. 1990). This includes 126 freshwater fish species. The vertebrate ranking system initiated a long-term planning effort to identify and prioritize taxonomic, survey, population monitoring, research, management, habitat protection, and education projects needed to conserve vertebrate wildlife taxa that might be at risk of extirpation (Enge et al. 2003). As a result, Florida has a preliminary list of 224 recommended conservation tasks:

- 24 projects have been identified for interior scrub and sandhill taxa, primarily sand swimming reptiles, the Florida scrub-jay, and several mammals.
- 36 projects address the interior prairie region, primarily the Florida grasshopper sparrow, sandhill crane, whooping crane, crested caracara, and short-tailed hawk.
- 19 projects apply mostly to the Key deer and endemic rodents of south Florida rockland habitats.
- 52 projects are identified for amphibians, reptiles, and fishes inhabiting northwest Florida streams and wetlands.

- 72 tasks have been identified for coastal taxa: seaside sparrows, marsh wrens, declining Neotropical migrants, mangrove-nesting songbirds, larids, shorebirds, rails, wading birds, rodents of coastal uplands and tidal marshes, salt marsh snakes, diamondback terrapins, American crocodiles, and nesting sea turtles.

- 21 conservation tasks have been identified for imperiled bat species which were not covered under the five regions/habitats.

In addition, Florida wildlife managers have adopted a feral and free-ranging cat policy to protect all native wildlife. Florida has management guidelines in place for Florida burrowing owls in urban areas, ospreys nesting on man-made structures, gopher tortoises on lands slated for development, and a conservation strategy for the black bear.

Recently, Florida has made advances in assessing the needs of native non-game, imperiled freshwater fish species. *The Florida Imperiled Fish Species Investigation* surveyed for the presence, distribution, and relative abundance of Florida's imperiled fishes and to establish sites suitable for a long-term monitoring program (Bass et al. 2004).

Conservation actions directed towards nongame wildlife benefit from a Nongame Wildlife Trust Fund established in 1983 by the Florida Legislature, resulting in the 1984 initiation of the Nongame Wildlife Program for the Florida Game and Fresh Water Fish Commission (now Florida Fish and Wildlife Conservation Commission). The program's intent is to maintain or restore the richness and natural diversity of Florida's native nongame wildlife and establish an integrated and coordinated approach to the management and conservation of nongame (Florida Game and Fresh Water Fish Commission and Nongame Wildlife Advisory Council 1984). Over the years a variety of program accomplishments have included (1) establishment of nongame conservation priorities, (2) sponsored research, (3) survey and population monitoring, (4) urban wildlife management, (5) nongame technical assistance including guidance for conservation lands acquisition, (6) species and habitat management, (7) conservation education including Project Wild, (8) protected species coordination, and (9) wildlife viewing initiatives. The base revenue for the trust fund is provided through used-car original title fees and vehicle speeding fines. Current revenue from these sources approximates $6 million dollars annually. Even with these funds, and although the nongame program has had successes, Florida, like many states, continues to have significant unmet species and habitat needs.

Endangered Ecosystems

In an assessment of risk to ecosystems in the United States, seven southeastern states (Florida, Georgia, North Carolina, South Carolina, Virginia, Alabama, and Tennessee) made the "extreme risk" category based on number of endangered ecosystems, percentage of imperiled species by state, and development pressures. The highest ranking endangered ecosystem in the United States is the south Florida landscape. Seven additional Florida ecosystems were also identified in the list of the top 21 endangered ecosystems nationally (Noss and Peters 1995) *(priority order shown in parentheses)*:

- South Florida landscape (1)
- Longleaf pine and savanna (3)
- Eastern grasslands, savanna, and barrens (4)
- Coastal communities in the lower 48 states (7)
- Large streams and rivers in the lower 48 states (11)
- Cave and Karst systems (12)
- Florida scrub (15)
- Southern forested wetlands (21)

Conservation Planning

Florida is a national leader in conducting detailed species assessments and adopting systematic, landscape-based reserve designs to protect connectivity and ecological processes. Two of the most significant conservation planning efforts for statewide biodiversity are described below. The FWC's Closing the Gaps Project was initiated in 1990 with the goal of identifying the minimum amount of land in Florida that, if protected, would ensure the long-term persistence of most elements of Florida's biodiversity. The initial assessment and strategy, or first phase, was reported in *Closing the Gaps in Florida's Wildlife Habitat Conservation System* (Cox et al. 1994). Strategic Habitat Conservation Areas and Regional Biodiversity Hotspots were identified (Figure 4.). A second phase, completed in 1998, included assessing the habitat conservation needs of 125 additional species of wildlife (Cox and Kautz 2000). A third phase, anticipating completion in 2006, is for creating an updated species' potential habitat models based on the 2003 land cover map (Stys et al 2004) and re-evaluating the Strategic Habitat Conservation Areas.

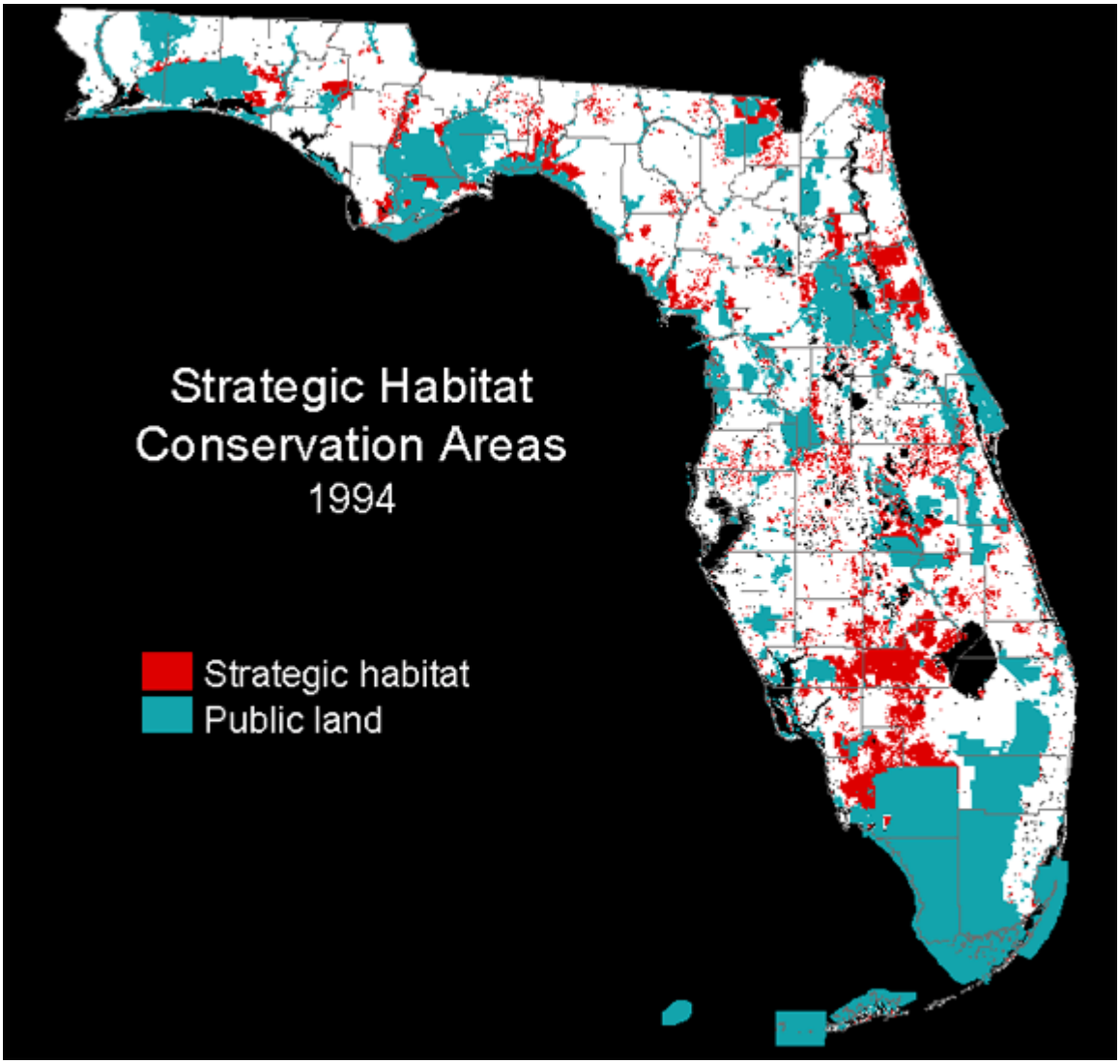


Figure 4. Strategic Habitat Conservation Areas from *Closing the Gaps in Florida's Wildlife Habitat Conservation System (Cox et al. 1994).*

The University of Florida's Ecological Network Project (Hoctor et al. 2000) was completed in 1999 and identified a statewide system of landscape hubs, linkages, and conservation corridors (Figure 5.). The project's goal was to use a regional landscape approach to design an ecologically functional Statewide Greenways System that: (1) conserves critical elements of Florida's native ecosystems and landscapes, (2) restores and maintains essential connectivity among diverse native ecological systems and processes, (3) facilitates the ability of these ecosystems and landscapes to function as dynamic systems, and (4) maintains the evolutionary potential of the biota of these ecosystems and landscapes to adapt to future environmental changes. For more information visit Florida Statewide Greenways Planning Project at http://www.geoplan.ufl.edu/projects/greenways/finalreport.html.

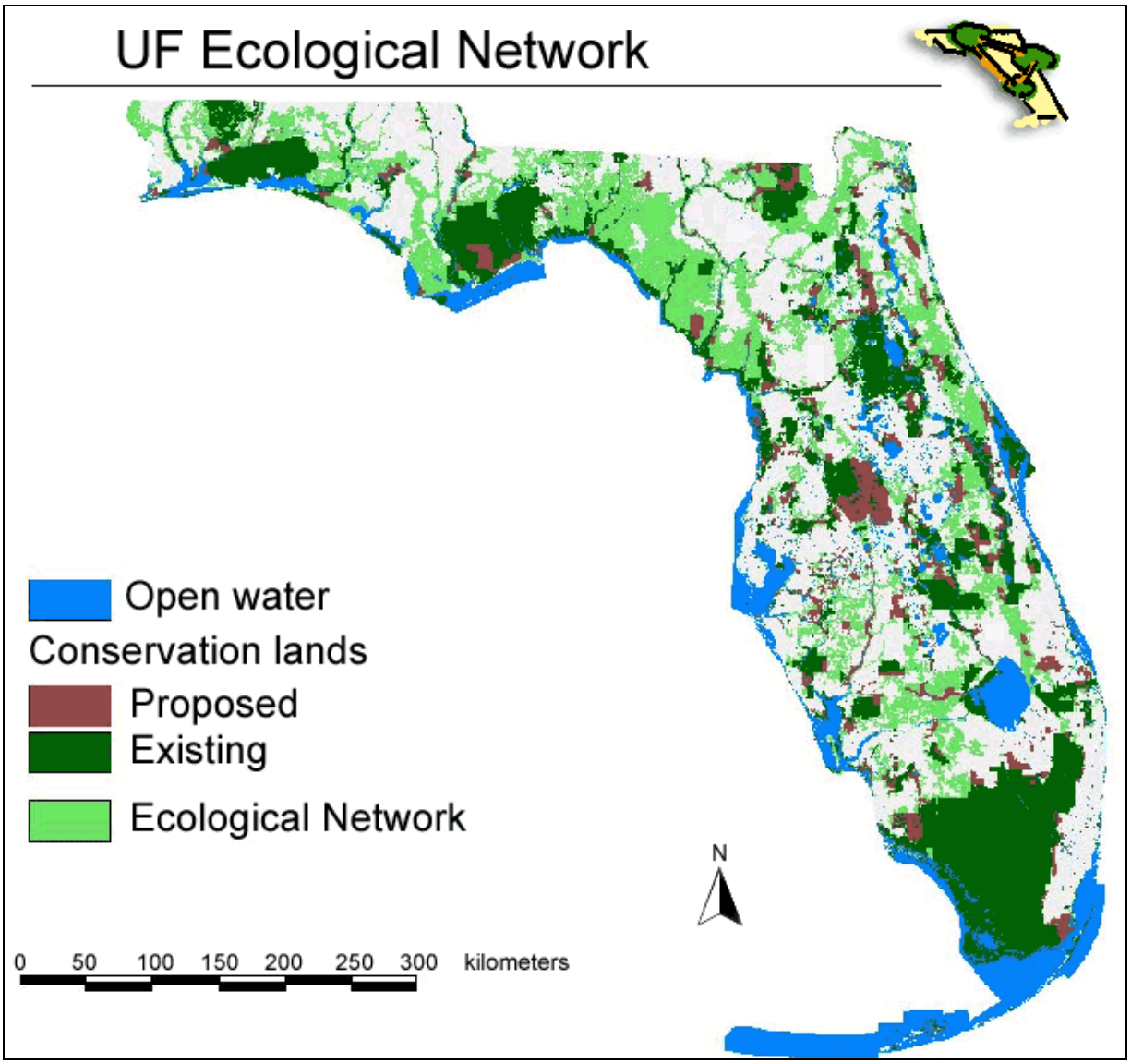


Figure 5. Map of Proposed Priority Conservation Areas, University of Florida Ecological Network Project (Hoctor et al. 2000).

Geographic Information Systems

To facilitate conservation planning, Florida has Geographic Information System (GIS) data sets that include the location of ecological communities, Strategic Habitat Conservation Areas, regional biodiversity hotspots, areas of conservation interest, potential natural areas, rare natural plant communities, land use, existing and proposed conservation lands, private lands larger than 300 acres (130 hectares), roadless areas, road densities, Aquatic Preserves, Outstanding Florida Waters, shellfish harvesting waters, Wild and Scenic Rivers, National Estuarine Research Reserves, coastal barrier lands, 100 year floodplains, areas of significant aquifer recharge, vegetation, plant and animal occurrences, soils, Landsat ETM+ and SPOT imagery.

The GIS data sets can be obtained from sources such as the Florida Department of Environmental Protection, the FWC, Florida Natural Areas Inventory (FNAI), Florida's Water Management Districts, and The Nature Conservancy's Florida Chapter. The University of Florida's Geoplan Center is the GIS data repository for the state at http://www.geoplan.ufl.edu/.

Land Protection

Florida has one of the world's largest conservation land-buying programs. The Florida Forever program, which commenced in 2001, is a ten-year $3 billion land and water resource acquisition program (http://www.dep.state.fl.us/lands/acquisition/FloridaForever/default.htm). Appropriations are funded through the cash proceeds from the sale of a series of bonds and cash transfers from General Revenues. Florida Forever succeeded its groundbreaking predecessor Preservation 2000, Florida's previous ten-year $3.2 billion land acquisition program that protected over one million acres of natural resources.

Currently, potential acquisitions are evaluated, prioritized, and progress measured by the FNAI's *Florida Forever Conservation Needs Assessment* (Knight et al. 2000) process. The state's conservation needs are also progressively re-evaluated as GIS layers are updated. More information is available at http://www.fnai.org/FLForever.cfm.

Florida Natural Areas Inventory also maintains a comprehensive, up-to-date source of boundaries and information for conservation lands in Florida. Currently more than 1,200 individual managed areas are documented (Jue et al. 2001). All federal and state conservation lands are documented in the database; some local government lands in counties with land acquisition programs are also included.

Critical Areas for Terrestrial Conservation

The FWC's *Closing the Gaps* report (Cox et al. 1994) identified 4.82 million acres (1.94 million hectares) (approximately 13 percent of the land area of Florida) as Strategic Habitat Conservation Areas. These are privately owned lands, which are the focus of on-going land conservation efforts using land-use planning, land acquisition, conservation easements, and other tools. The University of Florida's Ecological Network Project (Hoctor et al. 2000) identified 11 million acres (27.5 percent of the state) that need added protection.

The FWC's species ranking system identified five geographic regions or discrete habitat types as priority conservation areas because many imperiled taxa occurred there: interior scrub and sandhill habitats; interior dry prairie region; South Florida pine rockland and rockland hammocks; northwest Florida streams and wetlands; and coastal communities (Enge et al. 2003).

Critical Areas for Freshwater Conservation

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has identified 582 World Heritage sites that it considers of "outstanding universal value" http://www.unesco.org/whc/nwhc/pages/home/pages/homepage.htm. In the United States, there are 22 of these sites; one of these, Everglades National Park, is located in Florida. The Everglades, or "River of Grass" as the Seminoles called it, is formed by a river of fresh water six inches (15 centimeters) deep and 50 miles (80 kilometers) wide that flows slowly across an expanse of sawgrass marshes, pine forests, and mangrove islands. More than 300 species of birds live in the park as well as alligators, manatees, and Florida panthers. The Everglades is the subject of what has been described as the world's largest restoration effort. The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guide to restore, protect, and preserve the water resources of central and southern Florida, including the Everglades. It includes 16 counties over 18,000 square miles (46,000 square kilometers) (See http://www.evergladesplan.org/about/rest_plan.cfm).

In recent years, several aquatic assessments have been undertaken by conservation organizations, each addressing freshwater biodiversity conservation at different scales. The World Wildlife Fund conducted a conservation assessment of freshwater ecoregions of North America (Abell et al. 2000). The Nature Conservancy (TNC) assessed small-scale watersheds across the country (Master et al.1998), and subsequently identified priority areas within four freshwater ecoregions in the southeast (Smith et al. 2002). These efforts identify the southeastern United States as a key region for freshwater conservation efforts. Florida fits into this regional perspective as follows:

- Florida's freshwater resources ranked as one of 15 globally outstanding ecoregions. Florida is recognized for its diverse aquatic habitats, from springs, to extensive freshwater swamps and marshes, and the intact Suwannee River.
- The Apalachicola River and Florida Gulf are outstanding aquatic resources and priorities for conservation as identified by Abell et al. (2000).
- Seven of the 327 key small watershed areas identified across the country by Master et al. (1998) are found in Florida.

Florida's *Freshwater Aquatic Habitat and Species Conservation Planning* (Hoehn 1998) project found that the greatest number of imperiled fish species occur in the Escambia River drainage of northwestern Florida, and designated 126 of 256 sub-basins as Sub-basins of Management Concern.

Marine Conservation

Unlike terrestrial and freshwater aquatic environments in Florida, the marine environment is in public ownership so acquisition and land owner incentive-type programs are not available and management and conservation of these habitats and the fish and wildlife species they support

present different challenges. Marine based conservation efforts are in their infancy compared to terrestrial and freshwater efforts. Comprehensive mapping and characterization of marine habitats is underway but has not been completed statewide. Detailed comprehensive statewide assessments of large-scale patterns of environmental processes, ecosystem dynamics, and linkages between terrestrial systems and coastal habitats are lacking. Data on point and non-point source pollution impacts in coastal waters is largely unknown as is the long-term effectiveness of restoration programs and technologies. Basic life history and species distribution information is unknown for many species. Identification, prioritization and conservation of critical marine habitats will require public awareness and support, and interdisciplinary collaboration and coordination among the private and public sectors. Linking societal and economic benefits of Florida's marine fish and wildlife and their habitats is key to their successful conservation.

Additionally, Florida is home to 41 Aquatic Preserves, three of the nation's 26 National Estuarine Research Reserves, and one of the largest underwater refuges in the world. To further protect the near-shore waters of the Florida Keys, the state and federal governments designated the Florida Keys National Marine Sanctuary as a "no discharge zone" and established the Tortugas Ecological Reserve, one of the world's largest marine reserves. With more than 8,400 miles of shoreline and habitats ranging from the tropical coral reefs in the keys to the productive oyster reefs of Apalachicola Bay, Florida is truly unique in the variety and productivity of its marine resources.

Florida continues to be one of the most rapidly growing states in the nation. During the last decade the state's population increased by over 23 percent. Florida's rapid growth places increased pressures on marine resources. The most widespread impacts are often the least apparent, such as a decline in water quality or loss of seagrass or other habitat. Clearly, Florida must make forward-looking, informed management decisions to protect critical resources and balance competing demands for limited resources.

When Congress passed the Oceans Act of 2000, it acknowledged the importance of the oceans to this country. The U.S. Commission on Ocean Policy was created to establish findings and develop recommendations for a new comprehensive national ocean policy. This resulted in the 2004 report, *U.S. Commission on Ocean Policy's Ocean Blueprint for the 21st Century*. The report supports a science-driven, ecosystem-based management approach and makes specific recommendations for actions needed to conserve marine resources while considering the complex interrelationships among the ocean, land, air, and all living creatures, including humans, and the interactions among multiple activities that affect entire systems. This ecosystem-based approach to managing marine recourses is the basis of the U.S Ocean Action Plan and the newly formed Gulf of Mexico Alliance.

Further recognizing the significance of marine ecosystems and their importance to Florida's economy and environmental quality, the Florida Oceans and Coastal Council was established by the 2005 Florida Legislature to focus ocean and coastal research activities and establish a statewide ocean research plan (See http://www.dep.state.fl.us/secretary/news/2005/06/0608_03.htm). This council also coordinates public and private coastal and ocean research for more effective coastal management. To begin laying the groundwork for future ecosystem-based management in Florida, an interdisciplinary project has recently begun to synthesize and catalog existing physical, biological, and human-use information for Florida's marine waters.

Florida’s Strategic Vision

Creating a strategic vision for Florida is essential to implementing the Comprehensive Wildlife Conservation Strategy (Strategy). Fundamental to the strategic vision is the recognition that everyone who lives in Florida, visits Florida, or invests in Florida has a shared vested interest in the stability and the quality of Florida’s environment. The overarching task ahead is to promote recognition of the shared advantages that accrue to all sectors of Florida by maintaining wildlife and its habitats. This should be self evident because many of the qualities and values that attract people to Florida are based in wildlife and habitat. Clean water, beautiful lakes, pristine beaches, fishing, hunting, and other recreational opportunities, retirement in natural surroundings, and the appealing climate are Florida’s stock in trade.

To be successful, all partners, stakeholders, and individuals will need to work together in implementing Florida’s Strategy. The Florida Fish and Wildlife Conservation Commission (FWC) has the capacity and resources to initiate and catalyze many of the proposed actions in the Strategy through its existing structure and new program, Florida’s Wildlife Legacy Initiative (Chapter. Introduction). Appropriately integrating wildlife conservation into the planning, research, and action framework for all of Florida is the FWC’s goal and the intent of the Strategy. This chapter will help realize that goal by highlighting the overall themes that become apparent when looking at Florida’s Strategy from a higher level. The Strategy contains valuable information about the conservation needs of Florida's wildlife and habitats. Nearly 1,000 wildlife species are identified as Species of Greatest Conservation Need (SGCN) and are associated with 45 habitat categories representing the state’s terrestrial, freshwater and marine resources. The Strategy has a clear articulation of the threats and actions, prioritization of the most urgent concerns, and a cooperative and incentive-based approach to address these issues. The Strategy demonstrates the great challenges we face in trying to conserve our natural resources and to keep common species common for the enjoyment and use by all Floridians.

A Wildlife Species Endeavor

Florida’s Strategy started with species as the initial building blocks and ultimately ends with wildlife as the determinant of success. Although the Strategy is organized around habitat categories and much effort has gone into identifying habitat-based conservation actions, it is intended to be a wildlife conservation endeavor. Many of the high-order issues that drive the threats and actions developed in the Strategy often are only secondarily related to the species they are intended to benefit. Accomplishment of these conservation actions is important and will lead to sustained wildlife populations. However, as Strategy completion, review, and revision progresses, focus must continually be placed back upon the species for which all this work is being done. Conservation of habitat alone is not enough without the wildlife that inhabits and defines it.

Priority Habitats

Florida's Strategy uses a habitat approach to arrange wildlife species, and the conservation threats and actions needed to conserve them, into meaningful and manageable categories. These habitat categories are organized at the broad level and are intended to identify large-scale vegetation and structural associations across the state for terrestrial, freshwater and marine ecosystems. Although any such classification tends to become arbitrary at some scale, Florida's habitat categories provide a framework for grouping of wildlife, and categorizing and prioritizing conservation efforts. Florida is an interwoven and interdependent system of habitats. Therefore, while it is useful to work with the habitat categories individually, they should always be considered within the overall system, and it must be recognized that each habitat category will affect and be affected by other habitat categories, especially those geographically adjacent to each other. Additionally, many species move freely across the habitat categories and most are dependent upon a mix of habitat categories to provide the needed resources for life. The general concept presented in Florida's Strategy however, is that by taking actions that sustain the health and integrity of the habitat categories, the broad array of wildlife that lives within each will be conserved and maintained.

All 45 habitat categories identified in this Strategy are worthy of attention and conservation effort; however, several are identified as being under the greatest threat. Eight terrestrial habitat categories were identified as having the highest relative threat status (Table 2). (*Presented alphabetically*):

- Beach/Surf Zone
- Coastal Strand
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Natural Pineland
- Pine Rockland
- Sandhill
- Scrub

These terrestrial habitat categories generally were associated with coastal, wetland, and upland pine area.

Three freshwater habitat categories were identified as having the highest relative threat status (Table 3). (*Presented alphabetically*):

- Coastal Tidal River or Stream
- Softwater Stream
- Spring and Spring Run

These freshwater habitat categories coincide with and reinforce the coastal and upland pine areas identified under the terrestrial habitat categories. Additionally, Florida's unique springs and spring runs emerged as highly important for conservation attention.

Nine marine habitat categories were identified as having the highest relative threat status (Table 4). (*Presented alphabetically*):

- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coral Reef
- Inlet
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Tidal Flat

Two of these marine habitat categories (Beach/Surf Zone and Coastal Tidal River or Stream) were also identified in the terrestrial and freshwater habitat categories. They were placed in both systems because of the process used to determine threats and actions and because of their importance to each ecosystem. Several of the highest ranking marine habitat categories coincide with coastal systems that transition between terrestrial/freshwater and marine systems. Other highly ranked marine habitat categories generally were associated with reefs and submerged vegetation, which provide structure and food for a vast multitude of marine species.

The relationships among habitat categories and associated threats may be visualized in tabular format. Three tables, one each for Terrestrial (Table 2), Freshwater (Table 3), and Marine (Table 4) habitat categories were created based on the 12 Threat and Action Workshop sessions across Florida (See Chapter Florida's Approach to Meeting the Eight Required Elements). Each table shows the habitat categories across the top and the associated threats down the left side. The colored cells between them depict the relative rank of each threat within each habitat category. These threat ranks then are totaled across habitat categories to give an Overall Threat Rank on the right side of each table. The threat categories are ordered in descending Overall Threat Rank. The Overall Threat Rank was determined by a process that combined threat ranks across all habitat categories, and was not simply a reflection of the highest threat rank within any habitat category (Low 2003). Therefore, several "Low" scores could total to a "High" overall score and different combinations of "Low," "Medium," "High," and "Very High" scores could result in different Overall Threat Ranks. These tables allow quick identification of those threat and habitat categories that are of highest relative rank. Additionally, for each habitat category, the level of each threat can be seen. An overall summary of the highest threat level for each habitat category is presented at the bottom of each table. Similarly, threat levels can be compared across all habitat categories for each threat category. Five habitat categories (Agriculture, Artificial Structure, Canal/Ditch, Disturbed/Transitional, Mixed Hardwood-Pine Forest, and Urban/Developed) were not addressed through the Threat and Action Workshop process and were not included in the summary tables.

Table 2. Overall threat rank across terrestrial habitat categories and collective threat status among terrestrial habitat categories.

	Threat Category	Threat Rank By Habiat Category																		Overall Threat Rank
		Bay Swamp	Beach/ Surf Zone	Bottomland Hardwood Forest	Coastal Strand	Cypress Swamp	Dry Prairie	Freshwater Marsh and Wet Prairie	Grassland/ Improved Pasture	Hardwood Hammock Forest	Hardwood Swamp/ Mixed Wetland Forest	Hydric Hammock	Industrial/ Commercial Pineland	Natural Pineland	Pine Rockland	Sandhill	Scrub	Terrestrial Cave	Tropical Hardwood Hammock	All Habitat Categories
1	Conversion to housing and urban development	High	-	-	Very High	High	Very High	Very High	High	High	Medium	-	High	Very High	Very High	Very High	Very High	-	Medium	Very High
2	Roads	-	-	Medium	High	Medium	Very High	High	High	High	Medium	-	Medium	Very High	Very High	Very High	Very High	-	Low	Very High
3	Conversion to commercial and industrial development	-	-	-	-	-	High	-	-	High	-	-	High	High	Very High	High	Very High	-	-	Very High
4	Incompatible fire	Low	-	-	Low	Low	Medium	High	-	Low	Medium	-	-	High	High	High	Very High	-	Medium	Very High
5	Incompatible recreational activities	-	Very High	-	High	-	-	Medium	-	-	Low	-	-	High	-	Very High	Medium	High	-	Very High
6	Surface water withdrawal	Medium	-	-	-	High	Medium	High	-	Medium	High	-	-	High	-	-	-	-	Medium	Very High
7	Invasive plants	High	-	Medium	Medium	High	Low	High	-	Medium	High	Medium	-	High	Medium	Medium	Medium	-	High	Very High
8	Incompatible forestry practices	-	-	-	-	High	Low	Low	-	-	High	-	High	High	-	-	Very High	-	-	Very High
9	Conversion to agriculture	High	-	-	-	Medium	Medium	Very High	Medium	Low	Medium	-	-	Low	-	-	Very High	-	-	Very High
10	Invasive animals	Low	High	Medium	Medium	Medium	-	Medium	-	Low	Medium	-	-	Low	Medium	Medium	Medium	-	High	Very High
11	Incompatible resource extraction: mining / drilling	-	-	-	-	Low	Low	High	-	Medium	-	-	-	Low	-	Medium	Very High	Medium	-	Very High
12	Shoreline hardening	-	High	-	Very High	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very High
13	Sea level rise	-	High	-	High	-	-	-	-	-	-	High	-	-	-	-	-	-	-	Very High
14	Conversion to recreation areas	-	-	-	High	-	-	-	Low	Low	-	-	-	Medium	-	Medium	Medium	-	-	Very High
15	Groundwater withdrawal	Medium	-	-	-	Medium	-	Medium	-	Low	Low	-	-	Medium	-	-	-	-	Medium	High
16	Light pollution	-	High	-	High	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
17	Nutrient loads - agriculture	-	-	-	-	High	-	High	-	-	-	-	-	-	-	-	-	-	-	High
18	Utility corridors	-	-	-	-	-	-	-	-	-	-	-	-	Medium	-	High	-	-	-	High
19	Incompatible residential activities	-	-	-	High	-	-	-	-	Low	-	-	-	-	Low	-	-	-	Low	High
20	Climate variability	-	-	-	High	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
21	Management of nature - inlet relocation and dredging	-	High	-	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
22	Military activities	-	-	-	Medium	-	Low	-	-	-	-	Low	-	-	-	Medium	Medium	-	-	High
23	Nuisance animals	-	Medium	-	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	Low	High
24	Channel modification / shipping lanes	-	Medium	-	Medium	-	-	Low	-	-	-	-	-	-	-	-	-	-	-	High
25	Management of nature - stormwater facilities	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High	-	-	High
26	Management of nature - dredge spoil deposition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High	-	-	High
27	Parasites / pathogens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High	-	-	-	High
28	Nutrient loads - urban	-	-	-	Low	Low	-	Medium	-	-	-	-	-	-	-	-	-	-	-	Medium
29	Management of nature - water control structures	-	-	-	-	Low	-	Medium	-	-	Low	-	-	-	-	-	-	-	-	Medium
30	Incompatible grazing and ranching	Low	-	-	-	Low	Low	Low	-	-	Low	-	-	Low	-	-	Low	-	-	Medium
31	New dams	-	-	-	-	-	-	-	-	-	Medium	-	-	-	-	-	-	-	-	Medium
32	Incompatible agricultural practices	-	-	-	-	Low	Low	-	-	Low	-	-	-	-	Low	-	Medium	-	Low	Medium
33	Incompatible vegetation harvest	-	-	-	-	Low	-	-	-	-	Low	-	-	-	-	-	-	-	Low	Medium
34	Chemicals and toxins	-	-	-	Low	-	-	-	-	-	-	-	-	-	Medium	-	-	-	Low	Medium
35	Solid waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium	-	Medium
36	Management of nature - beach raking	-	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
37	Incompatible wild animal harvest	-	-	-	-	-	-	-	-	-	Low	-	-	-	-	Low	-	-	Low	Low
38	Humidity and temperature changes	-	-	-	-	-	-	-	-	Low	-	-	-	-	-	-	-	-	-	Low
39	Dam operations	-	-	-	-	-	-	-	-	-	Low	-	-	-	-	-	-	-	-	Low
40	Degraded habitat	-	-	-	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low
41	Altered wind due to buildings	-	-	-	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low
42	Management of nature - renourishment	-	-	-	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low
43	Management of nature - driving for maintenance	-	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low
44	Key predator / herbivore / pollinator losses	-	-	-	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low
	Habitat Category Threat Status	High	Very High	Medium	Very High	High	Very High	Very High	High	High	High	Medium	High	Very High	Very High	Very High	Very High	Medium	High	Very High

Table 3. Overall threat rank across freshwater habitat categories and collective threat status among freshwater habitat categories.

	Threat Category	Threat Rank By Habitat Category									Overall Threat Rank
		Aquatic Cave	Calcareous Stream	Coastal Tidal River or Stream	Large Alluvial Stream	Natural Lake	Reservoir/ Impoundment	Seepage/ Steephead Stream	Softwater Stream	Spring and Spring Run	All Habitat Categories
1	Invasive plants	-	High	Medium	-	High	High	-	Medium	Very High	Very High
2	Nutrient loads - urban	-	High	Medium	-	High	High	-	Medium	Very High	Very High
3	Surface water withdrawal	-	-	High	Medium	Medium	-	-	High	Medium	Very High
4	Invasive animals	-	Medium	Low	Medium	Medium	High	Medium	Medium	High	Very High
5	Nutrient loads - agriculture	-	High	Medium	-	Medium	Medium	-	High	High	Very High
6	Dam operations	-	-	High	High	High	-	-	Medium	-	Very High
7	Conversion to housing and urban development	-	Medium	High	-	High	-	Medium	High	-	Very High
8	Channel modification / shipping lanes	-	-	High	High	-	-	-	-	-	Very High
9	Roads	-	Medium	Medium	-	-	-	Medium	High	-	High
10	Chemicals and toxins	-	Medium	Medium	Low	Medium	Medium	-	Medium	-	High
11	Incompatible recreational activities	Medium	-	-	Low	Low	High	-	Low	Medium	High
12	Conversion to commercial and industrial development	-	-	Medium	-	Medium	-	Medium	Medium	Low	High
13	Management of nature - water control structures	-	-	-	High	-	-	Medium	-	-	High
14	Conversion to agriculture	-	-	-	-	Medium	-	-	High	-	High
15	Incompatible resource extraction: mining / drilling	Medium	Low	-	-	-	-	Medium	Medium	-	High
16	Shoreline hardening	-	-	High	-	-	-	-	-	-	High
17	Management of nature - veg clearing/snagging for water conveyance	-	-	Medium	-	-	-	-	-	-	Medium
18	Groundwater withdrawal	-	-	-	Low	Low	-	-	Low	Medium	Medium
19	Incompatible fire	-	-	-	-	-	-	Medium	-	-	Medium
20	Incompatible forestry practices	-	Low	-	Low	-	Low	Low	Low	Low	Medium
21	Incompatible agricultural practices	-	Low	-	-	Low	Medium	-	Low	-	Medium
22	Incompatible construction practices	-	-	-	-	-	Medium	-	-	-	Medium
23	Conversion to recreation areas	-	-	-	-	-	-	-	-	Low	Low
24	Management of nature - aquatic plant treatment	-	-	-	-	Low	-	-	-	-	Low
25	Sea level rise	-	-	Low	-	-	-	-	-	-	Low
26	Incompatible residential activities	-	-	-	-	Low	-	-	-	-	Low
27	Solid waste	Low	-	-	-	-	-	-	-	-	Low
	Habitat Category Threat Status	Medium	High	Very High	High	High	High	Medium	Very High	Very High	Very High

Table 4. Overall threat rank across marine habitat categories and collective threat status among marine habitat categories.

	Threat Category	Threat Rank By Habitat Category													Overall Threat Rank
		Annelid Reef	Beach/ Surf Zone	Bivalve Reef	Coastal Tidal River or Stream	Coral Reef	Inlet	Mangrove Swamp	Hardbottom	Pelagic	Salt Marsh	Submerged Aquatic Vegetation	Subtidal Unconsolidated Marine/ Estuarine Sediment	Tidal Flat	All Habitat Categories
1	Coastal development	High	Very High	High	Very High	Very High	High	Very High	-	-	Very High	Very High	High	Very High	Very High
2	Inadequate stormwater management	Low	Medium	Very High	Very High	Very High	-	Medium	Medium	High	High	Very High	High	High	Very High
3	Dam operations/incompatible release of water (quality, quantity, timing)	Medium	Medium	High	Very High	High	High	High	Medium	-	High	High	High	High	Very High
4	Incompatible industrial operations	High	High	Low	High	Medium	Medium	High	Medium	Low	High	High	Medium	Very High	Very High
5	Channel modification/shipping lanes	High	High	Medium	Very High	High	High	High	High	Low	High	Very High	Medium	Medium	Very High
6	Climate variability	High	Very High	-	Medium	Very High	-	High	Medium	-	High	High	-	Medium	Very High
7	Roads, bridges & causeways	-	Very High	High	Medium	High	Medium	High	Low	-	High	High	Medium	High	Very High
8	Management of nature (beach nourishment, impoundments)	High	High	Medium	High	High	High	Medium	Medium	-	High	Medium	Low	High	Very High
9	Shoreline hardening	Low	High	-	Very High	Medium	High	High	Low	-	Medium	High	-	Medium	Very High
10	Harmful algal blooms	-	High	High	-	Medium	Medium	High	Medium	High	-	Very High	-	Low	Very High
11	Invasive plants	-	High	-	High	High	Medium	High	Medium	-	Medium	High	-	-	Very High
12	Nutrient loads (all sources)	-	Medium	Medium	Medium	Very High	-	Medium	-	Medium	-	High	Low	-	Very High
13	Disruption of longshore transport of sediments	Medium	High	-	-	Low	High	-	High	-	High	Medium	-	Medium	Very High
14	Invasive animals	-	Medium	Medium	High	-	Low	High	Low	Medium	-	Medium	Low	High	Very High
15	Surface water withdrawl	-	-	Medium	High	-	Low	Medium	-	-	High	High	Low	Low	Very High
16	Incompatible fishing pressure	-	Medium	Low	Medium	Very High	Medium	Medium	Medium	Medium	-	Medium	-	-	Very High
17	Incompatible recreational activities	Low	Medium	Low	Medium	Medium	High	Medium	-	-	-	Medium	Medium	High	Very High
18	Chemicals & toxins	-	Medium	-	High	Medium	-	Medium	Low	-	Medium	Medium	Low	High	Very High
19	Large industrial spills	-	Medium	-	High	Medium	Medium	Medium	-	-	Medium	Medium	-	High	Very High
20	Parasites/pathogens	-	-	-	-	Very High	-	High	High	-	-	Low	-	-	Very High
21	Boating impacts	Low	-	Low	Medium	High	High	Medium	Low	-	Low	Medium	Low	Medium	Very High
22	Key predator/herbivore losses	-	Medium	-	-	High	-	-	Medium	High	-	Medium	-	-	Very High
23	Fishing gear impacts	Low	Low	-	Low	High	Medium	Low	Low	-	-	Medium	Medium	Low	Very High
24	Groundwater withdrawl	-	-	-	High	-	-	Medium	-	-	-	High	-	Low	Very High
25	Wildlife & fisheries management	-	Low	Low	-	-	-	High	Low	Low	High	-	-	-	Very High
26	Utility corridors	Medium	Low	-	Medium	Medium	Low	Low	Low	-	Medium	Medium	-	-	High
27	Vessel impacts	-	Low	-	Medium	High	Medium	-	Low	-	Low	Low	-	Low	High
28	Solid waste	-	Medium	-	Medium	Low	-	Medium	Low	-	-	Medium	Low	Medium	High
29	Incompatible resource extraction: mining/drilling	-	Medium	-	Medium	Medium	-	-	-	-	-	-	-	-	High
30	Incompatible aquaculture operations	-	Medium	-	-	-	-	Medium	-	Low	-	Medium	-	-	High
31	Sonic pollution	-	Low	-	Low	-	Medium	Medium	-	-	-	-	-	-	High
32	Light pollution	-	Medium	-	-	-	Medium	-	-	-	-	-	-	-	High
33	Placement of artificial structures	Low	-	-	-	Medium	-	Low	Low	Low	Low	Medium	-	-	Medium
34	Incompatible aquarium trade	-	-	-	-	Medium	-	-	Low	-	-	Low	-	-	Medium
35	Indadequate stormwater management	-	-	-	-	-	Medium	-	-	-	-	-	-	-	Medium
36	Thermal pollution	-	-	-	Low	-	-	Low	-	-	-	Low	Low	-	Medium
37	Military activities	-	-	-	-	Low	Medium	-	-	-	Low	-	-	-	Medium
	Habitat Category Threat Status	High	Very High	Very High	Very High	Very High	Very High	Very High	High	High	Very High	Very High	High	Very High	Very High

Statewide Threats

This section synthesizes the highest priority common themes and briefly describes each Many of the threats facing wildlife in Florida form common themes that affect multiple habitat categories and numerous species (See Chapter Multiple Habitat Threats and Conservation Actions). By focusing attention and efforts on these threats, benefits can be accrued to a wide variety of habitat categories and species. Although not encompassing all that needs to be accomplished, implementation of actions and projects that diminish these threats should have the largest positive impact for wildlife resources across the state.

Habitat Loss and Fragmentation

The Strategy identifies habitat loss and fragmentation as one of the most pervasive threats to Florida's wildlife, reaching across habitats statewide. This threat primarily comes from residential, commercial and industrial development and is directly related to a subsequent array of threats from infrastructure or actions of Florida's residents (e.g., roads, surface water diversion and withdrawal, residential activities, and nutrient loads). Habitat fragmentation affects wildlife by isolating populations, altering the movement patterns of individuals, and increasing the negative aspects of edge effects. Development disrupts ecological connectivity and results in substantial loss of function of adjacent natural habitat including landscape-level functions (e.g., sediment movement, hydrology, fire regime, and wildlife movements). As the human population increases, more land will be developed with the highest pressure occurring on coastal and upland habitats.

Degradation of Water Resources

Degradation of Florida's water resources, primarily from withdrawal and contamination, is another widespread threat to the state's wildlife throughout aquatic habitats. This threat includes groundwater withdrawal, drainage or channelization of wetlands, surface water diversion and withdrawal, diversion of rainfall due to impervious cover, contamination from industrial operations, and contamination from inadequate stormwater management. In many of Florida's springs, decline in water quality and reduced flow discharge have been detected. Contamination by nutrients and harmful chemicals such as pesticides, herbicides and petroleum hydrocarbons can degrade water systems to the point that they no longer support wildlife. Increased salinity levels are another source of water degradation. Economic impacts result from decreased associated revenues due to effects of water degradation including the degradation and loss of marine, freshwater fisheries and waterfowl. Diversion or withdrawal of surface water for consumptive uses is expected to increase in the immediate future as limits on groundwater withdrawals are reached.

Incompatible Fire Management

Many of Florida's habitats lie within fire-maintained ecosystems and many wildlife and plant species depend on periodic fires to maintain habitat conditions. Changes in vegetation structure and composition occur where fire frequency, seasonal timing, intensity, and extent are

altered. These changes have resulted in loss of habitat value for particular wildlife species, even in lands managed for conservation. Many of Florida's fire dependant habitats have become more fragmented due to urban development, making naturally occurring fire and prescribed fire more problematic and resulting in accumulation of fuels. When fire management does not keep pace with the accumulation of fuels, fire hazards increase and when fire does occur it can be severe and may result in destruction of the seed bank, sterilization of the soil, and jeopardize human health and safety. Lack of appropriate fire management is an established threat in many of the terrestrial habitats.

Invasive Plants and Animals

While the distribution of invasive species differs regionally in Florida, the threat posed by these species occurs across all habitats. Invasive plants and animals change community structure and composition, alter hydrological and fire regimes, alter soil sedimentation and erosion processes, and modify habitat values for both wildlife and humans. Invasive species also pose direct threats to wildlife through competition, predation, and pathogen movement. New invasive species are identified regularly in Florida. Florida's mild climate has contributed to the establishment of numerous species of exotic fish, amphibians, and reptiles. Exotic marine species are introduced into Florida waters when vessels discharge bilge water and exchange ballast water in ports or in nearshore marine environments. Public and private land managers have identified the high ecological and economic costs of invasive species.

Management of the Physical Environment

The threat of management of the physical environment (i.e. management of nature), including dams, shoreline hardening, dredging, beach nourishment, and impoundments is a concern for Florida's aquatic resources. These management actions often provide services necessary for human health and safety, including securing property from damage due to flooding or erosion, maintaining navigation, and creating reservoirs to meet water supply needs. While any one management action may not be significant, it is the cumulative effects of this threat that is important. Management actions can be incompatible with wildlife conservation due to altered water quality and hydrologic regime and overall degradation or destruction of habitats. Where these actions are necessary, additional management may be necessary to lessen affects to wildlife.

Statewide Actions

Many tools are already available to address wildlife and habitat conservation on both public and private lands. These range from direct conservation efforts such as land acquisition, habitat restoration, and private landowner incentive programs, to indirect but important efforts such as conservation education, research and increased inter-agency coordination. The following are actions that are discussed repeatedly in the Strategy which would abate multiple threats within terrestrial and aquatic systems.

Develop Incentive-based Programs for Natural Resource Conservation

Florida's Strategy is intended as an incentive-based, non-regulatory document and many of the actions are incentive-driven. Many current incentive programs on private lands, administered by state and federal agencies, encourage private landowners to implement land management actions that benefit wildlife and ecosystem functions. These programs provide technical and financial assistance to private landowners. Examples of these programs include Partners for Fish and Wildlife (USFWS), Landowner Incentive Program (LIP; USFWS/FWC), Cooperative Forestry Assistance Program (FDOF) and Farm Bill programs (NRCS/FWC) such as the Environmental Quality Incentives Program, Wildlife Habitat Incentives Program and Farm and Ranch Protection Program. Links for many of these programs are available on the FWC LIP web site, http://www.myfwc.com/lip.

High Priorities:

- Maintain and enhance current private landowner incentive programs.
- Create the partnerships and cooperative efforts needed to establish and implement new incentive programs (e.g., explore creative private/public funding partnerships).

Acquire Lands and Waters Important to Wildlife Conservation

Land acquisition and conservation easement programs at the federal, state, and local levels will continue to be essential to conserve areas important to wildlife and to ensure the public has access to quality conservation areas in order to hunt, fish, and participate in other recreational activities. Acquisition and easements are tools applicable to terrestrial and many freshwater habitats. This is not the case for many coastal or marine habitats where most areas are either sovereign commons or already developed. Land acquisition will become more challenging as land values increase, therefore new and enhanced strategies will be required (e.g., cooperative and incentive based programs).

High Priorities:

- Continue support for acquisitions through the Florida Forever program.
- Emphasize the purchase of, and less-than-fee acquisition of conservation easements for, coastal lands and buffer areas.

Coordinate Natural Resource Conservation Efforts

Coordination is critical to implementing many of the actions needed to conserve Florida's natural resources. Threats to wildlife and habitats are under the jurisdiction and responsibility of many agencies, but the challenges are beyond any one agency or organization. Therefore coordination, cooperation, and communication among federal agencies, state agencies, local governments, non-governmental organizations, and private entities are essential. Effective coordination is a formidable challenge due to the broad array of existing responsibilities and priorities, missions and visions, and historical interactions between agencies and organizations. The strategic vision for Florida is that these obstacles can and will be overcome through effective coordination and partnership development.

High Priorities:

- Maximize conservation benefits on public conservation lands. The large land area and proportion of land surface in public ownership provides the most hopeful opportunity for implementing new and enhanced cooperative conservation actions identified in the Strategy (e.g., increasing the capacity, resources and coordination of prescribed fire efforts).

- Fund and ensure implementation of existing plans (e.g., Springs Task Force, Comprehensive Everglades Restoration Plan, Rural and Family Lands Protection Act, Weeds Won't Wait, and Southeast Florida Coral Reef Initiative).

Educate the Public about Florida's Natural Resources

Education plays a vital role in conservation of Florida's wildlife and other natural resources. The goal of conservation education is to lead individuals from awareness to beneficial action and behavior. Many citizens know little about Florida's natural resources and do not realize how their individual actions collectively contribute to the threats to these resources. The future health of Florida's natural resources will depend on continuous and comprehensive educational efforts designed to promote ecological literacy and the balance between natural resources, wildlife conservation, economic productivity and development.

High Priorities:

- Communicate the message that "natural resources are important and vital to your quality of life. We all benefit from it and need to work to maintain it" and "We need to invest in conserving wildlife and vital natural areas for the enjoyment and use by future generations".

- Enhance and promote more broad and consistent education materials on water conservation.

- Facilitate the creation of "hands-on" educational opportunities to provide training on conducting successful restoration projects.

- Improve knowledge and awareness of marine, estuarine and coastal resource values and the cumulative effects of activities to marine, estuarine and coastal resources of the state, and the positive effects managed hunting and fishing can have on wildlife conservation and to the state's economy.

A Statewide Cooperative Conservation Effort

One conservation action that was identified multiple times as a "Very High" or "High" priority was what experts identified as a need to develop a statewide, cooperative "ecological network"(Gordon et al 2005), referred to here as the "Cooperative Conservation Blueprint". This

action then served as a starting point for development of several other actions that those experts identified and appears in the following multi-habitat threat categories: Conversion to Agriculture, Conversion to Housing and Urban Development, Conversion to Recreation Areas, Incompatible Recreational Activities, and Roads, Bridges and Causeways (See Chapter Multiple Habitat Threats and Conservation Actions). The FWC has modified the original stakeholder suggested "ecological network" concept and more fully described the proposed process.

Florida has previously developed several programs that represent a vast amount of information and useful planning tools; it would therefore be redundant to create a new conservation planning effort. The "Cooperative Conservation Blueprint" would not be a brand new, stand alone conservation effort, but rather a process which works to harmonize existing efforts into a single agreed upon and unified blueprint. The process would likely begin by integrating, updating, and unifying existing conservation planning efforts, such as the Strategic Habitat Conservation Areas (Cox et al. 1994), Florida Conservation Needs Assessment (Knight et al. 2000) and University of Florida's Ecological Network (Hoctor et al. 2000). In addition, the process would seek to expand upon these existing efforts by more effectively incorporating social and economic factors in planning for conservation of Florida. For example, by acknowledging the benefits of rural and agricultural land to wildlife and taking further coordinated steps to preserve the values of Florida's working landscapes.

Once created, the "Cooperative Conservation Blueprint" could serve as a tool for state and local agencies, stakeholders, and nongovernmental organizations to help guide conservation efforts. Experts agreed that a cooperative conservation effort of this nature is needed to help improve and coordinate conservation efforts on public and privately owned lands that are managed primarily for use and conservation of natural resources and to help encourage new or additional conservation activities on other private lands. As a tool used in this manner, the blueprint could help to further prioritize and guide public conservation land planning and help to direct voluntary, incentive and outreach programs to private lands within the identified areas. Private landowners may benefit from this process through goals of outreach, stakeholder coordination, and improved access to information, technical assistance and streamline applications for federal and state programs that direct public funds to private landowners for conservation and restoration of natural resources on their lands. The adoption of this type of statewide cooperative conservation effort would improve the effectiveness of natural resource conservation at local and regional scales.

The "Cooperative Conservation Blueprint" would be an ongoing process, regularly updated by local and state government, stakeholder, public, and conservation organizations as conditions change or other conservation activities are successfully completed. The dynamic blueprints would serve as a temporary conservation tools to better identify data gaps, improve stakeholder involvement, increase planning efficiency or other, similar activities during a next phase of the process.

It is suggested that local and state government, stakeholder, public, and conservation organizations collaborate to adapt and continually change the "Cooperative Conservation Blueprint." The process would then be steered by involvement and coordination with local and state government, stakeholder, public, and conservation organizations. By producing and continually adapting the "Cooperative Conservation Blueprint" wildlife and habitat conservation efforts could be more directed to high priority areas and be flexible to adapt to Florida's changing landscape and land us.

Priority Data Gaps

During the development of the Strategy, information gaps on species and habitat distribution, status and trends were identified. This section highlights the highest priority data and information gap of the Strategy. Some gaps may identify a need for an appropriate future conservation action and others may be limitations of time and resources. Information gaps for individual habitats are detailed in the TNC's Final Report (Gordon et al., 2005). Many of the gaps suggested in the report evolved into research actions within the Strategy.

Priority gaps include:

- A datum need identified in Threat and Actions Workshops was for improved mapping of the Strategy's habitats. While representing the best available land cover analysis at this time (See Chapter Habitats), the existing data layers for some of the habitats addressed do not adequately reflect their true spatial extent and/or configuration. In each workshop, the experts assessed threats based on the true distribution of the habitat as best they understood it, rather than restricting assessment to the cover as presented. Some of the experts' suggestions for improving the freshwater habitat mapping were incorporated into the freshwater habitat layers. Several of the terrestrial habitat covers should be revised. TNC was unable to complete the full stress and source of stress analysis in any workshop for the habitat category Mixed Hardwood-Pine Forest due to incomplete mapping and because the experts were unable to distinguish this habitat from several other habitat types. As a result, no actions were developed through the Threat and Action Workshops for this habitat. Additionally, marine and estuarine habitat data layers in some regions of Florida do not exist or are incomplete or outdated. For example, the Strategy has not yet identified sources for the mapping of the Pelagic or Subtidal Unconsolidated Marine/Estuary Sediments habitat categories, and mapping is not complete for several other marine habitats including Annelid Reef and Hard Bottom. Improved mapping of these habitats will be necessary to support future projects and conservation efforts.

- An important continuing data gap is accurate and up-to-date information on the life history, status and trend, population dynamics, and other aspects of all species, particularly those identified in this Strategy. Working to continue to fill this data gap must be a priority if practical and effective conservation measures are to be developed, undertaken, and assessed for success. Continuing research and monitoring of mammals, birds, amphibians, reptiles, fish, and invertebrates is needed, particularly for those SGCN whose status is unknown or low and whose trend is unknown or declining. Invertebrate groups in particular have received little attention because of lack of awareness and funding. These groups tend to include smaller species, however many perform critical ecosystem functions that need to be better understood.

- Conservation actions in the marine environment differ from terrestrial and freshwater in that all marine environments are in public ownership. Development of the Strategy re-emphasized the need for additional mapping and characterization of nearshore marine environments. There is also the need for information on basic life history, distribution, and status and trends of less well-known marine species. Monitoring of increased

numbers of marine species and habitats will help prioritize and focus conservation actions on the species at the highest risk. Awareness and education of the value of Florida's marine resources is critical. Increased partnerships and collaborative efforts with federal, state, and local agencies as well as public and private organizations will be necessary to successfully conserve marine fish and wildlife species.

- Genetic diversity emerged as an important data gap during the Strategy development process. While the Strategy currently does not address the issue in much detail, it is recognized as an integral piece of the conservation puzzle. Genetic diversity forms the foundation for the maintenance of individuals, populations and taxa through time and provides another field in which to explore population and ecosystem richness and function. An inventory of what is known about the population genetics of the SGCN is needed to better understand the geographical extent of interbreeding populations, levels and patterns of gene flow among populations, the degree of isolation of populations, and the levels and organization of genetic diversity within populations and species. Information on gene flow and genetic diversity of imperiled species is critical. Areas of genetic richness may or may not align with areas of species richness and may identify previously unrecognized areas of critical importance to conserving wildlife resources in Florida.

Monitoring and Performance Measures

Monitoring, performance measurement, and adaptive management are integral components of Florida's strategic vision for wildlife conservation. Developing a comprehensive adaptive management scheme for a system as large as Florida is a daunting task; therefore, Florida has taken a flexible approach that targets multiple levels and systems. The basic approach is to implement projects focused on key actions and then to monitor changes in performance measures through time (See Figure 6. below). The actions will be based on information and needs identified in the Strategy and performance will be measured at the species, habitat, threat, and Strategy levels. Florida Wildlife Legacy Initiative projects will be evaluated on an annual cycle whereas the Strategy will be evaluated on a five-year cycle. Actions will be evaluated on both cycles, with the annual cycle focused mainly on whether actions are being completed successfully and the five-year cycle focused mainly on whether the appropriate actions have been identified and implemented. Performance measures at the species-, habitat-, and threat-levels collectively will be used to determine if the Strategy is being successfully implemented or needs review and revision. Monitoring and adaptive management efforts will be dependent upon cooperation and partnering at many levels by many organizations and individuals. To be successful, all those working in the conservation arena will need to work together to develop and track measures that can be used to monitor response to conservation efforts and adapt management as necessary to achieve the goals of the Strategy.

To maximize both effectiveness and efficiency, a principal goal of the Strategy is to concentrate conservation efforts at the habitat level to prevent additional SGCN from attaining imperiled status. Monitoring is focused at all levels (species, habitat and threats) within the Strategy as appropriate to assess consistency with performance measures established to determine

the effectiveness of conservation actions. Overall, successful implementation of key conservation actions would be expected to result in:

- Lowered biological scores and action scores for ranked SGCN (see Species Monitoring below).
- Increased percentage of lands and waters conserved through purchases, easements, or otherwise conserved in natural or semi-natural state (see Habitat Monitoring below).
- Reduced rate of habitat conversion or degradation (see Habitat Monitoring below).
- Achievement of major threat monitoring goals (see Threat Monitoring below).
- Decreased number of species lacking population trend and status information (see Priority Data Gaps above).
- Reduction in number of identified data gaps (see Priority Data Gaps above).
- Increased public understanding about the ecological importance of human impacts on habitats.
- A number of completed conservation actions.

Species Monitoring

Florida already has developed valuable tools for prioritizing the conservation of its fish and wildlife resources. The species ranking system, a peer-reviewed monograph publication of The Wildlife Society (Millsap et al. 1990), was developed to prioritize efforts for vertebrate conservation. The system ranks a total of 668 vertebrate taxa (both species and subspecies) according to biological vulnerability, population status (to the extent known), and management needs. For each taxon, the system assigns a biological score, which is the sum of factors that reflect distribution, abundance and life history, and an action score, which is the sum of factors reflecting the current knowledge of a taxon's distribution, population trend, current amount of conservation effort, and limiting factors to the population. The higher the biological score the more vulnerable a taxon is to declines in population. A high action score indicates that little is currently being done in the way of research or management actions for the taxon.

The FWC reevaluates and updates the species ranking list periodically to improve management of these species and adaptively plan necessary conservation efforts. This ranking system enables state conservation planners to track the status and trends of species (biological score), as well as monitor the implementation of conservation actions on a species by species basis (action score). Many of the SGCN will be monitored at a statewide level using the species ranking system. The FWC can measure the relative increase in implementation of conservation actions addressed in the Strategy by assessing the species ranking action scores; if action scores are lowered, that can demonstrate successful implementation of the Strategy. Similarly, lower biological scores for taxa can demonstrate that conservation actions have been effective.

Currently the ranking system is not inclusive of all SGCN identified in the Strategy. Certain species, namely invertebrates and marine species, are not yet included in the ranking system. A high priority monitoring action is to readdress the species ranking list to align it with the SGCN list.

Habitat Monitoring

Public agencies and private entities involved in managing conservation lands currently utilize Geographic Information Systems (GIS) systems to monitor land use and habitat types or land cover on areas they manage. Use of the GIS systems makes it possible to more effectively plan management actions and monitor changes to habitats at the landscape scale throughout the state and at regional and local scales as well. One conservation goal for this Strategy will be to continue and expand use of these GIS systems to monitor habitats and more effectively and efficiently coordinate and integrate conservation actions at the landscape level and other levels, whenever appropriate.

Conservation actions undertaken through programs such as Florida Forever(FDEP), Florida Natural Areas Inventory (FNAI), and the Strategic Habitat Conservation Areas (SHCAs) help to ensure that high priority lands throughout Florida are conserved wherever possible (See Chapter State of the State). Through these programs, important natural areas can be conserved by direct land acquisitions, acquisition of conservation easements, and incentives and cost shares for conservation on private lands. Programs such as these have proven to be successful in the past and will continue to play an important role in the conservation of Florida's wildlife and their habitats as Florida implements this Strategy. The FWC can measure the relative increase in habitat conservation addressed in the Strategy by assessing the percentage of lands protected; if the percentage increases, that can demonstrate successful implementation of the Strategy. Ultimately, targets for evaluating success should be set, with conservation priorities for habitats identified and finalized. Use of these performance measures and targets will make it possible to produce reasonably accurate quantitative assessments of habitat conservation, in terms of preservation or loss.

In addition to monitoring areas of habitats that are conserved, it is important to monitor habitat conditions and the quality of those habitats. This monitoring need is addressed in conservation actions throughout the Strategy. The goal for these actions will be to ensure that suitable habitat management techniques are employed to maintain appropriate habitat quality. Currently, no statewide habitat quality performance measures exist, but work is underway on developing and testing schemes such as the FWC's Objective-Based Vegetation Management system (Florida Fish and Wildlife Conservation Commission 2004) and public (FDEP) and private efforts to monitor success in burning of fire-dependent landscapes.

A further subject for habitat monitoring will be to evaluate conservation actions addressing the issue of habitat conversion. Again, GIS is used for these actions to monitor habitat conversion at the landscape scale. The 2003 Florida Vegetation and Land Cover GIS Data, which was developed by the FWC (Stys et al. 2004), is the most comprehensive statewide assessment of current land covers and habitat conditions; this GIS coverage is based upon 2003 Landsat Enhanced Thematic Mapper satellite imagery (Stys et al. 2004). These GIS data, when combined with appropriate ground truthing, provide a useful tool by which to monitor relatively small-scale changes in habitat condition (land cover) that result from habitat conversion. The quantitative

nature of GIS makes it possible to measure amounts of land converted from one habitat type to another. Decreasing conversion rates of key habitats will be indicative of successful implementation of conservation actions. Although currently not available, similar mapping efforts can be developed for freshwater and marine habitats.

Threat Monitoring

In the previous 'Statewide Threats' section of this chapter a set of five major threats affecting multiple habitats and many species was identified. Incorporated into those threats are issues related to the overall success of the Strategy. Monitoring the success of conservation actions directed toward abating those threats will provide a basis for evaluating overall success of action implementation. Listed below for each of the five major threats is the conservation goal developed as the principal solution for that threat and a series of performance measures proposed to evaluate the success of projects developed to achieve that goal.

Habitat Loss and Fragmentation

Goal: Reduce habitat loss and fragmentation resulting from conversion of natural or semi natural habitats to minimize the effects of development

Performance Measures:

- Increased proportion of road, bridge, and/or causeway projects that are appropriately designed and located (i.e., sited)
- Reduced rate of conversion of natural habitats
- Reduced index of habitat fragmentation
- Increased human population density inside the development footprint

Degradation of Water Resources

Goal: Improve the quality of Florida water resources

Performance Measures:

- Decreased per capita water use
- Decreased rates of ground water withdrawal
- Maintained or increased acres of ground water recharge areas
- Increased voluntary landowner participation in wastewater/fertilizer application wise use programs to control urban nutrient loads
- Increased amount of acres of stream and/or shoreline miles which meet minimum flow and water quality standards
- Increased number of stream miles and acres of designated high quality water bodies (e.g., Outstanding Florida Waters)

Incompatible Fire Management

Goal: Increase the presence of appropriately applied fire on the Florida landscape

Performance Measures:

- Increased proportion of each fire-dependent habitat managed with an appropriate fire regime
- Increased area of appropriately burned land by habitat category

Invasive Plants and Animals

Goal: Reduce the presence of and impact of non-native, invasive plants and animals

Performance Measures:

- Decreased number of acres impacted by non-native, invasive animals
- Decreased number of acres dominated by non-native, invasive plants
- Decreased number of infestations of non-native, invasive plants
- Decreased number of newly introduced invasive animal and plant species

Management of the Physical Environment

Goal: Minimize the cumulative effects that management of nature, including dams, shoreline hardening, dredging, beach nourishments, and impoundments, have on Florida's habitat, especially in regard to aquatic resources

Performance Measures:

- Increased number of beach/shoreline acres/miles acquired or otherwise protected
- Increased tidal connections to isolated and impounded wetlands
- Increased proportion of beach nourishment or impoundment projects that are appropriately designed and located (i.e., sited)
- Increased usage of alternative methods for beach protection
- Increased number of naturally functioning inlets
- Decreased amount of adverse deposition and erosion of sediment, and more ecologically-appropriate flow rates around bridges and causeways
- Increased causeway replacement with bridges

Evaluating Success and the Effectiveness of the Strategy

A major component of the monitoring program for the Strategy is evaluation and adaptive management (See Chapter Florida's Approach to Meeting the Eight Required Elements). Inputs (resources—e.g., money or time) are monitored at the individual project level and at the Strategy level to evaluate not only the effectiveness but also the efficiency of conservation actions and adapt changes as necessary. A database will be developed to track Strategy inputs from sources such as State Wildlife Grant (SWG) funds or matching and other funds associated with SWG-funded projects. Results or outcomes are monitored at several levels including: individual projects, specified conservation actions, and the overall Strategy. The database will assist in answering questions including: Are conservation actions focused in the appropriate directions to achieve larger-scale, Strategy, objectives? Are conservation actions achieving desired objectives in an effective and efficient manner? Evaluations also will be conducted along several time scales. Annual and final reports will be conducted for individual projects, annual and five-year assessments

will be conducted for conservation actions, and five-year assessments will be conducted for the Strategy. Project review will be based on performance measures appropriate to each project (Was it completed on time? Was it on budget? Did it have the desired outcome?, etc.). Action review will be based on assessment of all projects implemented under each action on an annual basis and on species, habitat, and threat performance measures tracked every five years. Strategy review will be based on assessment of all projects, actions, and performance measures. However, it is important to note that many variables and influences outside the control and influence of the Strategy may be affecting the performance measures regardless of the successful implementation of key actions. Therefore, the five-year review will assess Strategy success within the context of the global environment in Florida.

The flow chart in Figure 6 demonstrates how monitoring and evaluations are incorporated at multiple levels and how, together with reporting procedures, they will be applied to provide feedback on the effectiveness of the Strategy as it is implemented. This multi-level, overall evaluation scheme will help ensure that the Strategy is meaningfully implemented and will provide needed documentation of progress. The projected reporting and evaluation schedule for the Strategy over the next five years encompasses the following levels and time-scales:

I. Individual projects
- A. Annual (interim)—Reports
- B. Final—Reports and evaluations

II. Conservation Actions
- A. Annual —Assessment and evaluation
- B. Five-year—Assessment and evaluation

III. Strategy
- A. Five-year — Assessment, evaluation, and revision as needed

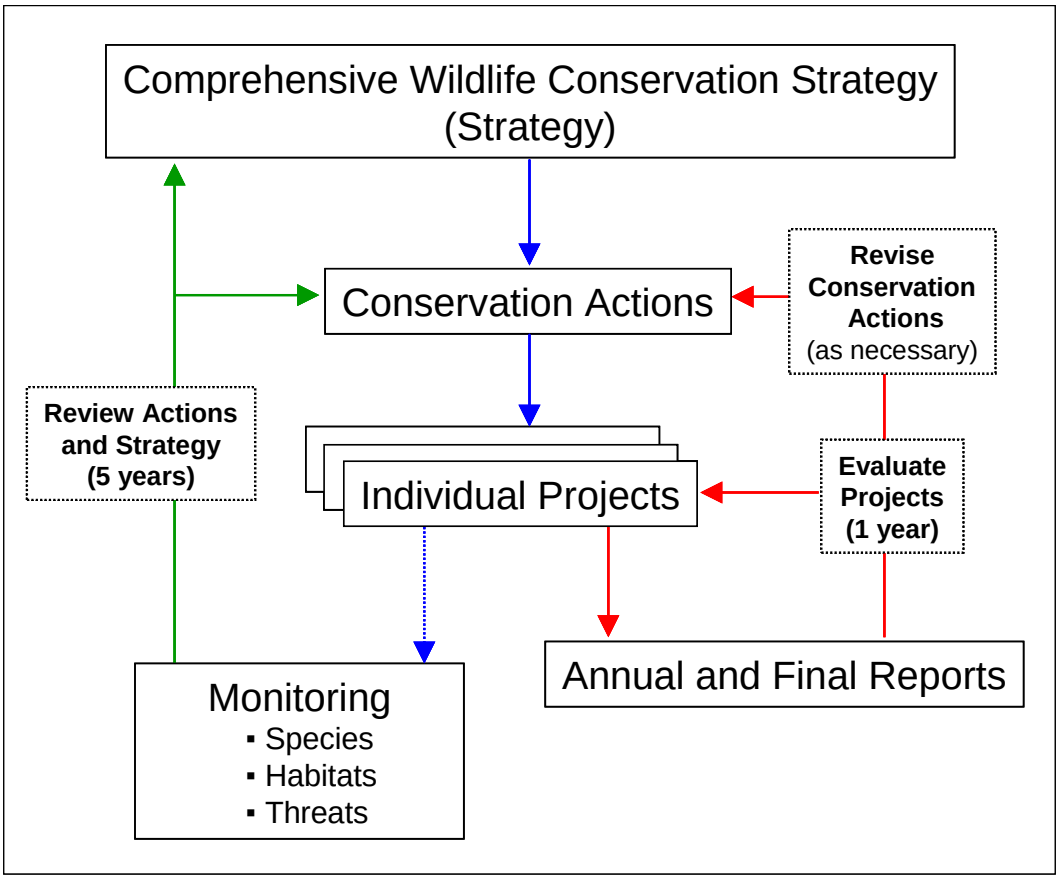


Figure 6. Flow chart showing the conceptual framework for how monitoring and evaluations will be applied to provide feedback at multiple levels as Florida's Strategy is implemented.

Even with the more formal five-year review, the Strategy is intended to be a flexible, living document and will be subject to continual revision and update as data gaps are filled, new information arises, and stakeholder and public input is received. Less formal Strategy updates may be produced at intervals shorter than the periods stated above in response to these matters or as newly emerging issues and needs arise. When determined to be necessary, such Strategy updates may be submitted to the U.S. Fish and Wildlife Service (USFWS) for review and comment.

Monitoring Tools and Resources

Current Monitoring and Database Development

A plethora of public and private organizations currently conduct a tremendous number of monitoring projects for both species and habitats within the lands and waters of Florida. The monitoring program administered by the FWC staff encompasses over 200 existing projects that are conducted throughout the state. Other major, ongoing monitoring projects include the Florida Springs Initiative (FDEP), the Comprehensive Everglades Restoration Plan (USACE and SFWMD), the Integrated Water Resource Monitoring Network (FDEP), and those undertaken by the National Coral Reef Institute. Additional current monitoring projects are identified throughout this Strategy.

As the initial step in implementing the monitoring program for the Strategy, FWC is developing a baseline inventory of existing monitoring projects to more effectively identify and coordinate data being collected through the multitude of current monitoring projects in Florida. Identifying existing projects helps to better-integrate new and existing monitoring projects. Data for the baseline inventory is recorded in a relational database. Data recorded in the database for each monitoring project include conservation threats addressed, conservation actions implemented, species and habitat monitoring techniques employed, and performance indicators and targets used to evaluate success. This baseline inventory covers public and private conservation and management entities around the state. Data are input to the database from existing management plans and similar documents, as well as from results of personal interviews of biologists and land managers who are implementing such plans. Compilation of this information in a searchable database form will assist future adaptive management efforts to improve protocols for monitoring projects and revise conservation actions undertaken, as appropriate. As implementation of the adaptive management process moves forward, the database can be used to track changes in monitoring as priorities for conservation actions are revised. The database will be available on the internet, so that the state's citizens and natural resource managers can benefit from the information archived there.

Species Monitoring Databases

Numerous detailed monitoring databases have been developed to compile and archive data on the distribution, abundance, and status of particular populations, species, or species groups (e.g., nesting shorebirds). Databases are regularly updated to incorporate new data that become available from the results of conservation projects that are undertaken. Information from species monitoring databases is regularly imported into the central database for rare and imperiled species.

Although these databases were developed at different times and for different purposes, efforts are in progress to standardize formats and better enable linkage, including the use of common formats in fields for site, habitat, and spatial (location) data. Databases incorporating spatial data can be linked to GIS files, making it possible to more easily summarize all work that has occurred in a particular location. Currently these efforts apply primarily to species monitoring databases within the FWC, but could be expanded to include other existing databases in Florida.

Monitoring the Strategy in the Future

Throughout the process of developing this Strategy, there has been an identified need for further improvement in, and coordination of, monitoring programs throughout the state. As implementation proceeds, evaluations that are undertaken will provide feedback to refine plans for future developments in the Strategy. In general, future goals for monitoring within the Strategy will include further development of databases for compiling and tracking data.

Most Florida habitats require periodic or occasional management and virtually all the statewide threats have a spatial component. Expansion of spatial information (i.e., GIS) systems to enhance species and habitat evaluations will be another important future Strategy-level monitoring goal. An additional statewide GIS coverage of conservation threats and implemented management actions would be examined as a monitoring tool to assess success in addressing those elements of Florida's Strategy. For example, in the case of the 'Incompatible Fire' threat, a GIS coverage would be created to depict the current location and condition of Florida's fire-dependent habitat

categories; associated with that would be relational database tables containing fire history data including fields such as date of, and time since, last fire. As conservation actions are initiated, the data table and condition map would be updated. Desired performance measures would be included as data fields for use in evaluating the scope of the response and effectiveness of the management project or conservation action that was conducted. Data can be assessed from a statewide perspective to test for trends or spatial correlations. Although potentially powerful analytical tools for use in providing feedback on the effectiveness of the Strategy, development of GIS applications such as these would require major resource investments (e.g., time and funding). For development and maintenance of these GIS tools, effective cooperation, communication, and coordination among Strategy partners would be vital.

Another goal is to work with other public agencies and private organizations to create a statewide Monitoring Design and Coordination (MDC) team, which would include members representing agencies, private organizations and stakeholders. Objectives for this team would include developing recommendations by which to revise monitoring procedures as necessary for enhanced and better coordinated monitoring activities across the state. The team also could review, and develop recommendations for adopting, potential new monitoring strategies, such as the concept of an adaptive monitoring design (Ringold et al. 1996). Other objectives for the MDC team could include: improving monitoring efficiency, filling monitoring gaps, further refining performance measures, increasing rates at which monitoring data are shared among Strategy partners, and developing additional performance measures. Continued stakeholder and partnership involvement in the implementation and revision of this Strategy will ensure the best application of data gained through all monitoring efforts.

Key Conservation Challenges

There are many obstacles to administering and monitoring the effectiveness of conservation programs. This is a problem faced by agencies and organizations statewide and across the nation. Florida's Strategy identified these key conservation challenges and highlights recommendations to collaboratively address these issues to improve the efficiency of conservation efforts in Florida.

Partnership Challenges

Partnering is an integral component of both developing and implementing the Strategy. The FWC has the capacity and resources to initiate and catalyze the proposed actions, however successful and long term implementation will require the combined activity of the FWC and many partners in other agencies, conservation organizations and the private sector. In this first iteration the process has identified many potential partners (Appendix A. Identified Conservation Partners). Many of these are the result of organizations stepping forward to offer their assistance in principle to help implement the Strategy.

To develop these optimistic declarations of support into functional partnerships, several organizational and logistic issues will need clarification. Specific action items in the strategy need to be matched to specific partners who have the interest and capacity to assist their implementation. Partnerships will need to be based on clear statements of expectations and understanding of mutual

obligations. They will need to identify the strengths and resources that each partner brings to the project and mechanisms for mutual support and shared responsibility and credit. Partnerships will need to be multidimensional, with partners contributing in numerous ways including expertise, financial and in-kind support, political strength, public support, communications and policy development. Partnering becomes a way to involve different constituencies and promote the ideal of proactive efforts and implementation of conservation actions and 'keeping common species common' among diverse interests. Because the Strategy has been developed in close consultation with many potential partners, it should provide a valuable 'action plan' that the FWC and its partners can use to identify those common interests.

Several components of the Strategy will support partnership development. Funding, derived from State Wildlife Grants and applied following the Strategy's guidance, will support partnering through matching fund requirements, initiating and catalyzing project direction and coordinating otherwise independent and discordant activities. Partnerships will be built on a project by project basis, focused on the immediate needs of strategic action and the recognition of common goals. The incentive driven nature of the Strategy provides additional opportunities to build partnerships, particularly with the private sector. The FWC envisions partnership building to be a continuous process, beginning with the consultations undertaken to develop this Strategy, and continuing as an integral component of Strategy implementation. The list of identified partners (Appendix A. Identified Conservation Partners) provides a view of the breadth of partners perceived as needed to achieve wildlife and habitat conservation in Florida.

Information Management Challenges

Throughout this Strategy process, information needs and management were identified as key challenges and potential barriers to addressing important threats to Florida's wildlife and habitats. Numerous entities across the state collect and manage ecological data. This information is compiled in different formats and systematically organized for various purposes. An even greater challenge is to acquire traditional knowledge that is generally passed orally through generations. It is only recently that our data management infrastructure has allowed GIS capabilities to capture vital data on species distribution, abundance, status and trends.

Agencies constantly face the challenge of limiting redundancy in acquiring data and improving means of sharing capabilities. This obstacle was encountered in our attempts to collect scientific data on a significant number of species. Had there been an integrated network of information, there would not be so many data gaps that could possibly be costly to address. One of the goals of Florida's Strategy is to build capabilities to share the most accurate, updated information on species and habitats. This Strategy has initiated the steps necessary to identify the needs and the gaps; now there needs to be a collaborative effort to create a more unified database management system. This will allow for better informed management objectives and decisions, as well as incorporation of existing knowledge.

It is important to recognize the realm of knowledge base that exists and reach out to promote and facilitate meaningful participation by scientists as well as resource users. Recreational users (i.e., hunters, anglers, birders) possess a vast amount of knowledge that is not always integrated into statewide monitoring and survey analysis. This information provides a critical source of data that might otherwise be inaccessible. The overarching goal with information management is to share

information so the most accurate and recent data are available to better the conservation of Florida's wildlife and habitats.

Public Awareness Challenge

Promoting informed decision-making and participation in Florida's conservation and management issues is imperative to achieving the goals of the Strategy and avoiding further exhaustion of opportunities associated with our fish and wildlife.

Conservation of Florida's fish and wildlife ultimately depends upon the commitment of Floridians to its protection. The key to instilling this commitment is through effectively designed conservation education programs.

Conservation educators must match target audiences with issues and craft messages and strategies that incorporate an understanding of public opinion, attitudes and demographic trends and are targeted at the appropriate stage of awareness (little or no awareness, awareness, appreciation, understanding, concern, action). Today's challenge is bringing citizens from the concerned stage to the action stage. Previous research has shown that while many Floridians were concerned about the loss of Florida's wildlife, very few were acting on its behalf, largely because they did not know what to do. Knowledge of action strategies is one of the most important variables in beneficial behavior and responsible action. Developing programs that focus on teaching citizens the appropriate action they can take to assist in wildlife conservation will be key.

Implementation of Florida's Strategy offers opportunities for outreach and contribution of many constituencies. Successful and effective conservation requires integrated and interdisciplinary efforts. The development and implementation of programs that raise awareness and motivate helpful action behaviors among the various target publics are key goals. Educational programs increase public involvement, furthering support of our fish and wildlife and the habitats upon which they depend. This would also allow an avenue for gathering information and knowledge on species status and trends. Conservation education programs will increase knowledge of and concern for the conditions of our terrestrial, marine, freshwater, and estuarine ecosystems and the relationships of their use. It is essential that education efforts support other actions already taking place and integrate accordingly. Florida's goal is to encourage everyone to become involved in a pro-active manner for the benefit of all fish and wildlife populations.

Conclusion

In order to meet and overcome challenges to conservation, it is important that significant portions of this Strategy be implemented and the Strategy be revised and updated continually. It is beyond the scope of the FWC to comprehensively address all of the complexities facing Florida's wildlife. There are numerous other agencies at the federal, state and local level, and public and private organizations addressing different components of the issues or that have the responsibility and mission to do so. Partnering is therefore an integral aspect of implementing the Strategy. Successful and long-term implementation will require the combined activity of the FWC and many partners in other agencies, conservation organizations and the private sector.

Species of Greatest Conservation Need

Florida is one of the most biologically diverse states in the nation. Approximately 750 species of mammals, birds, amphibians and reptiles inhabit Florida's land and water. Additionally, approximately 1,250 species of freshwater and marine fish and 50,000 species of invertebrates occur in Florida waters. As part of the federal requirements for the Comprehensive Wildlife Conservation Strategy (Strategy) to address the broad array of wildlife species in Florida, 974 Species of Greatest Conservation Need (SGCN) were identified (Table 6. Florida's Species of Greatest Conservation Need). The selection criteria for these species can be found in the Chapter Florida's Approach to Meeting the Eight Required Elements.

The criteria created a comprehensive list of wildlife that has conservation needs. The SGCN include all taxa from sponges and corals to birds and mammals. Many of the SGCN are listed as threatened or endangered such as the American bald eagle and Florida panther (Table 5), as well as several game species, such as the northern bobwhite quail and common snook. Even though these species already have funding in place, Florida recognizes that these species have conservation needs that this Strategy may help meet. The remaining and largest portion of the SGCN list is wildlife that has no dedicated funding sources. The majority of Florida's species have conservation needs that are not funded through the Endangered Species Act or hunting and game programs. This Strategy and the funds from the State Wildlife Grants program will provide and help identify additional funds for these species. Future partnerships and matching funds could also be developed to address the needs of all SGCN (Chapter Introduction; Chapter Florida's Approach to Meeting the Eight Required Elements).

Table 5. Florida's Wildlife Compared to Number of Species of Greatest Conservation Need.

Wildlife Taxa Group	Number of Species	State Threatened/Endangered	State Species of Special Concern	Species of Greatest Conservation Need
Mammals	99	24	6	56
Birds	485	18	18	104
Amphibians	57	0	5	19
Reptiles	114	16	8	48
Fish	1,250	5	10	378
Invertebrates	50,000	4	4	369
Totals		67	51	974

Table 6. Florida's Species of Greatest Conservation Need

The population status and trends are listed in taxonomic order by group. The status and trend of each population represents input from professionals in the various taxonomic fields. This table is the result of technical questionnaires, workshops, and reviews (see Chapter Florida's Approach to Meeting the Eight Required Elements). It should be noted that experts frequently have opposing opinions about the status and trend of a species. This table represents the best professional knowledge available at this time and therefore may be modified with additional data.

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
Mammals										
1	*Blarina carolinensis shermani*	Sherman's Short-tailed Shrew				●				●
2	*Sorex longirostris*	Southeastern Shrew				●				●
3	*Microtus pennsylvanicus dukecampbelli*	Florida Salt Marsh Vole				●				●
4	*Condylura cristata*	Star-nosed Mole				●				●
5	*Eumops floridanus*	Florida Bonneted Bat	●							●
6	*Molossus molossus*	Pallas' Mastiff Bat				●				●
7	*Myotis austroriparius*	Southeastern Bat		●				●		
8	*Myotis grisescens*	Gray Bat	●				●			
9	*Lasiurus borealis*	Eastern Red Bat				●				●
10	*Lasiurus seminolus*	Seminole Bat				●				●
11	*Lasiurus intermedius*	Northern Yellow Bat				●				●
12	*Lasiurus cinereus*	Hoary Bat				●				●
13	*Corynorhinus rafinesquii*	Rafinesque's Big-eared Bat	●							●
14	*Eptesicus fuscus*	Big Brown Bat		●						●
15	*Pipistrellus subflavus*	Eastern Pipistrelle				●				●
16	*Sylvilagus palustris hefneri*	Lower Keys Marsh Rabbit	●				●			
17	*Sylvilagus floridanus*	Eastern Cottontail Rabbit				●				●
18	*Sciurus niger avicennia*	Big Cypress Fox Squirrel				●				●
19	*Sciurus niger niger*	Southeastern Fox Squirrel				●				●
20	*Sciurus niger shermani*	Sherman's Fox Squirrel	●				●			
21	*Tamias striatus*	Eastern Chipmunk		●				●		
22	*Geomys pinetis pinetis*	Southeastern Pocket Gopher		●			●			
23	*Neofiber alleni*	Round-tailed Muskrat	●				●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
24	*Oryzomys palustris planirostris*	Pine Island Marsh Rice Rat				●				●
25	*Oryzomys palustris sanibeli*	Sanibel Island Marsh Rice Rat				●				●
26	*Oryzomys argentatus*	Silver Rice Rat	●					●		
27	*Sigmodon hispidus exsputus*	Lower Keys Cotton Rat	●							●
28	*Sigmodon hispidus insulicola*	Insular Cotton Rat				●				●
29	*Neotoma floridana smalli*	Key Largo Woodrat	●				●			
30	*Peromyscus gossypinus allapaticola*	Key Largo Cotton Mouse	●							●
31	*Peromyscus polionotus allophrys*	Choctawhatchee Beach Mouse	●					●		
32	*Peromyscus polionotus leucocephalus*	Santa Rosa Beach Mouse		●						●
33	*Peromyscus polionotus niveiventris*	Southeastern Beach Mouse		●						●
34	*Peromyscus polionotus peninsularis*	St. Andrews Beach Mouse	●							●
35	*Peromyscus polionotus phasma*	Anastasia Island Beach Mouse	●							●
36	*Peromyscus polionotus trissyllepsis*	Perdido Key Beach Mouse	●				●			
37	*Podomys floridanus*	Florida Mouse		●			●			
38	*Ursus americanus floridanus*	Florida Black Bear		●				●		
39	*Procyon lotor auspicatus*	Key Vaca Raccoon				●				●
40	*Procyon lotor incautus*	Key West Raccoon				●				●
41	*Lutra canadensis lataxina*	River Otter		●			●			
42	*Mustela frenata olivacea*	Southeastern Weasel	●							●
43	*Mustela frenata peninsulae*	Florida Long-tailed Weasel	●							●
44	*Mustela vison evergladensis*	Everglades Mink	●							●
45	*Mustela vison halilimnetes*	Gulf Salt Marsh Mink	●							●
46	*Mustela vison lutensis*	Atlantic Salt Marsh Mink	●							●
47	*Mustela vision mink*	Common Mink				●				●
48	*Spilogale putorius*	Spotted Skunk				●				●
49	*Mephitis mephitis*	Striped Skunk				●				●
50	*Puma concolor coryi*	Florida Panther	●							●
51	*Odocoileus virginianus clavium*	Key Deer		●				●		
52	*Trichechus manatus latirostris*	Florida Manatee		●				●		
53	*Eubalaena glacialis*	North Atlantic Right Whale	●				●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
54	*Kogia simus*	Dwarf Sperm Whale				●				●
55	*Kogia breviceps*	Pygmy Sperm Whale				●				●
56	*Tursiops truncatus*	Atlantic Bottlenose Dolphin				●				●
Birds										
57	*Anas fulvigula fulvigula*	Florida Mottled Duck		●			●			
58	*Anas acuta*	Northern Pintail	●				●			
59	*Aythya affinis*	Lesser Scaup		●			●			
60	*Colinus virginianus*	Northern Bobwhite	●				●			
61	*Gavia immer*	Common Loon		●			●			
62	*Podiceps auritus coronutus*	Horned Grebe		●						●
63	*Sula dactylatra*	Masked Booby	●				●			
64	*Pelecanus occidentalis*	Brown Pelican			●		●			
65	*Fregata magnificens*	Magnificent Frigatebird	●					●		
66	*Ardea herodias occidentalis*	Great White Heron		●				●		
67	*Botaurus lentiginosus*	American Bittern		●						●
68	*Ixobrychus exilis*	Least Bittern		●						●
69	*Egretta thula*	Snowy Egret		●			●			
70	*Egretta caerulea*	Little Blue Heron		●			●			
71	*Egretta tricolor*	Tricolored Heron		●						●
72	*Egretta rufescens*	Reddish Egret	●					●		
73	*Nycticorax nycticorax*	Black-crowned Night-Heron				●				●
74	*Nyctanassa violacea*	Yellow-crowned Night-Heron				●				●
75	*Ajaja ajaja*	Roseate Spoonbill	●				●			
76	*Eudocimus albus*	White Ibis			●					●
77	*Plegadis falcinellus*	Glossy Ibis		●				●		
78	*Mycteria americana*	Wood Stork		●				●		
79	*Elanoides forficatus*	Swallow-tailed Kite	●							●
80	*Elanus leucurus*	White-tailed Kite	●							●
81	*Rostrhamus sociabilis plumbeus*	Snail Kite	●				●			
82	*Ictinia mississippiensis*	Mississippi Kite		●						●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
83	*Haliaeetus leucocephalus*	Bald Eagle		●					●	
84	*Buteo platypterus platypterus*	Broad-winged Hawk		●						●
85	*Buteo brachyurus*	Short-tailed Hawk	●							●
86	*Caracara cheriway*	Crested Caracara	●							●
87	*Falco sparverius paulus*	Southeastern American Kestrel	●				●			
88	*Falco columbarius*	Merlin		●						●
89	*Falco peregrinus*	Peregrine Falcon		●				●		
90	*Coturnicops noveboracensis noveboracensis*	Yellow Rail				●				●
91	*Laterallus jamaicensis*	Black Rail				●				●
92	*Rallus longirostris insularum*	Mangrove Clapper Rail	●							●
93	*Rallus longirostris scottii*	Florida Clapper Rail		●						●
94	*Rallus elegans elegans*	King Rail				●				●
95	*Aramus guarauna*	Limpkin		●						●
96	*Grus canadensis pratensis*	Florida Sandhill Crane		●			●			
97	*Grus americana*	Whooping Crane	●							●
98	*Charadrius alexandrinus tenuirostris*	Cuban Snowy Plover	●				●			
99	*Charadrius wilsonia*	Wilson's Plover		●						●
100	*Charadrius melodus*	Piping Plover	●				●			
101	*Haematopus palliatus*	American Oystercatcher	●				●			
102	*Recurvirostra americana*	American Avocet	●				●			
103	*Numenius phaeopus hudsonicus*	Whimbrel				●				●
104	*Limosa fedoa*	Marbled Godwit	●							●
105	*Calidris canutus rufa*	Red Knot		●			●			
106	*Calidris alba*	Sanderling				●				●
107	*Calidris pusilla*	Semipalmated Sandpiper			●					●
108	*Calidris mauri*	Western Sandpiper			●					●
109	*Calidris fuscicollis*	White-rumped Sandpiper				●				●
110	*Calidris melanotos*	Pectoral Sandpiper		●						●
111	*Sterna nilotica*	Gull-billed Tern	●				●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
112	*Sterna caspia*	Caspian Tern	●							●
113	*Sterna maxima*	Royal Tern		●				●		
114	*Sterna sandvicensis*	Sandwich Tern				●				●
115	*Sterna dougallii*	Roseate Tern	●				●			
116	*Sterna antillarum*	Least Tern		●						●
117	*Sterna anaethetus*	Bridled Tern	●						●	
118	*Sterna fuscata*	Sooty Tern		●				●		
119	*Anous stolidus*	Brown Noddy		●				●		
120	*Rynchops niger*	Black Skimmer	●				●			
121	*Columba leucocephala*	White-crowned Pigeon	●							●
122	*Columbina passerina*	Common Ground-Dove		●			●			
123	*Coccyzus minor*	Mangrove Cuckoo	●							●
124	*Athene cunicularia floridana*	Florida Burrowing Owl		●						●
125	*Chordeiles gundlachii*	Antillean Nighthawk	●							●
126	*Melanerpes erythrocephalus*	Red-headed Woodpecker		●			●			
127	*Picoides villosus*	Hairy Woodpecker	●							●
128	*Picoides borealis*	Red-cockaded Woodpecker	●				●			
129	*Colaptes auratus auratus*	Northern Flicker		●			●			
130	*Campephilus principalis*	Ivory-billed Woodpecker				●				●
131	*Tyrannus dominicensis*	Gray Kingbird		●						●
132	*Lanius ludovicianus*	Loggerhead Shrike			●		●			
133	*Vireo altiloquus*	Black-whiskered Vireo	●							●
134	*Aphelocoma coerulescens*	Florida Scrub-Jay	●				●			
135	*Sitta carolinensis*	White-breasted Nuthatch	●				●			
136	*Sitta pusilla*	Brown-headed Nuthatch		●			●			
137	*Cistothorus palustris griseus*	Worthington's Marsh Wren		●				●		
138	*Cistothorus palustris marianae*	Marian's Marsh Wren	●							●
139	*Hylocichla mustelina*	Wood Thrush	●							●
140	*Dendroica dominica stoddardi*	Stoddard's Yellow-throated Warbler			●			●		
141	*Dendroica petechia gundlachi*	Cuban Yellow Warbler	●							●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
142	*Dendroica discolor paludicola*	Florida Prairie Warbler		●						●
143	*Dendroica cerulea*	Cerulean Warbler		●			●			
144	*Protonotaria citrea*	Prothonotary Warbler		●						●
145	*Helmitheros vermivorum*	Worm-eating Warbler		●				●		
146	*Limnothlypis swainsonii*	Swainson's Warbler	●							●
147	*Seiurus montacilla*	Louisiana Waterthrush				●				●
148	*Oporornis formosus*	Kentucky Warbler	●							●
149	*Wilsonia citrina*	Hooded Warbler		●				●		
150	*Aimophila aestivalis*	Bachman's Sparrow		●			●			
151	*Ammodramus savannarum*	Grasshopper Sparrow (migrant)				●	●			
152	*Ammodramus savannarum floridanus*	Florida Grasshopper Sparrow	●				●			
153	*Ammodramus henslowii*	Henslow's Sparrow		●						●
154	*Ammodramus maritimus fisheri*	Louisiana Seaside Sparrow	●							●
155	*Ammodramus maritimus junicolus*	Wakulla Seaside Sparrow			●			●		
156	*Ammodramus maritimus macgillivraii*	Macgillivray's Seaside Sparrow				●				●
157	*Ammodramus maritimus mirabilis*	Cape Sable Seaside Sparrow	●				●			
158	*Ammodramus maritimus peninsulae*	Scott's Seaside Sparrow		●			●			
159	*Passerina ciris*	Painted Bunting	●				●			
160	*Sturnella magna*	Eastern Meadowlark			●		●			
Amphibians										
161	*Amphiuma pholeter*	One-toed Amphiuma		●				●		
162	*Pseudobranchus striatus lustricolus*	Gulf Hammock Dwarf Siren				●				●
163	*Ambystoma cingulatum*	Flatwoods Salamander	●				●			
164	*Ambystoma tigrinum*	Tiger Salamander	●				●			
165	*Notophthalmus perstriatus*	Striped Newt	●				●			
166	*Desmognathus auriculatus*	Southern Dusky Salamander	●				●			
167	*Desmognathus monticola*	Seal Salamander	●					●		
168	*Desmognathus cf. conanti*	Eglin Ravine Dusky Salamander	●				●			
169	*Desmognathus apalachicolae*	Apalachicola Dusky Salamander		●				●		
170	*Hemidactylium scutatum*	Four-toed Salamander				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
171	*Stereochilus marginatus*	Many-lined Salamander				●				●
172	*Eurycea chamberlaini*	Chamberlain's Dwarf Salamander	●							●
173	*Eurycea cf. quadridigitata*	Bog Dwarf Salamander	●							●
174	*Haideotriton wallacei*	Georgia Blind Salamander				●				●
175	*Hyla andersonii*	Pine Barrens Treefrog		●						●
176	*Pseudacris ornata*	Ornate Chorus Frog				●				●
177	*Rana virgatipes*	Carpenter Frog				●				●
178	*Rana okaloosae*	Florida Bog Frog		●				●		
179	*Rana capito*	Gopher Frog		●			●			
Reptiles										
180	*Crocodylus acutus*	American Crocodile	●						●	
181	*Macrochelys temminckii*	Alligator Snapping Turtle		●				●		
182	*Kinosternon subrubrum steindachneri*	Florida Mud Turtle				●				●
183	*Kinosternon baurii*	Key Mud Turtle	●					●		
184	*Clemmys guttata*	Spotted Turtle	●							●
185	*Terrapene carolina major*	Gulf Coast Box Turtle			●					●
186	*Terrapene carolina bauri*	Florida Box Turtle		●			●			
187	*Malaclemys terrapin*	Diamondback Terrapin				●	●			
188	*Graptemys barbouri*	Barbour's Map Turtle		●				●		
189	*Graptemys ernsti*	Escambia Map Turtle		●				●		
190	*Pseudemys concinna suwanniensis*	Suwannee Cooter		●				●		
191	*Pseudemys nelsoni*	Florida Redbelly Turtle - Florida Panhandle				●				●
192	*Deirochelys reticularia*	Chicken Turtle			●					●
193	*Gopherus polyphemus*	Gopher Tortoise		●			●			
194	*Chelonia mydas*	Green Turtle	●						●	
195	*Eretmochelys imbricata*	Hawksbill	●							●
196	*Caretta caretta*	Loggerhead		●				●		
197	*Lepidochelys kempii*	Kemp's Ridley	●					●		
198	*Dermochelys coriacea*	Leatherback	●						●	
199	*Apalone mutica calvata*	Gulf Coast Smooth Softshell		●				●		

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
200	*Sceloporus woodi*	Florida Scrub Lizard			●		●			
201	*Eumeces anthracinus*	Coal Skink		●						●
202	*Eumeces egregius egregius*	Florida Keys Mole Skink	●				●			
203	*Eumeces egregius insularis*	Cedar Key Mole Skink	●					●		
204	*Eumeces egregius lividus*	Bluetail Mole Skink		●			●			
205	*Neoseps reynoldsi*	Sand Skink		●			●			
206	*Nerodia cyclopion*	Mississippi Green Water Snake				●				●
207	*Nerodia clarkii clarkii*	Gulf Salt Marsh Snake		●				●		
208	*Nerodia clarkii compressicauda*	Mangrove Salt Marsh Snake		●				●		
209	*Nerodia clarkii taeniata*	Atlantic Salt Marsh Snake	●							●
210	*Storeria dekayi wrightorum*	Midland Brown Snake				●				●
211	*Storeria dekayi*	Lower Keys Brown Snake	●							●
212	*Thamnophis sauritus*	Lower Keys Ribbon Snake	●							●
213	*Virginia valeriae*	Smooth Earth Snake (Highlands Co population only)				●				●
214	*Heterodon platirhinos*	Eastern Hognose Snake				●	●			
215	*Heterodon simus*	Southern Hognose Snake	●				●			
216	*Diadophis punctatus acricus*	Key Ringneck Snake	●							●
217	*Farancia erytrogramma*	Rainbow Snake				●				●
218	*Drymarchon couperi*	Eastern Indigo Snake	●				●			
219	*Pituophis melanoleucus mugitus*	Florida Pine Snake		●			●			
220	*Lampropeltis calligaster*	Mole Kingsnake	●							●
221	*Lampropeltis getula*	Common Kingsnake	●				●			
222	*Stilosoma extenuatum*	Short-tailed Snake				●				●
223	*Tantilla relicta pamlica*	Coastal Dunes Crowned Snake		●			●			
224	*Tantilla oolitica*	Rim Rock Crowned Snake	●				●			
225	*Agkistrodon contortrix*	Copperhead		●				●		
226	*Crotalus horridus*	Timber Rattlesnake		●						●
227	*Crotalus adamanteus*	Eastern Diamondback Rattlesnake		●			●			
Fish										

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
228	*Ginglymostoma cirratum*	Nurse Shark		●						●
229	*Rhincodon typus*	Whale Shark	●					●		
230	*Carcharhinus acronotus*	Blacknose Shark	●							●
231	*Carcharhinus brevipinna*	Spinner Shark	●							●
232	*Carcharhinus falciformis*	Silky Shark	●				●			
233	*Carcharhinus isodon*	Finetooth Shark				●				●
234	*Carcharhinus leucas*	Bull Shark	●							●
235	*Carcharhinus limbatus*	Blacktip Shark	●					●		
236	*Carcharhinus obscurus*	Dusky Shark	●				●			
237	*Carcharhinus perezii*	Reef Shark	●							●
238	*Carcharhinus plumbeus*	Sandbar Shark	●						●	
239	*Galeocerdo cuvier*	Tiger Shark	●					●		
240	*Negaprion brevirostris*	Lemon Shark	●							●
241	*Prionace glauca*	Blue Shark	●							●
242	*Rhizoprionodon terraenovae*	Atlantic Sharpnose Shark		●				●		
243	*Sphyrna lewini*	Scalloped Hammerhead	●							●
244	*Sphyrna mokarran*	Great Hammerhead	●							●
245	*Sphyrna tiburo*	Bonnethead		●				●		
246	*Sphyrna zygaena*	Smooth Hammerhead	●							●
247	*Carcharias taurus*	Sand Tiger	●				●			
248	*Alopias superciliosus*	Bigeye Thresher				●				●
249	*Alopias vulpinus*	Thresher Shark				●		●		
250	*Carcharodon carcharias*	White Shark	●							●
251	*Isurus oxyrinchus*	Shortfin Mako	●				●			
252	*Isurus paucus*	Longfin Mako				●				●
253	*Pristis pectinata*	Smalltooth Sawfish	●				●			
254	*Pristis pristis*	Largetooth Sawfish	●							●
255	*Aetobatus narinari*	Spotted Eagle Ray				●				●
256	*Manta birostris*	Giant Manta				●				●
257	*Acipenser oxyrinchus oxyrinchus*	Atlantic Sturgeon	●				●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
258	*Acipenser oxyrinchus desotoi*	Gulf Sturgeon	●					●		
259	*Atractosteus spatula*	Alligator Gar	●							●
260	*Megalops atlanticus*	Tarpon	●					●		
261	*Albula vulpes*	Bonefish	●					●		
262	*Anguilla rostrata*	American Eel	●							●
263	*Echidna catenata*	Chain Moray				●				●
264	*Enchelycore nigricans*	Viper Moray				●				●
265	*Gymnothorax funebris*	Green Moray				●				●
266	*Gymnothorax miliaris*	Goldentail Moray				●				●
267	*Gymnothorax moringa*	Spotted Moray				●				●
268	*Gymnothorax vicinus*	Purplemouth Moray				●				●
269	*Uropterygias macularius*	Marbled Moray				●				●
270	*Myrichthys breviceps*	Sharptail Eel				●				●
271	*Alosa aestivalis*	Blueback Herring	●							●
272	*Alosa alabamae*	Alabama Shad	●			●				
273	*Alosa mediocris*	Hickory Shad	●				●			
274	*Alosa sapidissima*	American Shad	●				●			
275	*Cyprinella callitaenia*	Bluestripe Shiner	●				●			
276	*Hybognathus hayi*	Cypress Minnow	●				●			
277	*Luxilus zonistius*	Bandfin Shiner		●				●		
278	*Macrhybopsis n. sp. cf aestivalis*	Florida Chub/Speckled chub		●						●
279	*Notropis melanostomus*	Blackmouth Shiner		●				●		
280	*Notropis chalybaeus*	Ironcolor Shiner		●						●
281	*Pteronotropis welaka*	Bluenose Shiner		●						●
282	*Moxostoma n. sp. cf poecilurum*	Grayfin Redhorse			●			●		
283	*Moxostoma carinatum*	River Redhorse	●				●			
284	*Ameiurus brunneus*	Snail Bullhead				●	●			
285	*Ameiurus serracanthus*	Spotted Bullhead		●			●			
286	*Umbra pygmaea*	Eastern Mudminnow	●				●			
287	*Opsanus beta*	Gulf Toadfish		●				●		

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
288	*Opsanus pardus*	Leopard Toadfish	●					●		
289	*Opsanus tau*	Oyster Toadfish		●				●		
290	*Antennarius striatus*	Striated Frogfish				●				●
291	*Halieutichthys aculeatus*	Pancake Batfish				●				●
292	*Ogcocephalus corniger*	Longnose Batfish	●					●		
293	*Ogcocephalus cubifrons*	Polka-dot Batfish	●					●		
294	*Ogcocephalus nasutus*	Shortnose Batfish	●					●		
295	*Ogcocephalus pantostictus*	Spotted Batfish	●					●		
296	*Ogcocephalus parvus*	Roughback Batfish	●					●		
297	*Ogcocephalus rostellum*	Palefin Batfish	●					●		
298	*Zalieutes mcgintyi*	Tricorn Batfish				●				●
299	*Agonostomus monticola*	Mountain Mullet	●					●		
300	*Mugil cephalus*	Striped Mullet		●				●		
301	*Mugil curema*	White Mullet		●				●		
302	*Mugil gyrans*	Whirligig Mullet		●						●
303	*Mugil sp.*	Redeye Mullet				●				●
304	*Menidia conchorum*	Key Silverside	●				●			
305	*Hemiramphus balao*	Balao	●					●		
306	*Hemiramphus brasiliensis*	Ballyhoo	●					●		
307	*Hyporhamphus meeki*	False Silverstripe Halfbeak	●					●		
308	*Hyporhamphus unifasciatus*	Atlantic Silverstripe Halfbeak	●					●		
309	*Rivulus marmoratus*	Mangrove Rivulus	●				●			
310	*Fundulus blairae*	Western Starhead Topminnow	●							●
311	*Fundulus jenkinsi*	Saltmarsh Topminnow	●					●		
312	*Gambusia rhizophorae*	Mangrove Gambusia	●							●
313	*Anarchopterus criniger*	Fringed Pipefish	●							●
314	*Bryx dunckeri*	Pugnose Pipefish				●				●
315	*Cosmocampus albirostris*	Whitenose Pipefish				●				●
316	*Cosmocampus brachycephalus*	Crested Pipefish				●				●
317	*Cosmocampus elucens*	Shortfin Pipefish				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
318	*Halicampus crinitus*	Banded Pipefish				●				●
319	*Hippocampus erectus*	Lined Seahorse	●					●		
320	*Hippocampus reidi*	Longsnout Seahorse	●					●		
321	*Hippocampus zosterae*	Dwarf Seahorse	●					●		
322	*Microphis brachyurus*	Opossum Pipefish	●				●			
323	*Syngnathus floridae*	Dusky Pipefish	●				●			
324	*Syngnathus fuscus*	Northern Pipefish	●							●
325	*Syngnathus louisianae*	Chain Pipefish	●				●			
326	*Syngnathus pelagicus*	Sargassum Pipefish				●				●
327	*Syngnathus scovelli*	Gulf Pipefish		●			●			
328	*Syngnathus springeri*	Bull Pipefish				●				●
329	*Aulostomus maculatus*	Atlantic Trumpetfish				●				●
330	*Fistularia petimba*	Red Cornetfish				●				●
331	*Fistularia tabacaria*	Bluespotted Cornetfish				●				●
332	*Centropomus ensiferus*	Swordspine Snook	●							●
333	*Centropomus parallelus*	Smallscale Fat Snook	●							●
334	*Centropomus pectinatus*	Tarpon Snook	●							●
335	*Centropomus undecimalis*	Common Snook	●					●		
336	*Morone saxatilis*	Striped Bass	●							●
337	*Centropristis ocyurus*	Bank Sea Bass				●				●
338	*Centropristis philadelphica*	Rock Sea Bass				●				●
339	*Centropristis striata*	Black Sea Bass	●				●			
340	*Cephalopholis cruentata*	Graysby				●				●
341	*Cephalopholis fulva*	Coney				●				●
342	*Dermatolepis inermis*	Marbled Grouper				●				●
343	*Epinephelus adscensionis*	Rock Hind				●				●
344	*Epinephelus drummondhayi*	Speckled Hind	●				●			
345	*Epinephelus flavolimbatus*	Yellowedge Grouper	●					●		
346	*Epinephelus guttatus*	Red Hind				●				●
347	*Epinephelus itajara*	Goliath Grouper	●						●	

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
348	*Epinephelus morio*	Red Grouper	●						●	
349	*Epinephelus mystacinus*	Misty Grouper				●				●
350	*Epinephelus nigritus*	Warsaw Grouper	●				●			
351	*Epinephelus niveatus*	Snowy Grouper	●				●			
352	*Epinephelus striatus*	Nassau Grouper	●				●			
353	*Hypoplectrus aberrans*	Yellowbelly Hamlet	●					●		
354	*Hypoplectrus gemma*	Blue Hamlet	●					●		
355	*Hypoplectrus guttavarius*	Shy Hamlet	●					●		
356	*Hypoplectrus indigo*	Indigo Hamlet	●					●		
357	*Hypoplectrus nigricans*	Black Hamlet	●					●		
358	*Hypoplectrus puella*	Barred Hamlet	●					●		
359	*Hypoplectrus unicolor*	Butter Hamlet	●					●		
360	*Liopropoma eukrines*	Wrasse Basslet				●				●
361	*Liopropoma rubre*	Peppermint Basslet				●				●
362	*Mycteroperca bonaci*	Black Grouper	●						●	
363	*Mycteroperca interstitialis*	Yellowmouth Grouper				●				●
364	*Mycteroperca microlepis*	Gag	●					●		
365	*Mycteroperca phenax*	Scamp	●				●			
366	*Mycteroperca venenosa*	Yellowfin Grouper				●				●
367	*Paranthias furcifer*	Atlantic Creole-fish				●				●
368	*Pseudogramma gregoryi*	Reef Bass				●				●
369	*Rypticus bistrispinus*	Freckled Soapfish				●				●
370	*Rypticus saponaceus*	Greater Soapfish				●				●
371	*Rypticus subbifrenatus*	Spotted Soapfish				●				●
372	*Schultzea beta*	School Bass				●				●
373	*Serranus annularis*	Orangeback Bass	●					●		
374	*Serranus baldwini*	Lantern Bass	●					●		
375	*Serranus tabacarius*	Tobaccofish	●					●		
376	*Serranus tigrinus*	Harlequin Bass	●					●		
377	*Lonchopisthus micrognathus*	Swordtail Jawfish				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
378	*Opistognathus aurifrons*	Yellowhead Jawfish				●				●
379	*Opistognathus lonchurus*	Moustache Jawfish				●				●
380	*Opistognathus macrognathus*	Banded Jawfish				●				●
381	*Opistognathus maxillosus*	Mottled Jawfish				●				●
382	*Opistognathus robinsi*	Spotfin Jawfish				●				●
383	*Opistognathus whitehursti*	Dusky Jawfish				●				●
384	*Acantharchus pomotis*	Mud Sunfish	●				●			
385	*Enneacanthus chaetodon*	BlackBanded Sunfish		●						●
386	*Micropterus cataractae*	Shoal Bass			●			●		
387	*Micropterus notius*	Suwannee Bass		●				●		
388	*Crystallaria asprella*	Crystal Darter	●							●
389	*Etheostoma proeliare*	Cypress Darter		●				●		
390	*Etheostoma parvipinne*	Goldstripe Darter		●				●		
391	*Etheostoma histrio*	Harlequin Darter		●				●		
392	*Etheostoma okaloosae*	Okaloosa Darter		●				●		
393	*Etheostoma stigmaeum*	Speckled Darter				●				●
394	*Etheostoma olmstedi*	Tessellated Darter	●							●
395	*Apogon aurolineatus*	Bridle Cardinalfish				●				●
396	*Apogon binotatus*	Barred Cardinalfish				●				●
397	*Apogon lachneri*	Whitestar Cardinalfish				●				●
398	*Apogon maculatus*	Flamefish				●				●
399	*Apogon planifrons*	Pale Cardinalfish				●				●
400	*Apogon pseudomaculatus*	Twospot Cardinalfish				●				●
401	*Apogon quadrisquamatus*	Sawcheek Cardinalfish				●				●
402	*Apogon townsendi*	Belted Cardinalfish				●				●
403	*Astrapogon alutus*	Bronze Cardinalfish				●				●
404	*Astrapogon puncticulatus*	Blackfin Cardinalfish				●				●
405	*Astrapogon stellatus*	Conchfish				●				●
406	*Phaeoptyx conklini*	Freckled Cardinalfish				●				●
407	*Phaeoptyx pigmentaria*	Dusky Cardinalfish				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
408	*Phaeoptyx xenus*	Sponge Cardinalfish				●				●
409	*Caulolatilus cyanops*	Blackline Tilefish				●				●
410	*Caulolatilus microps*	Blueline Tilefish				●				●
411	*Pomatomus saltatrix*	Bluefish	●					●		
412	*Rachycentron canadum*	Cobia	●					●		
413	*Coryphaena hippurus*	Dolphinfish	●					●		
414	*Alectis ciliaris*	African Pompano				●				●
415	*Caranx latus*	Horse-eye Jack				●				●
416	*Elagatis bipinnulata*	Rainbow Runner				●				●
417	*Selar crumenophthalmus*	Bigeye Scad	●					●		
418	*Seriola dumerili*	Greater Amberjack	●					●		
419	*Seriola rivoliana*	Almaco Jack	●					●		
420	*Seriola zonata*	Banded Rudderfish	●					●		
421	*Trachinotus carolinus*	Florida Pompano	●					●		
422	*Trachinotus falcatus*	Permit	●					●		
423	*Trachinotus goodei*	Palometa	●							●
424	*Lutjanus analis*	Mutton Snapper	●					●		
425	*Lutjanus apodus*	Schoolmaster				●				●
426	*Lutjanus buccanella*	Blackfin Snapper				●				●
427	*Lutjanus campechanus*	Red Snapper	●						●	
428	*Lutjanus cyanopterus*	Cubera Snapper				●				●
429	*Lutjanus griseus*	Gray Snapper	●					●		
430	*Lutjanus jocu*	Dog Snapper				●				●
431	*Lutjanus mahogoni*	Mahogany Snapper				●				●
432	*Lutjanus synagris*	Lane Snapper	●				●			
433	*Lutjanus vivanus*	Silk Snapper	●					●		
434	*Ocyurus chrysurus*	Yellowtail Snapper	●					●		
435	*Pristipomoides aquilonaris*	Wenchman				●				●
436	*Rhomboplites aurorubens*	Vermilion Snapper	●					●		
437	*Lobotes surinamensis*	Atlantic Tripletail	●					●		

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
438	*Eugerres plumieri*	Striped Mojarra	●					●		
439	*Anisotremus surinamensis*	Black Margate				●				●
440	*Anisotremus virginicus*	Porkfish				●				●
441	*Haemulon album*	Margate	●					●		
442	*Haemulon aurolineatum*	Tomtate	●					●		
443	*Haemulon flavolineatum*	French Grunt	●					●		
444	*Haemulon plumierii*	White Grunt	●					●		
445	*Haemulon sciurus*	Bluestriped Grunt	●					●		
446	*Orthopristis chrysoptera*	Pigfish		●				●		
447	*Archosargus probatocephalus*	Sheepshead	●					●		
448	*Calamus bajonado*	Jolthead Porgy	●					●		
449	*Calamus calamus*	Saucereye Porgy	●					●		
450	*Calamus leucosteus*	Whitebone Porgy	●					●		
451	*Calamus nodosus*	Knobbed Porgy	●					●		
452	*Pagrus pagrus*	Red Porgy	●					●		
453	*Bairdiella batabana*	Blue Croaker	●							●
454	*Bairdiella sanctaeluciae*	Striped Croaker	●							●
455	*Cynoscion nebulosus*	Spotted Seatrout	●					●		
456	*Cynoscion regalis*	Weakfish	●					●		
457	*Equetus lanceolatus*	Jackknife-fish	●					●		
458	*Equetus punctatus*	Spotted Drum	●					●		
459	*Odontoscion dentex*	Reef Croaker				●				●
460	*Pareques acuminatus*	High-hat	●					●		
461	*Pareques umbrosus*	Cubbyu	●					●		
462	*Pogonias cromis*	Black Drum	●					●		
463	*Sciaenops ocellatus*	Red Drum	●					●		
464	*Pempheris schomburgkii*	Glassy Sweeper				●				●
465	*Chaetodon capistratus*	Foureye Butterflyfish	●					●		
466	*Chaetodon ocellatus*	Spotfin Butterflyfish	●					●		
467	*Chaetodon sedentarius*	Reef Butterflyfish	●					●		

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
468	*Chaetodon striatus*	Banded Butterflyfish	●					●		
469	*Prognathodes aculeatus*	Longsnout Butterflyfish	●					●		
470	*Centropyge argi*	Cherubfish	●					●		
471	*Holacanthus bermudensis*	Blue Angelfish	●					●		
472	*Holacanthus ciliaris*	Queen Angelfish	●					●		
473	*Holacanthus tricolor*	Rock Beauty	●					●		
474	*Pomacanthus arcuatus*	Gray Angelfish	●					●		
475	*Pomacanthus paru*	French Angelfish	●					●		
476	*Amblycirrhitus pinos*	Redspotted Hawkfish				●				●
477	*Abudefduf saxatilis*	Sergeant Major				●				●
478	*Abudefduf taurus*	Night Sergeant				●				●
479	*Chromis cyanea*	Blue Chromis				●				●
480	*Chromis enchrysura*	Yellowtail Reeffish				●				●
481	*Chromis insolata*	Sunshinefish				●				●
482	*Chromis multilineata*	Brown Chromis				●				●
483	*Chromis scotti*	Purple Reeffish				●				●
484	*Microspathodon chrysurus*	Yellowtail Damselfish				●				●
485	*Stegastes adustus*	Dusky Damselfish				●				●
486	*Stegastes diencaeus*	Longfin Damselfish				●				●
487	*Stegastes leucostictus*	Beaugregory				●				●
488	*Stegastes partitus*	Bicolor Damselfish				●				●
489	*Stegastes planifrons*	Threespot Damselfish				●				●
490	*Stegastes variabilis*	Cocoa Damselfish				●				●
491	*Bodianus pulchellus*	Spotfin Hogfish				●				●
492	*Bodianus rufus*	Spanish Hogfish				●				●
493	*Clepticus parrae*	Creole Wrasse				●				●
494	*Doratonotus megalepis*	Dwarf Wrasse				●				●
495	*Halichoeres bathyphilus*	Greenband Wrasse				●				●
496	*Halichoeres bivittatus*	Slippery Dick				●				●
497	*Halichoeres caudalis*	Painted Wrasse				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
498	*Halichoeres cyanocephalus*	Yellowcheek Wrasse				●				●
499	*Halichoeres garnoti*	Yellowhead Wrasse				●				●
500	*Halichoeres maculipinna*	Clown Wrasse				●				●
501	*Halichoeres pictus*	Rainbow Wrasse				●				●
502	*Halichoeres poeyi*	Blackear Wrasse				●				●
503	*Halichoeres radiatus*	Puddingwife				●				●
504	*Lachnolaimus maximus*	Hogfish	●					●		
505	*Thalassoma bifasciatum*	Bluehead				●				●
506	*Xyrichtys martinicensis*	Rosy Razorfish				●				●
507	*Xyrichtys novacula*	Pearly Razorfish				●				●
508	*Xyrichtys splendens*	Green Razorfish				●				●
509	*Cryptotomus roseus*	Bluelip Parrotfish				●				●
510	*Scarus coelestinus*	Midnight Parrotfish				●				●
511	*Scarus coeruleus*	Blue Parrotfish				●				●
512	*Scarus guacamaia*	Rainbow Parrotfish				●				●
513	*Scarus iseri*	Striped Parrotfish				●				●
514	*Scarus taeniopterus*	Princess Parrotfish				●				●
515	*Scarus vetula*	Queen Parrotfish				●				●
516	*Sparisoma atomarium*	Greenblotch Parrotfish				●				●
517	*Sparisoma aurofrenatum*	Redband Parrotfish				●				●
518	*Sparisoma chrysopterum*	Redtail Parrotfish				●				●
519	*Sparisoma radians*	Bucktooth Parrotfish				●				●
520	*Sparisoma rubripinne*	Yellowtail Parrotfish				●				●
521	*Sparisoma viride*	Stoplight Parrotfish				●				●
522	*Labrisomus bucciferus*	Puffcheek Blenny				●				●
523	*Labrisomus gobio*	Palehead Blenny				●				●
524	*Labrisomus guppyi*	Mimic Blenny				●				●
525	*Labrisomus haitiensis*	Longfin Blenny				●				●
526	*Labrisomus kalisherae*	Downy Blenny				●				●
527	*Labrisomus nigricinctus*	Spotcheek Blenny				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
528	*Labrisomus nuchipinnis*	Hairy Blenny				●				●
529	*Malacoctenus aurolineatus*	Goldline Blenny				●				●
530	*Malacoctenus macropus*	Rosy Blenny				●				●
531	*Malacoctenus triangulatus*	Saddled Blenny				●				●
532	*Paraclinus grandicomis*	Horned Blenny				●				●
533	*Paraclinus nigripinnis*	Blackfin Blenny				●				●
534	*Starksia ocellata*	Checkered Blenny				●				●
535	*Starksia starcki*	Key Blenny	●							●
536	*Acanthemblemaria aspera*	Roughhead Blenny				●				●
537	*Acanthemblemaria chaplini*	Papillose Blenny				●				●
538	*Chaenopsis limbaughi*	Yellowface Pikeblenny				●				●
539	*Emblemaria atlantica*	Banner Blenny				●				●
540	*Emblemaria pandionis*	Sailfin Blenny				●				●
541	*Emblemariopsis bahamensis*	Blackhead Blenny				●				●
542	*Emblemariopsis diaphana*	Glass Blenny				●				●
543	*Hemiemblemaria simula*	Wrasse Blenny				●				●
544	*Stathmonotus hemphilli*	Blackbelly Blenny				●				●
545	*Stathmonotus stahli*	Eelgrass Blenny				●				●
546	*Hypleurochilus bermudensis*	Barred Blenny				●				●
547	*Ophioblennius macclurei*	Redlip Blenny				●				●
548	*Acyrtops beryllinus*	Emerald Clingfish	●							●
549	*Gobiesox strumosus*	Skilletfish		●				●		
550	*Dormitator maculatus*	Fat Sleeper		●						●
551	*Eleotris amblyopsis*	Largescaled Spinycheek Sleeper				●				●
552	*Erotelis smaragdus*	Emerald Sleeper				●				●
553	*Gobiomorus dormitor*	Bigmouth Sleeper	●							●
554	*Awaous banana*	River Goby	●							●
555	*Coryphopterus dicrus*	Colon Goby				●				●
556	*Coryphopterus eidolon*	Pallid Goby				●				●
557	*Coryphopterus glaucofraenum*	Bridled Goby				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
558	*Coryphopterus hyalinus*	Glass Goby				●				●
559	*Coryphopterus lipernes*	Peppermint Goby				●				●
560	*Coryphopterus personatus*	Masked Goby				●				●
561	*Coryphopterus thrix*	Bartial Goby				●				●
562	*Coryphopterus tortugae*	Sand Goby				●				●
563	*Ctenogobius pseudofasciatus*	Slashcheek Goby	●							●
564	*Ctenogobius saepepallens*	Dash Goby				●				●
565	*Ctenogobius stigmaturus*	Spottail Goby	●							●
566	*Elacatinus oceanops*	Neon Goby				●				●
567	*Gnatholepis thompsoni*	Goldspot Goby				●				●
568	*Gobiosoma grosvenori*	Rockcut Goby				●				●
569	*Lythrypnus nesiotes*	Island Goby				●				●
570	*Lythrypnus phorellus*	Convict Goby				●				●
571	*Lythrypnus spilus*	Bluegold Goby				●				●
572	*Microgobius carri*	Seminole Goby				●				●
573	*Nes longus*	Orangespotted Goby	●							●
574	*Priolepis hipoliti*	Rusty Goby				●				●
575	*Chaetodipterus faber*	Atlantic Spadefish		●				●		
576	*Acanthurus bahianus*	Ocean Surgeon	●					●		
577	*Acanthurus chirurgus*	Doctorfish	●					●		
578	*Acanthurus coeruleus*	Blue Tang	●					●		
579	*Acanthocybium solandri*	Wahoo	●					●		
580	*Scomberomorus cavalla*	King Mackerel	●					●		
581	*Scomberomorus maculatus*	Spanish Mackerel		●					●	
582	*Scomberomorus regalis*	Cero	●							●
583	*Thunnus albacares*	Yellowfin Tuna	●					●		
584	*Thunnus atlanticus*	Blackfin Tuna	●				●			
585	*Thunnus thynnus*	Bluefin Tuna	●				●			
586	*Xiphias gladius*	Swordfish	●					●		
587	*Istiophorus platypterus*	Sailfish				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
588	*Etropus crossotus*	Fringed Flounder		●					●	
589	*Paralichthys albigutta*	Gulf Flounder	●					●		
590	*Paralichthys dentatus*	Summer Flounder	●					●		
591	*Paralichthys lethostigma*	Southern Flounder	●					●		
592	*Balistes capriscus*	Gray Triggerfish	●					●		
593	*Balistes vetula*	Queen Triggerfish	●					●		
594	*Canthidermis sufflamen*	Ocean Triggerfish				●				●
595	*Aluterus schoepfii*	Orange Filefish				●				●
596	*Aluterus scriptus*	Scrawled Filefish				●				●
597	*Cantherhines pullus*	Orangespotted Filefish				●				●
598	*Monacanthus tuckeri*	Slender Filefish				●				●
599	*Acanthostracion quadricornis*	Scrawled Cowfish		●				●		
600	*Lactophrys bicaudalis*	Spotted Trunkfish	●					●		
601	*Lactophrys trigonus*	Trunkfish	●					●		
602	*Lactophrys triqueter*	Smooth Trunkfish	●					●		
603	*Canthigaster rostrata*	Sharpnose Puffer				●				●
604	*Chilomycterus schoepfii*	Striped Burrfish		●				●		
605	*Diodon holocanthus*	Balloonfish				●				●
Invertebrates										
606	*Ircinia campana*	Vase Sponge			●				●	
607	*Spongia barbara*	Yellow Sponge		●				●		
608	*Spheciospongia vesparia*	Loggerhead Sponge			●				●	
609	*Dosilia palmeri*	Oklawaha Sponge				●				●
610	*Bartholomea annulata*	Ringed Anenome				●				●
611	*Condylactis gigantea*	Pink-tip Anenome				●				●
612	*Antipathes barbadensis*	Bottle Bruch Black Coral				●				●
613	*Antipathes pennacea*	Feather Black Coral				●				●
614	*Discosoma sanctithomae*	Warty False Coral				●				●
615	*Rhodactis spp.*	False Coral	●				●			
616	*Ricordea florida*	Florida False Coral	●				●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
617	*Gorgonia ventalina*	Purple Sea Fan		●			●			
618	*Acropora cervicornis*	Staghorn Coral	●				●			
619	*Acropora palmata*	Elkhorn Coral	●				●			
620	*Agaricia agaricites*	Lettuce Coral	●				●			
621	*Agaricia fragilis*	Fragile Saucer Coral	●					●		
622	*Agaricia lamarcki*	Sheet Coral	●				●			
623	*Leptoseris cucullata*	Sunray Lettuce Coral	●				●			
624	*Stephanocenia intersepta*	Blushing Star Coral	●						●	
625	*Eusmilia fastigiata*	Smooth Flower Coral	●				●			
626	*Cladocora arbuscula*	Tube Coral	●					●		
627	*Colpophyllia natans*	Boulder Brain Coral	●				●			
628	*Diploria clivosa*	Knobby Brain Coral	●					●		
629	*Diploria labyrinthiformis*	Grooved Brain Coral	●				●			
630	*Diploria strigosa*	Symmetrical Brain Coral	●				●			
631	*Favia fragum*	Golf Ball Coral		●				●		
632	*Manicina areolata*	Rose Coral	●					●		
633	*Montastraea annularis*	Column Star Coral		●			●			
634	*Montastraea cavernosa*	Great Star Coral		●			●			
635	*Solenastrea bournoni*	Smooth Star Coral	●					●		
636	*Solenastrea hyades*	Knobby Star Coral	●					●		
637	*Dendrogyra cylindrus*	Pillar Coral	●				●			
638	*Dichocoenia stokesi*	Pineapple Coral	●				●			
639	*Meandrina meandrites*	Maze Coral	●					●		
640	*Isophyllastraea rigida*	Rough Star Coral	●					●		
641	*Isophyllia sinuosa*	Sinuous Cactus Coral	●					●		
642	*Mussa angulosa*	Large Flower Coral	●					●		
643	*Mycetophyllia aliciae*	Knobby Cactus Coral	●				●			
644	*Mycetophyllia danaana*	Low-ridge Cactus Coral	●				●			
645	*Mycetophyllia ferox*	Rough Cactus Coral	●					●		
646	*Mycetophyllia lamarckiana*	Ridged Cactus Coral	●				●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
647	*Scolymia cubensis*	Artichoke Coral	●					●		
648	*Scolymia lacera*	Atlantic Mushroom Coral	●					●		
649	*Oculina diffusa*	Diffuse Ivory Bush Coral	●					●		
650	*Oculina robusta*	Robust Ivory Tree Coral	●					●		
651	*Madracis decactis*	Ten-rayed Star Coral	●					●		
652	*Madracis formosa*	Eight-rayed Star Coral	●					●		
653	*Madracis mirabilis*	Yellow Pencil Coral	●					●		
654	*Madracis pharensis*	Encrusting Star Coral	●					●		
655	*Porites astreoides*	Mustard Hill Coral	●				●			
656	*Porites branneri*	Blue Crust Coral	●					●		
657	*Porites porites*	Finger Coral	●				●			
658	*Astrangia poculata*	Northern Star Coral	●					●		
659	*Astrangia solitaria*	Solitary Cup Coral	●					●		
660	*Phyllangia americana*	Hidden Cup Coral	●					●		
661	*Siderastrea radians*	Lesser Starlet Coral	●				●			
662	*Siderastrea siderea*	Massive Starlet Coral	●				●			
663	*Palythoa caribaeorum*	Golden Sea Mat		●				●		
664	*Zoanthus pulchellus*	Green Sea Mat	●				●			
665	*Millepora alcicornis*	Encrusting Fire Coral	●				●			
666	*Millepora complanata*	Bladed Fire Coral	●				●			
667	*Physalia physalis*	Portuguese Man-o-war				●				●
668	*Distichopora violacea*	Violet Lace Coral	●				●			
669	*Stylaster filogranus*	Frilly Lace Coral	●				●			
670	*Aurelia aurita*	Moon Jelly			●			●		
671	*Stomolophus meleagris*	Cannonball Jelly			●			●		
672	*Mnemiopsis mccradyi*	Comb Jelly			●			●		
673	*Panopea bitruncata*	Atlantic Geoduck				●				●
674	*Lima scabra scabra*	Flame Scallop	●				●			
675	*Geukensia demissa*	Ribbed Mussel			●			●		
676	*Crassostrea virginica*	Eastern Oyster			●			●		

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
677	*Argopecten irradians*	Bay Scallop			●			●		
678	*Nodipecten nodosus*	Lion's Paw				●				●
679	*Spondylus americanus*	Atlantic Thorny Oyster				●				●
680	*Isognomon alatus*	Tree Oyster				●				●
681	*Isognomon bicolor*	Tree Oyster				●				●
682	*Isognomon radiatus*	Tree Oyster				●				●
683	*Alasmidonta undulata*	Triangle Floater	●							●
684	*Alasmidonta wrightiana*	Ochlockonee Arc-mussel	●							●
685	*Amblema neislerii*	Fat Threeridge	●				●			
686	*Anodonta heardi*	Apalachicola Floater	●							●
687	*Anodonta suborbiculata*	Flat Floater				●				●
688	*Elliptio arctata*	Delicate Spike				●				●
689	*Elliptio chipolaensis*	Chipola Slabshell	●							●
690	*Elliptio mcmichaeli*	Fluted Elephant-ear			●		●			
691	*Elliptio purpurella*	Inflated Spike	●							●
692	*Elliptoideus sloatianus*	Purple Bankclimber	●					●		
693	*Fusconaia escambia*	Narrow Pigtoe	●				●			
694	*Fusconaia rotulata*	Round Ebonyshell	●							●
695	*Glebula rotundata*	Round Pearlshell		●						●
696	*Lampsilis australis*	Southern Sandshell	●				●			
697	*Lampsilis ornata*	Southern Pocketbook	●				●			
698	*Lampsilis subangulata*	Shiny-rayed Pocketbook	●				●			
699	*Lampsilis teres*	Yellow Sandshell				●				●
700	*Medionidus acutissimus*	Alabama Moccasinshell	●				●			
701	*Medionidus penicillatus*	Gulf Moccasinshell	●							●
702	*Medionidus simpsonianus*	Ochlockonee Moccasinshell	●				●			
703	*Medionidus walkeri*	Suwannee Moccasinshell	●				●			
704	*Megalonaias nervosa*	Washboard		●						●
705	*Pleurobema pyriforme*	Oval Pigtoe	●				●			
706	*Pleurobema strodeanum*	Fuzzy Pigtoe	●				●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
707	*Ptychobranchus jonesi*	Southern Kidneyshell	●				●			
708	*Quadrula infucata*	Sculptured Pigtoe		●						●
709	*Quadrula kleiniana*	Suwannee Pigtoe	●							●
710	*Quincuncina burkei*	Tapered Pigtoe	●				●			
711	*Strophitus subvexus*	Southern Creekmussel				●				●
712	*Utterbackia peggyae*	Florida Floater		●						●
713	*Utterbackia peninsularis*	Peninsular Floater				●				●
714	*Villosa amygdala*	Florida Rainbow				●				●
715	*Villosa choctawensis*	Choctaw Bean	●				●			
716	*Villosa villosa*	Downy Rainbow	●							●
717	*Donax variabilis*	Variable Coquina			●			●		
718	*Mercenaria campechiensis*	Hard Clam			●			●		
719	*Mercenaria mercenaria*	Hard Clam			●			●		
720	*Octopus vulgaris*	Octopus			●			●		
721	*Aplysia dactylomela*	Spotted Seahare		●				●		
722	*Calliostoma adelae*	Keys Topsnail				●				●
723	*Astralium phoebium*	Longspine Starsnail				●				●
724	*Littoraria angulifera*	Mangrove Periwinkle				●				●
725	*Fasciolaria lilium*	Banded Tulip			●			●		
726	*Pleuroploca gigantea*	Horse Conch	●					●		
727	*Busycon sinistrum*	Lightning Whelk			●			●		
728	*Cassis flammea*	Helmet Shell	●				●			
729	*Cassis madagascariensis*	Helmet Shell	●				●			
730	*Cassis tuberosa*	Helmet Shell	●							
731	*Cypraea cervus*	Atlantic Deer Cowrie			●			●		
732	*Aphaostracon asthenes*	Blue Spring Hydrobe				●				●
733	*Aphaostracon chalarogyrus*	Freemouth Hydrobe				●				●
734	*Aphaostracon monas*	Wekiwa Hydrobe				●				●
735	*Aphaostracon pycnum*	Dense Hydrobe				●				●
736	*Aphaostracon theiocrenetum*	Clifton Springs Hydrobe				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
737	*Aphaostracon xynoelictum*	Fenney Springs Hydrobe				●				●
738	*Cincinnatia helicogyra*	Helicoid Spring Siltsnail				●				●
739	*Cincinnatia mica*	Ichetucknee Siltsnail	●					●		
740	*Cincinnatia monroensis*	Enterprise Siltsnail				●				●
741	*Cincinnatia parva*	Blue Spring Siltsnail				●				●
742	*Cincinnatia ponderosa*	Sanlando Spring Siltsnail				●				●
743	*Cincinnatia vanhyningi*	Seminole Spring Siltsnail				●				●
744	*Cincinnatia wekiwae*	Wekiwa Siltsnail				●				●
745	*Dasyscias franzi*	Shaggy Ghostsnail				●				●
746	*Cyphoma gibbosum*	Flamingo Tongue	●				●			
747	*Elimia clenchi*	Clench's Goniobasis				●				●
748	*Charonia tritonis variegata*	Atlantic Trumpet Triton	●				●			
749	*Strombus gigas*	Queen Conch	●							
750	*Hypselodoris webbi*	Florida Regal Doris				●				●
751	*Elysia crispata*	Lettuce Slug				●				●
752	*Liguus fasciatus matecumbensis*	Florida (Matecumbe) Tree Snail				●				●
753	*Orthalicus floridensis*	Banded Tree Snail			●				●	
754	*Orthalicus reses nesodryas*	Florida Keys Tree Snail	●				●			
755	*Orthalicus reses reses*	Stock Island Tree Snail	●				●			
756	*Praticolella bakeri*	Ridge Scrubsnail				●				●
757	*Chiton tuberculatus*	West Indian Green Chiton				●				●
758	*Oreaster reticulatis*	Cushion Star, Bahama Star	●					●		
759	*Comactinia echinoptera*	Red Arm Sea Feather	●				●			
760	*Nemaster spp.*	Feather Stars	●				●			
761	*Meoma ventricosa*	West Indian Sea Biscuit				●				●
762	*Clypeaster rosaceus*	West Indian Sea Biscuit				●				●
763	*Clypeaster subdepressus*	Sea Biscuit				●				●
764	*Encope michelini*	Sand Dollar				●				●
765	*Leodia sexiesperforata*	Sand Dollar				●				●
766	*Mellita isometra*	Sand Dollar				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
767	*Mellita quinquiesperforata*	Five-holed Keyhole Sand Dollar				●				●
768	*Mellita tenuis*	Sand Dollar				●				●
769	*Diadema antillarum*	Long-spined Urchin	●					●		
770	*Moira atropus*	Burrowing Heart Urchin				●				●
771	*Lytechinus variegatus*	Variegated Urchin			●			●		
772	*Tripneustes ventricosus*	Sea Egg Urchin				●				●
773	*Holothuria floridana*	Florida Sea Cucumber				●				●
774	*Ophiophragmus filograneus*	Brittle Star				●				●
775	*Asteroporpa annulata*	Basket Star				●				●
776	*Astrophyton muricatum*	Basket Star				●				●
777	*Hermodice carunculata*	Fire (Bristle) Worm				●				●
778	*Arenicola cristata*	Lugworm				●				●
779	*Spirobranchus gigantea gigantea*	Christmas Tree Worm				●				●
780	*Phragmatopoma lapidosa*	Worm Reef				●				●
781	*Eustala eleuthra*	(Eleuthra) Orb Weaver				●				●
782	*Sphodros rufipes*	Red-legged Purse-web Spider	●					●		
783	*Cesonia irvingi*	Key Gnaphosid (Keys Cesonia) Spider				●				●
784	*Sosippus placidus*	Lake Placid Funnel Wolf Spider	●					●		
785	*Paraphrynus raptator*	Dusky-handed Tailless Whip Scorpion				●				●
786	*Limulus polyphemus*	Horseshoe Crab			●		●			
787	*Crangonyx grandimanus*	Florida Cave Amphipod				●				●
788	*Crangonyx hobbsi*	Hobbs' Cave Amphipod				●				●
789	*Calappa flammea*	Shame-faced Crabs	●				●			
790	*Hepatus epheliticus*	Shame-faced Crabs				●				●
791	*Callichirus islagrande*	Ghost Shrimp				●				●
792	*Cambarellus blacki*	Cypress Crayfish	●							●
793	*Cambarus cryptodytes*	Dougherty Plain (Apalachicola) Cave Crayfish		●				●		
794	*Cambarus pyronotus*	Fire-back (Red-back) Crayfish	●					●		
795	*Procambarus acherontis*	Orlando (Palm Springs) Cave Crayfish	●							●
796	*Procambarus apalachicolae*	A Crayfish			●		●			

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
797	*Procambarus attiguus*	Silver Glen Springs (Cave) Crayfish	●					●		
798	*Procambarus capillatus*	A Crayfish	●					●		
799	*Procambarus delicatus*	Big-cheeked Cave Crayfish	●							●
800	*Procambarus econfinae*	Panama City Crayfish		●			●			
801	*Procambarus erythrops*	Santa Fe (Sim's Sink) Cave Crayfish	●					●		
802	*Procambarus escambiensis*	A Crayfish	●					●		
803	*Procambarus franzi*	Orange Lake Cave Crayfish	●							●
804	*Procambarus horsti*	Big Blue Spring Cave Crayfish	●							●
805	*Procambarus latipleurum*	A Crayfish	●							●
806	*Procambarus leitheuseri*	Coastal Lowland Cave Crayfish		●						●
807	*Procambarus lucifugus alachua*	Alachua Light-fleeing Cave Crayfish				●				●
808	*Procambarus lucifugus lucifugus*	Withlacoochee Light-fleeing Cave Crayfish				●				●
809	*Procambarus milleri*	Miami Cave Crayfish				●				●
810	*Procambarus morrisi*	Putnam County Cave Crayfish	●				●			
811	*Procambarus orcinus*	Woodville (Karst) Cave Crayfish		●				●		
812	*Procambarus pallidus*	Pallid Cave Crayfish			●			●		
813	*Procambarus pictus*	Black Creek Crayfish		●			●			
814	*Procambarus rathbunae*	A Crayfish	●				●			
815	*Procambarus rogersi expletus*	A Crayfish	●					●		
816	*Procambarus rogersi rogersi*	A Crayfish		●				●		
817	*Procambarus suttkusi*	A Crayfish				●				●
818	*Procambarus youngi*	Florida Longbeak Crayfish		●				●		
819	*Troglocambarus maclanei*	North Florida Spider Cave Crayfish	●					●		
820	*Coenobita clypeatus*	Land Hermit Crab				●				●
821	*Clibanarius tricolor*	Blue-legged or tricolor Hermit Crab				●				●
822	*Clibanarius vittatus*	Thinstripe Hermit Crab		●						●
823	*Cardisoma guanhumi*	Great Land Crab (Blue Land Crab)				●				●
824	*Aratus pisonii*	Mangrove Crab				●				●
825	*Sesarma benedicti*	Benedict's Wharf Crab				●				●
826	*Goniopsis cruentata*	Mangrove Crab				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
827	*Emerita benedicti*	Mole Crab				●				●
828	*Lysmata wurdemanni*	Peppermint Shrimp				●				●
829	*Mithrax spinosissimus*	Caribbean King Crab, Channel Clinging Crab				●				●
830	*Stenorynchus seticornis*	Yellowline Arrow Crab				●				●
831	*Ocypode quadrata*	Ghost Crab				●				●
832	*Uca minax*	Red-jointed Fiddler, Brackish Water Fiddler				●				●
833	*Uca pugilator*	Sand Fiddler				●				●
834	*Uca pugnax*	Mud Fiddler				●				●
835	*Phimochirus operculatus*	Polkadotted Hermit Crab				●				●
836	*Palaemonetes cummingi*	Squirrel Chimney Cave Shrimp				●				●
837	*Periclimenes yucatanicus*	Spotted Cleaner Shrimp				●				●
838	*Panulirus argus*	Spiny Lobster			●			●		
839	*Farfantepenaeus duorarum*	Pink Shrimp			●			●		
840	*Callinectes sapidus*	Blue Crab			●			●		
841	*Stenopus hispidus*	Banded-coral Shrimp			●			●		
842	*Upogebia spp.*	Ghost Shrimp				●				●
843	*Menippe nodifrons*	Cuban Stone Crab				●				●
844	*Caecidotea hobbsi*	Florida Cave Isopod				●				●
845	*Caecidotea sp. 1*	Rock Springs Cave Isopod				●				●
846	*Caecidotea sp. 8*	Econfina Springs Cave Isopod				●				●
847	*Remasellus parvus*	Swimming Little Florida Cave Isopod				●				●
848	*Neogonodactylus oerstedii*	Mantis Shrimp				●				●
849	*Lysiosquilla scabricauda*	Thumbsplitter Mantis Shrimp				●				●
850	*Aneflomorpha delongi*	Delong's Aneflomorpha	●							●
851	*Eburia stroheckeri*	Strohecker's Eburia	●					●		
852	*Heterachthes sablensis*	Cape Sable Longhorn	●					●		
853	*Linsleyonides albomaculatus*	White-spotted Longhorn	●					●		
854	*Stizocera floridana*	Florida Forestiera Borer	●					●		
855	*Romulus globosus*	Round-necked Romulus	●					●		
856	*Stenodontes chevrolati*	Chevrolat's Stenodontes	●					●		

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
857	*Cicindela highlandensis*	Highlands Tiger Beetle	●				●			
858	*Cicindela olivacea*	Olive Tiger Beetle				●				●
859	*Cicindela scabrosa*	(Florida) Scrub Tiger Beetle	●					●		
860	*Cicindela striga*	A Tiger Beetle				●				●
861	*Chelyoxenus xerobatis*	Gopher Tortoise Hister Beetle	●				●			
862	*Ceratocanthus aeneus*	A Scarab Beetle				●				●
863	*Anomala exigua*	Exiguous (Pygmy) Anomala Scarab Beetle	●							●
864	*Anomala eximia*	Archbold (Scrub) Anomala Scarab Beetle	●							●
865	*Anomala flavipennis okaloosensis*	Panhandle Beach Anomala Scarab Beetle				●				●
866	*Anomala robinsoni*	Robinson's Anomala Scarab Beetle				●				●
867	*Aphodius troglodytes*	Gopher Tortoise Aphodius Commensal Scarab Beetle				●				●
868	*Copris gopheri*	Gopher Tortoise Copris Commensal Scarab Beetle				●				●
869	*Mycotrupes pedester*	Scrub Island Burrowing Scarab Beetle (SW FL Mycotrupes)	●				●			
870	*Onthophagus polyphemi polyphemi*	Gopher Tortoise Onthophagus Commensal Scarab Beetle				●				●
871	*Trox howelli*	Caracara Commensal Scarab Beetle (Caracara Trox)				●				●
872	*Machimus polyphemi*	Gopher Tortoise Robber Fly	●				●			
873	*Anopheles albimanus*	Central American Malaria Mosquito				●				●
874	*Culex bahamensis*	Bahamian Culex				●				●
875	*Culex mulrennani*	Mulrennan's Culex				●				●
876	*Baetisca becki*	A Mayfly	●							●
877	*Baetisca rogersi*	A Mayfly		●				●		
878	*Dolania americana*	American Sand-burrowing Mayfly	●					●		
879	*Brachycercus nasutus*	A Mayfly	●					●		
880	*Attenella attenuata*	A Mayfly	●							●
881	*Dannella simplex*	A Mayfly	●					●		
882	*Hexagenia bilineata*	A Mayfly		●				●		
883	*Hexagenia limbata*	A Burrowing Mayfly	●					●		

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
884	*Hexagenia orlando*	A Burrowing Mayfly	●							●
885	*Macdunnoa brunnea*	A Mayfly	●							●
886	*Pseudiron centralis*	White Sand-river Mayfly	●					●		
887	*Stenacron floridense*	A Mayfly		●				●		
888	*Asioplax dolani*	A Mayfly	●							●
889	*Siphloplecton brunneum*	A Mayfly	●							●
890	*Siphloplecton fuscum*	A Mayfly	●							●
891	*Siphloplecton simile*	A Mayfly	●							●
892	*Homoeoneuria dolani*	Blue Sand-river Mayfly	●					●		
893	*Isonychia berneri*	A Mayfly		●				●		
894	*Isonychia sicca*	A Mayfly		●				●		
895	*Atrytone arogos arogos*	Arogos Skipper	●				●			
896	*Atrytonopsis hianna loammi*	Southern Dusted Skipper	●				●			
897	*Epargyreus zestos*	Zestos Skipper	●				●			
898	*Euphyes pilatka klotsi*	Palatka Skipper (Keys population)				●				●
899	*Ephyriades brunneus floridensis*	Florida Duskywing	●					●		
900	*Hesperia meskei pinocayo*	Meske's Skipper (Keys population)				●				●
901	*Callophrys gryneus sweadneri*	Sweadner's Juniper Hairstreak		●			●			
902	*Chlorostrymon maesites*	Amethyst Hairstreak				●				●
903	*Eumaeus atala*	Atala	●							●
904	*Hemiargus thomasi bethunebakeri*	Miami Blue	●					●		
905	*Incisalia irus*	Frosted Elfin	●				●			
906	*Strymon acis bartrami*	Bartram's Hairstreak	●							●
907	*Anaea troglodyta floridalis*	Florida Leafwing	●				●			
908	*Anthanassa frisia*	Cuban Crescent				●				●
909	*Eunica monima*	Dingy Purplewing	●					●		
910	*Eunica tatila tatilista*	Florida Purplewing				●				●
911	*Junonia genoveva*	Tropical Buckeye	●				●			
912	*Heraclides aristodemus ponceanus*	Schaus' Swallowtail	●					●		
913	*Papilio andraemon bonhotei*	Bahama Swallowtail	●							●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
914	*Appias drusilla neumoegeni*	Florida White	●					●		
915	*Eurema dina helios*	Dina Yellow	●					●		
916	*Eurema nise*	Mimosa Yellow	●					●		
917	*Hetaerina americana*	American Rubyspot				●				●
918	*Cordulegaster sayi*	Say's Spiketail				●				●
919	*Epitheca spinosa*	Robust Tongtail				●				●
920	*Neurocordulia clara*	Apalachicola Shadowfly				●				●
921	*Neurocordulia molesta*	Smoky Shadowfly				●				●
922	*Neurocordulia obsoleta*	Umber Shadowfly				●				●
923	*Somatochlora calverti*	Calvert's Emerald				●				●
924	*Somatochlora provocans*	Treetop Emerald				●				●
925	*Dromogomphus armatus*	Southeastern Spinyleg				●				●
926	*Erpetogomphus designatus*	Eastern Ringtail				●				●
927	*Gomphus geminatus*	Twin-striped Clubtail				●				●
928	*Gomphus hodgesi*	Hodges' Clubtail				●				●
929	*Gomphus modestus*	Gulf Coast Clubtail				●				●
930	*Gomphus vastus*	Cobra Clubtail				●				●
931	*Gomphus westfalli*	Diminutive (Westfall's) Clubtail				●				●
932	*Progomphus bellei*	Belle's Sanddragon				●				●
933	*Stylurus laurae*	Laura's Clubtail				●				●
934	*Stylurus potulentus*	Yellow-sided Clubtail				●				●
935	*Stylurus townesi*	Bronze (Townes') Clubtail				●				●
936	*Lestes inaequalis*	Elegant Spreadwing				●				●
937	*Libellula jesseana*	Purple Skimmer				●				●
938	*Nannothemis bella*	Elfin Skimmer				●				●
939	*Tachopteryx thoreyi*	Gray Petaltail				●				●
940	*Tettigidea empedonepia*	Torreya Pygmy Grasshopper				●				●
941	*Belocephalus micanopy*	Big Pine Key Conehead Katydid				●				●
942	*Belocephalus sleighti*	Keys Short-winged Conehead Katydid				●				●
943	*Cycloptilum irregularis*	Keys Scaly Cricket				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
944	*Cheumatopsyche gordonae*	Gordon's Little Sister Sedge				●				●
945	*Cheumatopsyche petersi*	Peters' Little Sister Sedge Caddisfly				●				●
946	*Hydroptila molsonae*	Molson's (Varicolored) Microcaddisfly				●				●
947	*Hydroptila wakulla*	Wakulla Springs Vari-colored Microcaddisfly				●				●
948	*Ochrotrichia okaloosa*	Okaloosa Somber Microcaddisfly				●				●
949	*Ochrotrichia provosti*	Provost's Somber Caddisfly				●				●
950	*Orthotrichia curta*	Short Orthotrichian Microcaddisfly				●				●
951	*Orthotrichia dentata*	Dentate Orthotrichian Microcaddisfly				●				●
952	*Orthotrichia instabilis*	Changeable Orthotrichian Microcaddisfly				●				●
953	*Oxyethira elerobi*	Elerob's (Cream and Brown Mottled) Microcaddisfly				●				●
954	*Oxyethira florida*	Florida Cream and Brown (Mottled) Microcaddisfly				●				●
955	*Oxyethira janella*	Little-entrance Oxyethiran Microcaddisfly				●				●
956	*Oxyethira kelleyi*	Kelley's Cream and Brown Mottled Microcaddisfly				●				●
957	*Oxyethira kingi*	King's Cream and Brown Mottled Microcaddisfly				●				●
958	*Oxyethira novasota*	Novasota Oxyethiran Microcaddisfly				●				●
959	*Lepidostoma morsei*	Morse's Little Plain Brown Sedge				●				●
960	*Ceraclea floridana*	Florida (Scaly Wing Sedge) Ceraclean Caddisfly				●				●
961	*Oecetis daytona*	Daytona Long-horned (Sedge) Caddisfly				●				●
962	*Oecetis floridana*	Florida Long-horn Sedge				●				●
963	*Oecetis parva*	Little Longhorned Caddisfly				●				●
964	*Oecetis porteri*	Porter's Long-horn Sedge				●				●
965	*Oecetis pratelia*	Little Meadow Long-horned (Sedge) Caddisfly				●				●
966	*Triaenodes florida*	Floridian Triaenode Caddisfly				●				●
967	*Triaenodes furcella*	Little-fork Triaenode Caddisfly				●				●
968	*Chimarra florida*	Floridian Finger-net Caddisfly		●				●		
969	*Cernotina truncona*	Florida Cernotinan Caddisfly				●				●
970	*Polycentropus floridensis*	Florida Brown Checkered Summer Sedge				●				●

Species of Greatest Conservation Need			Status				Trend			
Count	Scientific Name	Common Name	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown
971	*Agarodes libalis*	Spring-loving Psiloneuran Caddisfly				●				●
972	*Agarodes ziczac*	Zigzag Blackwater River Caddisfly				●				●
973	*Didemnum vanderhorst.*	Tunicates				●				●
974	*Eudistoma species indeterminate*	Strawberry Tunicates				●				●

Habitats

This chapter in divided into 45 sections; each section contains detailed information on each of the identified habitat categories, including location and status information, associated Species of Greatest Conservation Need (SGCN), threats to the habitat, and recommended actions. Methods for The Nature Conservancy (TNC) Threat and Action Workshops are described in the Chapter Florida's Approach to Meeting the Eight Required Elements. If an identified threat or action was unique to a particular habitat, the threats and actions are listed in that habitat section. Several threats and conservation actions were similar across many habitat types. If this occurred, it is noted in the habitat section and the threat descriptions and actions can be found in the Chapter Multiple Habitat Threats and Conservation Actions. The actions presented have been edited by the Florida Fish and Wildlife Conservation Commission (FWC) to reflect the incentive-based, non-regulatory intent of Florida's Comprehensive Wildlife Conservation Strategy (Strategy).

The Strategy incorporates a modified system for classifying the breadth of Florida's habitats. Forty-five habitat categories were used which were based on the best available science, Geographic Information Systems (GIS) data, committee opinions, and a crosswalk of the Florida Natural Areas Inventory (FNAI) habitat types. The goal of using this system was to maximize the functionality of the Strategy, while at the same time addressing needs and concerns for habitats across the entire landscape of Florida–terrestrial, freshwater, and marine. In this system, Florida's habitats are consolidated into 22 terrestrial, nine freshwater, and 14 marine habitat categories for mapping and workshop purposes. Refer to the Chapter Florida's Approach to Meeting the Eight Required Elements for more information regarding the formation and mapping of the habitat categories.

As with almost any habitat categorization, there are a few shortcomings associated with the classification system used for the Strategy that should be considered in evaluating the following habitat chapters:

- The natural environment of Florida is dynamic and intricate while the developed habitat categories are simplified and broad. Many exceptions to the category boundaries exist. For example, the classifications given to streams often shift both seasonally and altitudinally.

- The Strategy partitioned Florida into 45 habitat categories to identify the importance of and utilization of the SGCN in those habitats. This approach, however, does not account for the wide ranging habitat needs of mobile species or critical habitats at different stages of their life. This artificial sectioning becomes further complicated by the separation of terrestrial, freshwater and marine habitats. For example, freshwater fishes in the Alluvial Streams category will stray into the Bottomland Hardwood Forests category if the conditions are correct, numerous amphibians are as much part of an ephemeral pond as the Natural Pineland category that contains it, shorebirds may utilize Beach/Surf Zone and Coastal Strand borders, and many marine species utilize

freshwater habitats during feeding or reproductive activities, or for seasonal refuge. In addition to species usage of multiple habitats, it is important to recognize the interaction and interdependency of the described habitats among each other. What is classified as a spring upstream can be called a Calcareous Stream downstream and then a Softwater Stream down farther. Sandhill can gradually grade into Mixed Hardwood-Pine Forest or Natural Pineland. The processes and functions of one habitat can feed another like streams into an estuary. Because the classification is divided at a broad, statewide level, these interconnecting aspects of ecology are sometimes lost to the reader. Florida contains a vastly complex and diverse landscape; the Strategy's attempt to divide it into habitat categories will undoubtedly present a variety of complexities and limitations.

- The maps used to represent habitat categories are the most comprehensive GIS data available. Despite this, the cover of many of the habitats does not accurately reflect their true spatial extent and/or configuration. The habitat maps are intended to be used as a general guide for the distribution of the habitat types in Florida. (See Chapter Florida's Strategic Vision, Priority Data Gaps).

The three broad grouping of habitat categories are represented by three statewide maps; Figure 7. Florida Comprehensive Wildlife Conservation Strategy (CWCS) Freshwater Habitat Categories 2005, Figure 8. Florida CWCS Terrestrial Habitat Categories 2005, and Figure 9. Florida CWCS Marine Habitat Categories 2005. Due to the expansiveness of the GIS data sets used, it was not possible to merge all three maps into a single map of the State of Florida and still delineate habitat categories. The habitats are grouped by freshwater, terrestrial, and marine only for organizational purposes, and are not meant to strictly assign habitats into these categories.

To more thoroughly address each of the habitat categories in detail, this chapter is organized according to the 45 habitat categories, which are addressed in alphabetical order as follows:

1. Agriculture
2. Annelid Reef
3. Aquatic Cave
4. Artificial Structure
5. Bay Swamp
6. Beach/Surf Zone
7. Bivalve Reef
8. Bottomland Hardwood Forest
9. Calcareous Stream
10. Canal/Ditch
11. Coastal Strand
12. Coastal Tidal River or Stream
13. Coral Reef
14. Cypress Swamp
15. Disturbed/Transitional
16. Dry Prairie
17. Freshwater Marsh and Wet Prairie
18. Grassland/Improved Pasture

19. Hard Bottom
20. Hardwood Hammock Forest
21. Hardwood Swamp/Mixed Wetland Forest
22. Hydric Hammock
23. Industrial/Commercial Pineland
24. Inlet
25. Large Alluvial Stream
26. Mangrove Swamp
27. Mixed Hardwood-Pine Forest
28. Natural Lake
29. Natural Pineland
30. Pelagic
31. Pine Rockland
32. Reservoir/Managed Lake
33. Salt Marsh
34. Sandhill
35. Scrub
36. Seepage/Steephead Stream
37. Shrub Swamp
38. Softwater Stream
39. Spring and Spring Run
40. Submerged Aquatic Vegetation
41. Subtidal Unconsolidated Marine/Estuary Sediment
42. Terrestrial Cave
43. Tidal Flat
44. Tropical Hardwood Hammock
45. Urban/Developed

How to Use the Habitat Categories

This section is meant to be a brief guide of how to navigate and utilize the information contained within each of Florida's habitat categories.

Photos

The photos presented are a visual representation of the corresponding habitat category.

Distribution Map

The maps presented are the best available representation of where the habitat category generally occurs within the State of Florida. These maps are a general visual representation and may not always be precisely accurate. In habitats where complete map data are not currently

available, such as Hard Bottom and Pelagic, it is noted in the status section (see Status description below).

Status

The overall preliminary assessment of the condition and trend is summarized as a "status" for each habitat category. This rank represents our initial ecological assessment of a habitat from a statewide perspective. Total area, acres in conservation or private ownership, Florida Forever projects, and ecological significance (area of Strategic Habitat Conservation Areas) that each comprises were derived principally from GIS data sources (See Appendix D. GIS Data Tables). Florida Forever project acreages are those that are proposed conservation lands under the Florida Forever program**.** Strategic Habitat Conservation Areas (SHCA) are uplands and wetlands that are important habitat areas and are currently not protected. Acreages of communities and disturbances are approximate, but provide a reasonable estimate.

Habitat Description

The description is intended to be a succinct yet comprehensive portrayal of the habitat type for the reader. Habitat categories are cross-walked with the widely known ecosystem classification scheme employed by FNAI as presented in the *Guide to the Natural Communities of Florida* (Florida Natural Areas Inventory and Florida Department of Natural Resources 1990). The description and location of the community type presented for each habitat category was developed from a wide range of sources (see Chapter References/Literature Cited) and professional knowledge.

Associated Species

Within each habitat chapter there is a list of SGCN associated with the corresponding habitat category. These associations were determined by the best available professional opinion. Species are in phylogenetic order and are separated by taxa group (mammals, birds, reptiles, amphibians, fish, and invertebrates). Detailed information about the process of identifying the list of 974 SGCN can be found in Chapter Florida's Approach to Meeting the Eight Required Elements.

Conservation Threats

The threat ranking and evaluation of the habitat is based on The Nature Conservancy's (TNC) 5-S planning process described in Chapter. Florida's Approach to Meeting the Eight Required Elements and in detail in TNC's Threats and Actions Report (Gordon et al., 2005).

First, the reader will find a list of threats that were common to the current and multiple other habitats–these are a list of statewide threats that are fully addressed in Chapter Multiple Habitat Threats and Conservation Actions. For example, the following threats to wildlife and their habitats were identified to be widespread throughout the state of Florida:

- Conversion to housing and urban development
- Invasive plants
- Incompatible fire

Next, the reader will find a short evaluation of the habitat and the threats specific to it. This discussion is based on the threats that are most important to that particular habitat and the species it contains. Accompanying each assessment are two tables illustrating the results of TNC's threat analysis for the habitat. TNC's process divides "threat" into two parts:

- Stress–the factors that destroy, degrade, or impair habitats by impacting variables associated with habitat size, condition, or configuration in the landscape, and
- Source of Stress–the proximate cause of the stress.

Example Table 1 is an illustration of how the first table in the Conservation Threats section will appear:

Stresses		Habitat Stress Rank
A	Fragmentation of habitats, communities, ecosystems	High
B	Habitat destruction or conversion	High
C	Altered hydrologic regime	High
D	Altered fire regime	High
E	Insufficient size / extent of characteristic communities or ecosystems	High
F	Altered landscape mosaic or context	High
G	Altered community structure	Medium
H	Altered species composition / dominance	Medium
I	Habitat degradation / disturbance	Low

Example Table 1: Each Stress is assigned a letter and a rank. Stresses are ranked in terms of the potential severity of damage to the habitat and the geographic scope of that damage. In this example, Stresses A to F ranked as the highest threats to the habitat. A Stress may have multiple sources. In example table 1 above, threat D or "Altered fire regime" can be caused by numerous factors (roads, invasive plants, conversion to housing, etc). Only those Stresses that had an overall rank of very high or high were further addressed in the Source of Stress analysis.

Example Table 2 will be similar to the second table in the Conservation Threats section:

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Roads	**Very High**	A, B, C, D, E, F
2	Conversion to housing and urban development	**Very High**	A, B, C, D, E, F
3	Conversion to commercial and industrial development	**High**	A, B, E
4	Conversion to agriculture	**Medium**	A, B, C, E, F
5	Surface water withdrawal	**Medium**	A, C, D, F
6	Inappropriate fire	**Medium**	D, F
7	Incompatible grazing and ranching	**Low**	D, F
8	Military activities	**Low**	A, B, E
9	Invasive plants	**Low**	D, F
10	Incompatible agricultural practices	**Low**	A, B, F
11	Incompatible forestry practices	**Low**	A, E
12	Incompatible resource extraction: mining / drilling	**Low**	A, B, E
Overall Threat Rank of Habitat		**Very High**	

Example Table 2: Each Source is given a number, ranked, and associated with a lettered Stress from the first table. Sources are ranked in terms of the degree to which they contribute to the Stress, and the irreversibility of the Stress caused by the Source. In example table 2, Sources 1 and 2 are ranked as the highest in this habitat. Overall stress and source of stress rankings are combined to derive a statewide threat rank of the habitat. This overall rank estimates how threatened the particular habitat is statewide.

Understanding the Sources that contribute the greatest proportion of the particular Stress will help focus and prioritize action that should be undertaken to abate the threat. Multiple Sources generally contribute to a particular Stress, and a single Source may contribute to several Stresses. Therefore, examination and ranking of Sources aids in further focusing attention on the most critical conservation actions.

Conservation Actions

In this section of the habitat chapter, the reader will first find a list of conservation actions that were common to the current, and multiple other habitats. The threats that are extensive and span numerous habitat categories will have actions that are likely to be similar across the state. Conservation actions for statewide threats are found in Chapter Multiple Habitat Threats and Conservation Actions.

Next, the reader will be presented with actions to abate specific threats that were identified for the particular habitat. This will be exemplified as tables with the rankings:

Feasibility–Simply defined as the ease of implementation. Actions that are less complex and have been successfully implemented previously, that fit within the core competencies of the lead institution, and those that appeal to key constituencies have a higher likelihood of success than other actions.

Benefit–Simply defined as the threat abatement benefit. The degree to which the proposed action, if successfully implemented, is likely to achieve the desired outcome(s).

Cost–Simply defined as the order of magnitude in dollars. Total cost of implementing the action estimated for the time horizon of the action, but no longer than 10 years.

Overall Rank–Based on TNC's process, this is the average weighted rank combining Feasibility, Benefits, and Cost.

Feasibility, Benefit, Cost, and Overall Rank were either ranked: Very High (VH), High (H), Medium (M), or Low (L).

The following example, taken from the Natural Pineland habitat category, will illustrate how the actions tables will appear. This example will address two specific threats to Natural Pineland: invasive plants and utility corridors.

Invasive Plants

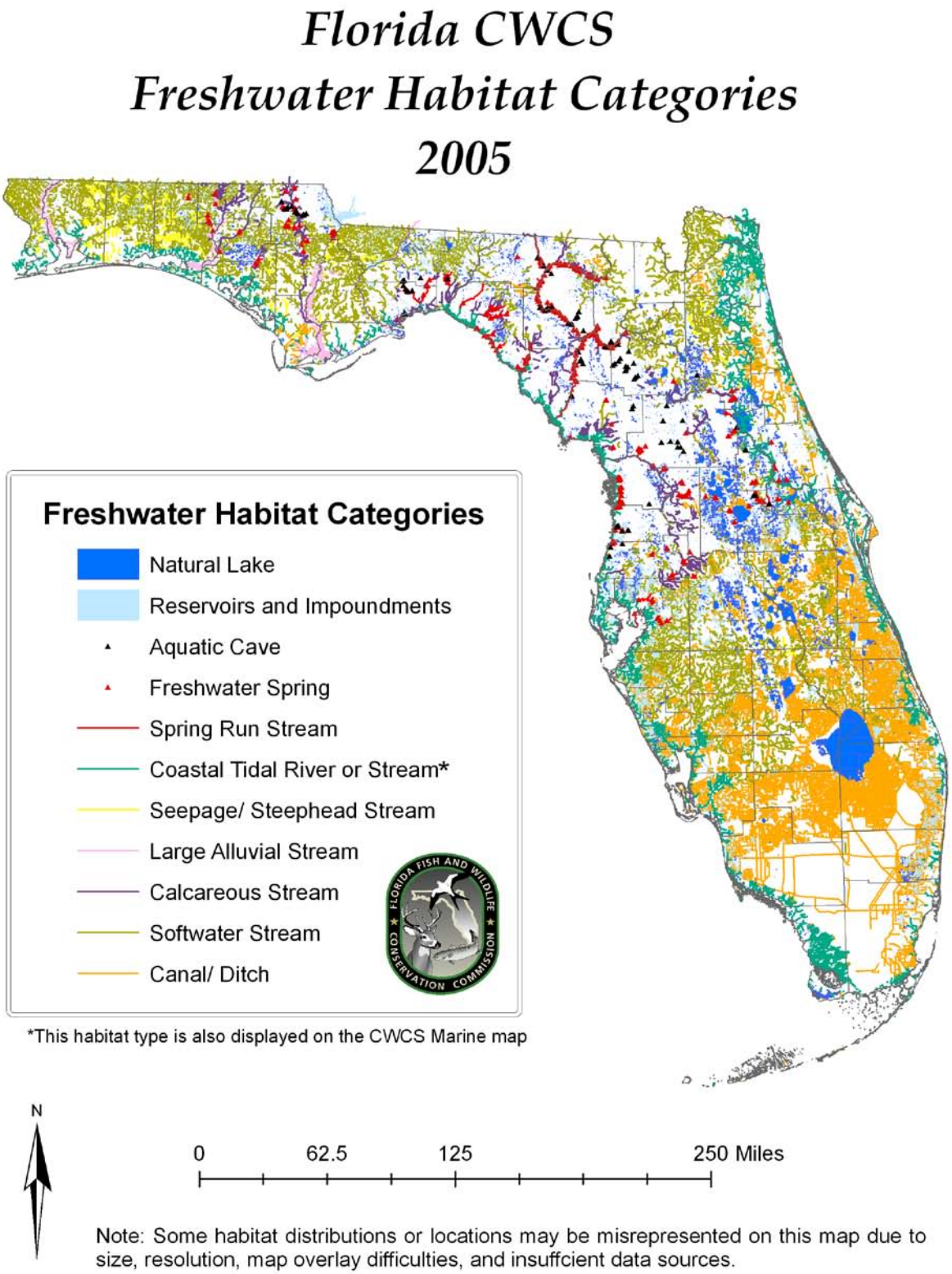
Overall Rank	Education and Awareness	*Feasibility*	*Benefits*	Cost
L	Educate the forest management consulting community about the illegality of selling pine straw bales contaminated with Japanese climbing fern and appropriate control methods.	H	L	L

The above table addresses the threat of invasive plants. A title and description of the proposed action is given along with the corresponding rankings. Given that this action received a Low (L) Overall Rank, priority could be given to actions that received higher rankings.

Utility Corridors

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
M	Develop private-public partnerships that facilitate placement of utilities on existing FDOT rights-of-way and vice-versa to minimize their cumulative impacts on habitats.	M	M	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
VH	Explore options to reduce fragmentation of public lands caused by incompatible utility placement and land use. Promote awareness of this issue and encourage compatible alternate routes and land uses.	M	VH	H

The above two rows address the same threat, utility corridors. Each gives a title and a description of the appropriate action recommended. Considering the Medium (M) and Very High (VH) Overall Rank of these actions, these tables suggest an order of priority.



. Florida CWCS Freshwater Habitat Categories 2005 (See Appendix D. GIS Data Tables).

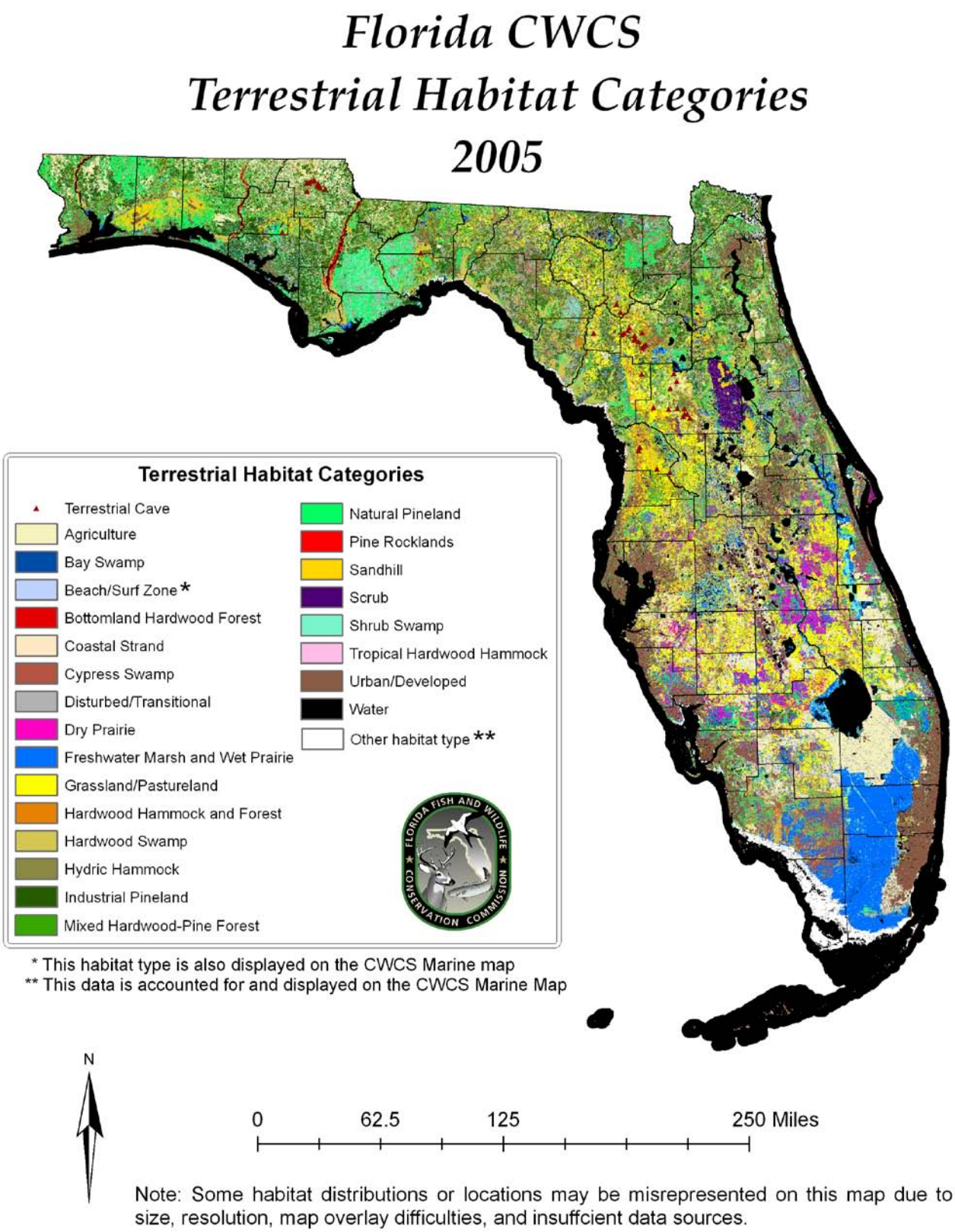


Figure 8. Florida CWCS Terrestrial Habitat Categories 2005 (See Appendix D. GIS Data Tables).

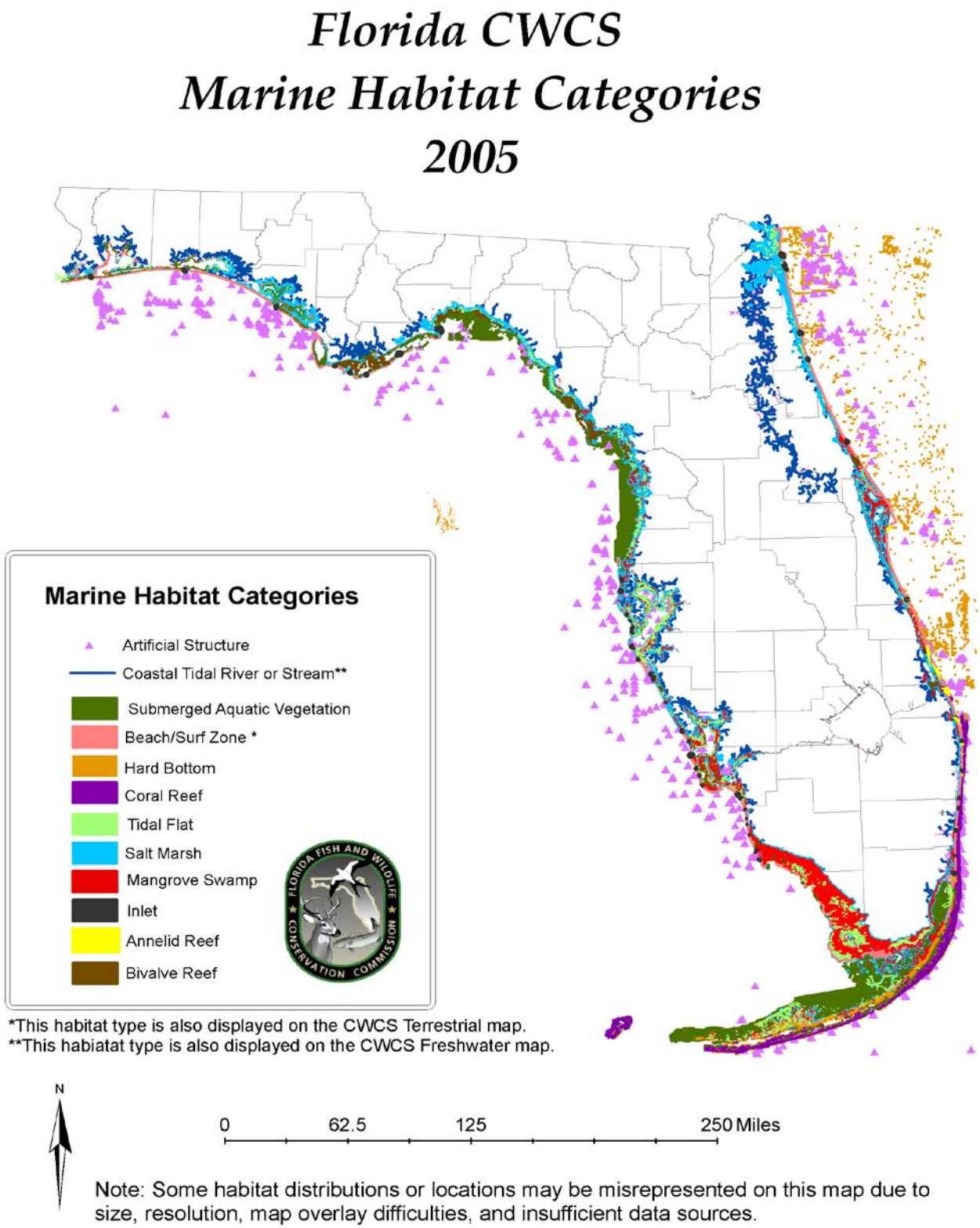
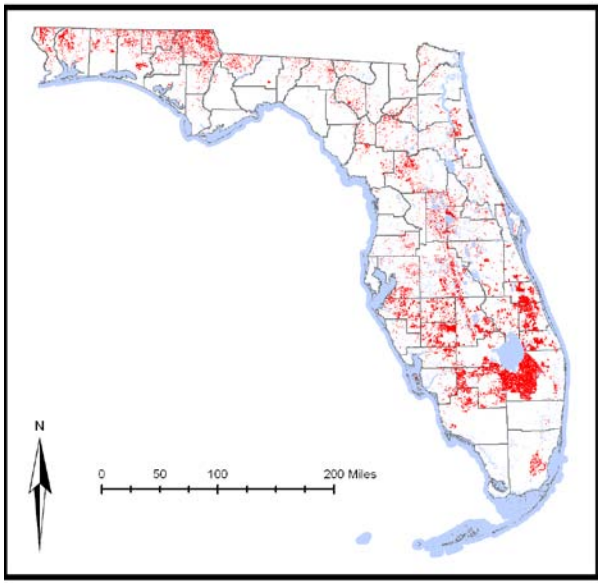


Figure 9. Florida CWCS Marine Habitat Categories 2005 (See Appendix D. GIS Data Tables).

Agriculture



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Fair and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 3,101,742 acres (1,255,230 ha) of Agriculture habitat exist. An unknown amount of this habitat is protected in reserves and easements. The majority is other private lands.

Habitat Description

FNAI type: None

This category includes lands which are planted to sugar cane, citrus groves, row crops (e.g., corn, tomatoes, potatoes, cotton, beans), field crops (e.g., hay and grasses), and other agricultural uses (e.g., orchards, nurseries, vineyards, horse and dairy farms, and fallow cropland). In most agricultural areas both the natural substrates and native plant communities have been greatly disturbed as a result of human activities. At the margins of Agriculture habitat, some patches of native vegetation may remain, but those areas often have been invaded to some degree by weedy or exotic species. Pastures and hayfields may provide secondary habitat for some wildlife species adapted to similar natural ecosystems. When managed appropriately, Agriculture habitat can provide food resources for migratory birds and other wildlife. Wildlife movements benefit from row crops and groves that can contribute to a network of continuous habitat.

Associated Species of Greatest Conservation Need

Mammals

- *Lasiurus borealis* Eastern Red Bat
- *Lasiurus seminolus* Seminole Bat
- *Lasiurus intermedius* Northern Yellow Bat
- *Sylvilagus floridanus* Eastern Cottontail Rabbit
- *Sciurus niger niger* Southeastern Fox Squirrel
- *Sciurus niger shermani* Sherman's Fox Squirrel
- *Geomys pinetis pinetis* Southeastern Pocket Gopher
- *Neofiber alleni* Round-tailed Muskrat
- *Ursus americanus floridanus* Florida Black Bear
- *Mustela frenata olivacea* Southeastern Weasel
- *Mustela frenata peninsulae* Florida Long-tailed Weasel
- *Spilogale putorius* Spotted Skunk
- *Mephitis mephitis* Striped Skunk
- *Puma concolor coryi* Florida Panther

Birds

- *Anas fulvigula fulvigula* Florida Mottled Duck
- *Anas acuta* Northern Pintail
- *Egretta thula* Snowy Egret
- *Egretta caerulea* Little Blue Heron
- *Egretta tricolor* Tricolored Heron
- *Egretta rufescens* Reddish Egret
- *Nycticorax nycticorax* Black-crowned Night-Heron
- *Nyctanassa violacea* Yellow-crowned Night-Heron
- *Ajaja ajaja* Roseate Spoonbill
- *Eudocimus albus* White Ibis
- *Plegadis falcinellus* Glossy Ibis
- *Mycteria americana* Wood Stork
- *Elanoides forficatus* Swallow-tailed Kite
- *Elanus leucurus* White-tailed Kite
- *Ictinia mississippiensis* Mississippi Kite
- *Haliaeetus leucocephalus* Bald Eagle
- *Caracara cheriway* Crested Caracara
- *Falco sparverius paulus* Southeastern American Kestrel
- *Falco peregrinus* Peregrine Falcon
- *Grus canadensis pratensis* Florida Sandhill Crane
- *Grus americana* Whooping Crane
- *Recurvirostra americana* American Avocet
- *Calidris mauri* Western Sandpiper
- *Calidris melanotos* Pectoral Sandpiper
- *Columbina passerine* Common Ground-Dove
- *Athene cunicularia floridana* Florida Burrowing Owl
- *Chordeiles gundlachii* Antillean Nighthawk
- *Lanius ludovicianus* Loggerhead Shrike
- *Aphelocoma coerulescens* Florida Scrub-Jay
- *Passerina ciris* Painted Bunting
- *Sturnella magna* Eastern Meadowlark

Amphibians

- *Ambystoma tigrinum* — Tiger Salamander
- *Rana capito* — Gopher Frog

Reptiles

- *Terrapene carolina bauri* — Florida Box Turtle
- *Gopherus polyphemus* — Gopher Tortoise
- *Heterodon platirhinos* — Eastern Hognose Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Pituophis melanoleucus mugitus* — Florida Pine Snake
- *Lampropeltis getula* — Common Kingsnake
- *Crotalus horridus* — Timber Rattlesnake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake

Invertebrates

- *Chelyoxenus xerobatis* — Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* — Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* — Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* — Gopher Tortoise Onthophagus Commensal Scarab Beetle

Conservation Threats

While threats to its conservation as well as remedial actions were identified during earlier workshops, the Agriculture habitat category was not addressed in the TNC workshops that generated tables of ranked threats and actions, as seen in most other habitat categories. The decision to not rank threats and actions for this habitat was made (1) to maximize discussion time for higher-priority habitats and (2) because of some disagreement over recognition of this habitat type as important to wildlife conservation. Therefore, threats and actions are presented as simple bulleted lists, arranged in alphabetical order, with no prioritization.

The following stresses threaten this habitat:

- Altered community structure
- Altered fire regime - timing, frequency, intensity, extent
- Altered hydrologic regime - timing, duration, frequency, extent
- Altered landscape pattern or mosaic
- Altered soil structure & chemistry
- Altered species composition/dominance
- Altered successional dynamics
- Altered water and/or soil temperature
- Altered water quality of surface water or aquifer: contaminants
- Altered water quality of surface water or aquifer: nutrients
- Erosion/sedimentation
- Excessive depredation and/or parasitism
- Fragmentation of habitats, communities, ecosystems
- Habitat degradation/disturbance

The sources of stress, or threats, were used to generate conservation actions:

- Chemicals and toxins
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Incompatible fire
- Incompatible recreational activities
- Invasive animals
- Invasive plants
- Management of nature impoundments
- Nuisance animals
- Nutrient loads
- Parasites/pathogens
- Solid waste

Conservation Actions

Actions to abate threats to Agriculture were designed to reduce the impacts of agricultural activities and increase the habitat's suitability to wildlife. Many threats were statewide (Chemicals and toxins, Conversion to commercial and industrial development, Conversion to housing and urban development, Incompatible fire, Incompatible recreational activities, Invasive animals, Invasive plants, and Nutrient loads).

The actions to abate threats that were identified for Agriculture are below, though none were prioritized for implementation.

Land/Water Protection

- Acquire open space with an emphasis on greenways and network of contiguous habitats
- Conserve wildlife-suitable agricultural lands through conservation easements

Land/Water/Species Management

- Restore hydrology by removing ditches, levees, and dams
- Better fire management of rangelands
- Control exotic plants and animals
- Develop and follow Best Management Practices
- Enroll lands in landowner incentive programs
- Reduce amount of pesticide and fertilizer use

Research, Education and Awareness

- Increase public/private training and awareness about value of these lands
- Continue to educate landowners about the proper use of BMPs
- Research plans for restoration of this habitat and its hydrology
- Research and educate landowners about management practices for controlling invasive species

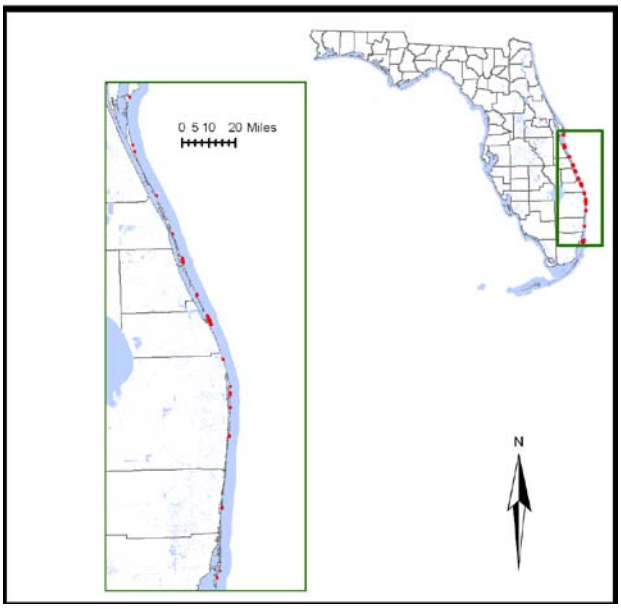
Economic and Other Incentives

- Provide landowner incentive (public and private) for protection and restoration of habitat

Capacity Building

- Form and facilitate partnerships, alliances and networks of organizations willing to research, conserve, and manage this habitat

Annelid Reef



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), approximately 426 acres (172 ha) of Annelid Reefs are present in Florida.

Habitat Description

FNAI type: Worm Reef

Annelid Reefs are formed by aggregations of *Phragmatopoma lapidosa* (also known as *P. caudata* and *P. lapidosa lapidosa*), a tropical marine worm, that create low reefs of sand tubes. These tubes consist of sand grains which are cemented together by protein produced by the worms. Phragmatopoma reproduce by releasing gametes into the water column. The free-floating larval stage can last from two to 20 weeks before they settle on or near existing Annelid Reefs that may result in habitat expansion. Waves and currents are important in transporting planktonic food and sand to the worms, thus influencing the health and growth of the reef. These reefs harbor a diverse community of live-bottom flora and fauna. Annelid Reefs provide a nursery for a variety of coastal fish and invertebrate species.

Annelid Reefs extend from Cape Canaveral to Key Biscayne in Florida but extend southward to near Santa Catarina, Brazil. In Florida, they occur in the highest abundances off St. Lucie and Martin counties. They are commonly found in the intertidal and shallow subtidal zone to about 10 m (33 ft) deep.

Associated Species of Greatest Conservation Need

Mammals

- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Reptiles

- *Chelonia mydas* — Green Turtle
- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley

Fish

- *Ginglymostoma cirratum* — Nurse Shark
- *Carcharhinus falciformis* — Spinner Shark
- *Carcharhinus leucas* — Bull Shark
- *Negaprion brevirostris* — Lemon Shark
- *Megalops atlanticus* — Tarpon
- *Gymnothorax funebris* — Green Moray
- *Gymnothorax moringa* — Spotted Moray
- *Opsanus beta* — Gulf Toadfish
- *Opsanus pardus* — Leopard Toadfish
- *Mugil cephalus* — Striped Mullet
- *Centropomus undecimalis* — Common Snook
- *Lutjanus apodus* — Schoolmaster
- *Lutjanus griseus* — Gray Snapper
- *Lutjanus synagris* — Lane Snapper
- *Anisotremus surinamensis* — Black Margate
- *Anisotremus virginicus* — Porkfish
- *Haemulon aurolineatum* — Tomtate
- *Haemulon plumieri* — White Grunt
- *Archosargus probatocephalus* — Sheepshead
- *Bairdiella sanctaeluciae* — Striped Croaker
- *Equetus lanceolatus* — Jackknife Fish
- *Equetus punctatus* — Spotted Drum
- *Pareques acumunatus* — High-hat
- *Holacanthus bermudensis* — Blue Angelfish
- *Holacanthus ciliaris* — Queen Angelfish
- *Pomacanthus arcuatus* — Gray Angelfish
- *Pomacanthus paru* — French Angelfish
- *Abudefduf saxatilis* — Sergeant Major
- *Stagastes adustus* — Dusky Damselfish
- *Stegastes leucostictus* — Beaugregory
- *Stegastes partitus* — Bicolor Damselfish
- *Stegastes variabilis* — Cocoa Damselfish
- *Halichoeres bivittatus* — Slippery Dick
- *Thalassoma bifasticiatum* — Bluehead

- *Labrisomus nuchipinnis* Hairy Blenny
- *Chaetodipterus* Atlantic Spadefish
- *Acanthurus bahianus* Ocean Surgeon
- *Balistes capriscus* Gray Triggerfish
- *Gerres cinereus* Yellowfin Mojarra

Invertebrates

- *Spongia barbara* Yellow Sponge
- *Spheciospongia vesparia* Loggerhead Sponge
- *Octopus vulgaris* Octopus
- *Aplysia dactylomela* Spotted Seahare
- *Astralium phoebium* Longspine Starsnail
- *Fasciolaria lilium* Banded Tulip
- *Pleuroploca gigantea* Horse Conch
- *Busycon sinistrum* Lightning Whelk
- *Cassis tuberosa* Helmet Shell
- *Cypraea cervus* Atlantic Deer Cowrie
- *Charonia tritonis variegata* Atlantic Trumpet Triton
- *Elysia crispata* Lettuce Slug
- *Oreaster reticulatis* Cushion Star, Bahama Star
- *Diadema antillarum* Long-spined Urchin
- *Lytechinus variegatus* Variegated Urchin
- *Tripneustes ventricosus* Sea Egg Urchin
- *Holothuria floridana* Florida Sea Cucumber
- *Ophiophragmus filograneus* Brittle Star
- *Astrophyton muricatum* Basket Star
- *Hermodice carunculata* Fire (Bristle) Worm
- *Phragmatopoma lapidosa* Worm Reef
- *Lysmata wurdemanni* Peppermint Shrimp
- *Stenorynchus seticornis* Yellowline Arrow Crab
- *Panulirus argus* Spiny Lobster
- *Farfantepenaeus duorarum* Pink Shrimp
- *Callinectes sapidus* Blue Crab
- *Upogebia islagrande* Ghost Shrimp
- *Menippe nodifrons* Cuban Stone Crab
- *Gonodactylus spp*. Mantis Shrimp
- *Lysiosquilla scabricauda* Thumbsplitter Mantis Shrimp

Conservation Threats

Threats to the Annelid Reef habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel Modification/Shipping Lanes
- Climate Variability
- Coastal Development
- Dam Operations/Incompatible release of water (quality, quantity, timing)
- Disruption of Longshore Transport of Sediments
- Fishing Gear Impacts
- Incompatible Industrial Operations
- Incompatible Recreational Activities

- Management of Nature (beach nourishment and impoundments)
- Shoreline Hardening

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered structure	Very High
B	Altered weather regime/sea level rise	High
C	Habitat destruction	High
D	Habitat disturbance	High
E	Sedimentation	High

The sources of stress, or threats, were used to generate conservation actions.

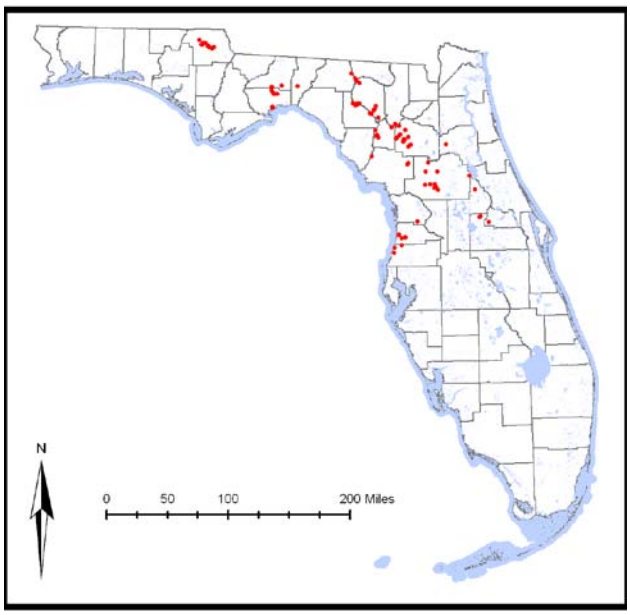
Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Climate variability	**High**	A, B
2	Coastal development	**High**	A, C
3	Management of nature (beach nourishment, impoundments)	**High**	A, C, D, E
4	Channel modification/shipping lanes	**High**	A, C, D
5	Incompatible industrial operations	**High**	A, D
6	Utility corridors	**Medium**	A, C
7	Disruption of longshore transport of sediments	**Medium**	E
8	Dam operations/incompatible release of water: (quality, quantity, timing)	**Medium**	D
9	Placement of artificial structures	**Low**	A, C
10	Fishing gear impacts	**Low**	C, D
11	Incompatible recreational activities	**Low**	D
12	Shoreline hardening	**Low**	C
13	Inadequate stormwater management	**Low**	D
14	Boating impacts	Low	C
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Annelid Reef habitats that were also identified as statewide threats (see list above), are in the Chapter Multiple Habitat Threats and Conservation Actions. Many of the threats to Annelid Reefs are the same as for several other marine and estuarine

habitats. Consequently, actions to abate these threats will be the same or similar to the actions recommended for abating threats to several other marine and estuarine habitats (e.g., Submerged Aquatic Vegetation, Mangrove Swamp, Coral Reef, and Beach/Surf Zone).

Aquatic Cave



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 84 Aquatic Caves are included here. This represents only a fraction of all caves that have been identified. Of the mapped aquatic caves, 29% (24) are in existing conservation or managed areas, 5% (4) are within lands covered by Florida Forever projects, 1% (1) are in SHCA-identified lands, and the remaining 65% (55) of Aquatic Caves are within other private lands.

Habitat Description

FNAI type: Aquatic Cave

Aquatic Caves are cavities below the surface of the ground that contain permanent standing water and range from shallow pools to completely inundated caverns. Caves develop in areas of karst topography, as water moves through underlying limestone, dissolving it and creating fissures and caverns. Due to the rise and fall of water levels, many Aquatic Caves have alternately been terrestrial caves. Some Aquatic Caves occur in conjunction with springs. Caves have stable internal environments with temperature, humidity, and water conditions remaining fairly constant. Cave waters are usually clear, and deep water often appears blue. The water may take on a brown stain if decaying plant matter is carried in with rainwater; in some areas the water may have a milky

appearance because fine limestone silt is present. The chemical makeup of the water in caves is dependent on the source; most waters in aquatic caves have a high mineral content. Many Aquatic Cave systems have species that are specifically adapted to and endemic in that system, and are therefore at greater risk from even minute changes in the habitat.

Associated Species of Greatest Conservation Need

Mammals

- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle

Amphibians

- *Haideotriton wallacei* — Georgia Blind Salamander

Invertebrates

- *Villosa amygdala* — Florida Rainbow
- *Crangonyx grandimanus* — Florida Cave Amphipod
- *Crangonyx hobbsi* — Hobbs' Cave Amphipod
- *Cambarus cryptodytes* — Dougherty Plain (Apalachicola) Cave Crayfish
- *Procambarus acherontis* — Orlando (Palm Springs) Cave Crayfish
- *Procambarus attiguus* — Silver Glen Springs (Cave) Crayfish
- *Procambarus delicatus* — Big-cheeked Cave Crayfish
- *Procambarus erythrops* — Santa Fe (Sim's Sink) Cave Crayfish
- *Procambarus franzi* — Orange Lake Cave Crayfish
- *Procambarus horsti* — Big Blue Spring Cave Crayfish
- *Procambarus leitheuseri* — Coastal Lowland Cave Crayfish
- *Procambarus lucifugus alachua* — Alachua Light-fleeing Cave Crayfish
- *Procambarus lucifugus lucifugus* — Withlacoochee Light-fleeing Cave Crayfish
- *Procambarus milleri* — Miami Cave Crayfish
- *Procambarus morrisi* — Putnam County Cave Crayfish
- *Procambarus orcinus* — Woodville (Karst) Cave Crayfish
- *Procambarus pallidus* — Pallid Cave Crayfish
- *Troglocambarus maclanei* — North Florida Spider Cave Crayfish
- *Palaemonetes cummingi* — Squirrel Chimney Cave Shrimp
- *Caecidotea hobbsi* — Florida Cave Isopod
- *Caecidotea sp. 1* — Rock Springs Cave Isopod
- *Caecidotea sp. 8* — Econfina Springs Cave Isopod
- *Remasellus parvus* — Swimming Little Florida Cave Isopod

Conservation Threats

Threats to the Aquatic Cave habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Incompatible recreational activities
- Incompatible resource extraction–mining/drilling

Threats specific to Aquatic Caves also included mining activities causing destruction of critical, irreplaceable habitat. Habitat-specific incompatible recreation includes gating cave entrances and filling in cave openings to prevent trespass from unauthorized recreation. Caves support unique/irreplaceable species and those with very unique adaptations that may be sensitive to small increases in levels of contaminants, shifts in dissolved oxygen, temperature, or food webs.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Habitat destruction or conversion	Medium
B	Habitat degradation/disturbance	Medium
C	Altered species composition/dominance	Medium
D	Altered hydrologic regime	Medium
E	Keystone species missing or lacking in abundance	Medium
F	Erosion/sedimentation	Low
G	Altered water quality or surface water or aquifer: contaminants	Low
H	Altered community structure	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Incompatible recreational activities	**Medium**	A
2	Incompatible resource extraction: mining/drilling	**Medium**	A
3	Solid waste	**Low**	A
Statewide Threat Rank of Habitat		**Medium**	

Conservation Actions

Actions to abate the threats to Aquatic Caves that were also identified as statewide threats (Incompatible recreational activities, Incompatible resource extraction–mining/drilling) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for statewide threats were only applicable to Aquatic Cave and a few other habitats (i.e., Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. These actions are intended to prevent harm to cave and other ecosystems influenced by groundwater by developing numeric nutrient criteria specific to cave systems and to prevent physical destruction or degradation of cave habitat from recreational activities (e.g., diving) and facilitate movement of bats and other species through upgrading or retrofitting cave entrances and infrastructure for access.

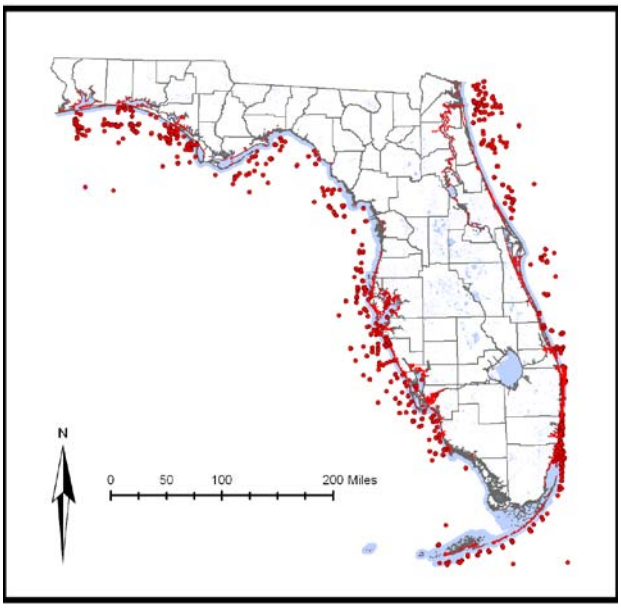
Incompatible Recreational Activities

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
M	Discourage hard-gating or filling of cave or sink entrances and provide incentives (e.g., liability limitations where appropriate management procedures have been taken), cost-sharing, or design advice to secure cave entrances with bat-friendly gates.	H	M	M
M	Upgrade access infrastructure (e.g., boardwalks, planking) to aquatic caves to eliminate sediment disturbance by divers and spelunkers.	H	M	M

Incompatible Resource Extraction: Mining/Drilling

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Create incentives to avoid loss of, and impacts to, SHCAs and sensitive habitats from mining, particularly wet and dry prairie, scrub, and bat caves.	H	M	H

Artificial Structure



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources

Status
Current condition: Unknown.
According to the best available GIS information at this time (see Appendix D. GIS Data Tables), over 2,000 artificial reefs and 4,368 miles (7,030 km) of hardened shoreline are known to exist.

Habitat Description

FNAI type: None

This artificial habitat is comprised of two major types of man-made structures in marine and estuarine waters–artificial reefs and hardened shorelines. Both of these structures create "Hard Bottom" habitat but after the initial deployment they typically are not actively managed as a habitat. There are multiple research and monitoring programs focusing on the impacts and benefits of these artificial habitats.

Artificial reefs are created to increase reef fish habitat, enhance recreational fishing and diving opportunities, provide socio-economic benefits to local coastal communities, and facilitate reef fish related research. Florida has one of the most active artificial reef programs among the 14 Gulf and Atlantic states involved in this activity. Thirty-four of 35 Florida coastal counties are or have been involved in artificial reef development, most of which has occurred in the last 20 years. Approximately 30 to 50 artificial reefs are constructed annually off Florida using a combination of federal, state, local, and private funds.

Hardened shorelines differ from artificial reefs in that they are a result of coastal development. Hardened shorelines include rip-rap and other types of coastal armoring as well as breakwaters, piers, and docks. These structures may also provide habitat for some sessile bivalves, crustaceans, and limited fish communities. In many cases they can negatively impact wildlife such as nesting sea turtles and shore birds, alter natural marine and estuarine shoreline processes, and alter or replace naturally-occurring coastal habitats such as marsh, beach, and dune.

Herein the term "Artificial Structure" includes structures (artificial reefs) specifically designed and placed to enhance natural populations of species associated with hard bottom and/or reef substrates as well as structures (breakwaters, seawalls) designed to moderate or eliminate natural coastal processes such as erosion. As artificial reefs are considered a tool for management (restoration or enhancement) of species associated with hard bottom or reef habitats, future versions of the Strategy should evaluate the management implications of artificial structures.

Associated Species of Greatest Conservation Need

Mammals

- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Pelecanus occidentalis* — Brown Pelican
- *Haematopus palliatus* — American Oystercatcher

Reptiles

- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley

Fish

- *Ginglymostoma cirratum* — Nurse Shark
- *Carcharhinus leucas* — Bull Shark
- *Carcharhinus limbatus* — Blacktip Shark
- *Carcharhinus perezii* — Reef Shark
- *Galeocerdo cuvier* — Tiger Shark
- *Negaprion brevirostris* — Lemon Shark
- *Rhizoprionodon terranovae* — Atlantic Sharpnose Shark
- *Sphyrna mokarran* — Great Hammerhead
- *Sphyrna tiburo* — Bonnethead
- *Carcharias taurus* — Sand Tiger
- *Megalops atlanticus* — Tarpon
- *Gymnothorax funebris* — Green Moray
- *Gymnothorax miliaris* — Goldentail Moray
- *Gymnothorax moringa* — Spotted Moray
- *Gymnothorax vicinus* — Purplemouth Moray
- *Opsanus beta* — Gulf Toadfish

- *Opsanus pardus* Leopard Toadfish
- *Opsanus tau* Oyster Toadfish
- *Centropristis ocyurus* Bank Sea Bass
- *Centropristis philadelphica* Rock Sea Bass
- *Epinephelus itajara* Goliath Grouper
- *Epinephelus morio* Red Grouper
- *Apogon maculatus* Flamefish
- *Apogon pseudomaculatus* Twospot Cardinalfish
- *Lobotes surinamensis* Atlantic Tripletail
- *Anisotremus surinamensis* Black Margate
- *Haemulon album* Margate
- *Holacanthus bermudensis* Blue Angelfish
- *Holacanthus tricolor* Rock Beauty
- *Stegastes adustus* Dusky Damselfish
- *Stegastes leucostictus* Beaugregory
- *Thalassoma bifasciatum* Bluehead
- *Gobiesox strumosus* Skilletfish
- *Thunnus atlanticus* Blackfin Tuna
- *Etropus crossotus* Fringed Flounder
- *Diodon holocanthus* Balloonfish

Invertebrates

- *Spondylus americanus* Atlantic Thorny Oyster
- *Littoraria angulifera* Mangrove Periwinkle
- *Clibanarius vittatus* Thinstripe Hermit Crab
- *Aratus pisonii* Mangrove Crab
- *Panulirus argus* Spiny Lobster

Conservation Threats

While threats to its conservation as well as remedial actions were identified during Strategy Science Workshops I and II, the Artificial Structure habitat category was not addressed in TNC workshops that generated tables of ranked threats and actions, as seen in most other habitat categories. The decision to not rank threats and actions for this habitat was made to maximize discussion time for higher-priority habitats and because of some disagreement over recognition of this habitat type as important to wildlife conservation. Therefore, threats and actions are presented as bulleted lists with no prioritization.

The following stresses threaten this habitat:

- Absent to insufficient biological legacies
- Altered community structure
- Altered hydrologic regime–timing, duration, frequency, extent
- Altered species composition/dominance
- Altered successional dynamics
- Altered water and/or soil temperature
- Altered water quality of surface water or aquifer: contaminants
- Altered water quality of surface water or aquifer: nutrients
- Erosion/sedimentation

- Excessive depredation and/or parasitism
- Fragmentation of habitats, communities, ecosystems
- Habitat degradation/disturbance
- Keystone species missing or lacking in abundance
- Missing key communities, functional guilds, or seral stages

The following sources of stress, or threats, were used to generate conservation actions:

- Acoustic pollution
- Chemicals and toxins
- Coastal development
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Harmful algal blooms
- Inadequate stormwater management
- Incompatible fishing pressure
- Incompatible recreational activities
- Incompatible wildlife and fisheries management strategies
- Invasive animals
- Invasive plants
- Management of nature–beach nourishment and impoundments
- Nuisance animals
- Nutrient loads–urban
- Parasites/pathogens
- Roads, bridges, and causeways
- Shoreline hardening
- Solid waste

Conservation Actions

Actions to abate threats to Artificial Structure were largely designed to reduce the impacts of urban activities, and to increase the habitat's suitability to wildlife. Most of the threats to this habitat (see list above) were also identified for multiple other habitats, and are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. Exceptions are Acoustic pollution, Nuisance animals, and Solid waste.

The actions to abate threats that were identified for Artificial Structure habitat are below, though none were prioritized for implementation.

Law and Policy

- Encourage coastal development planning that minimizes the demand for shoreline hardening
- Institute seafloor management planning for wildlife habitat retention
- Support policies that reduce waste and increase ease of recycling (e.g., monofilament collection and recycling, municipal composting, water reuse, and curbside recycling)

Research, Education and Awareness

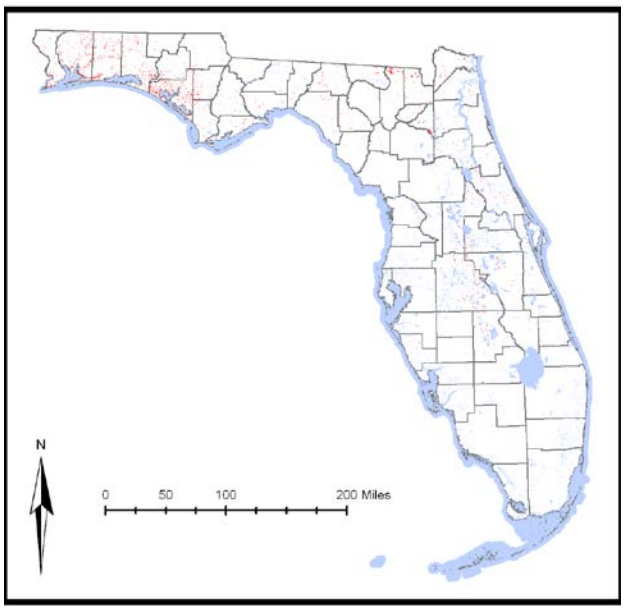
- Continue to investigate effects of artificial reefs on fish population dynamics
- Develop effective erosion control structures that minimize impacts to marine environment
- Target education for homeowners, developers, construction contractors, and policy makers to benefit wildlife in their day-to-day activities

- Involve community volunteers in wildlife conservation efforts and increase their opportunities for involvement
- Educate homeowners about proper pesticide and fertilizer use and disposal

Economic and Other Incentives

- Provide awards to municipalities, organizations, and individuals that implement wildlife-friendly design and management practices
- Provide funds and materials for landowners to remove invasive exotics (e.g., commensal rats, Brazilian pepper, etc)
- Support spay or neuter programs for cats and dogs and reduce number of free-ranging pets

Bay Swamp



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Unknown.
According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 201,765 acres (81,651 ha) of Bay Swamp habitat exist, of which 32% (65,570 ac; 26,535 ha) are in existing conservation or managed areas. Another 14% (27,471 ac; 11,117 ha) are Florida Forever projects and 7% (13,486 ac; 5,458 ha) are SHCA-identified lands. The remaining 47% (95,238 ac; 38,541 ha) are other private lands.

Habitat Description

FNAI type: Baygall, Bog

These hardwood swamps contain broadleaf evergreen trees that occur in shallow, stagnant drainages or depressions often found within pine flatwoods, or at the base of sandy ridges where seepage maintains constantly wet soils. Where Bay Swamp occurs in seepage areas it is often associated with or grades into Seepage/Steephead Stream habitat. The soils, which are usually covered by an abundant layer of leaf litter, are mostly acidic peat or muck that remains saturated for long periods but over which little water level fluctuation occurs.

The overstory within bayheads primarily is composed of evergreen hardwood trees, but bay trees, especially sweetbay, red bay, and loblolly bay, dominate the canopy and characterize the community. Depending on the location within the state, other species including pond pine, slash

pine, blackgum, cypress, and Atlantic white cedar can occur as scattered individuals. Understory and ground cover species may include dahoon holly, wax myrtle, fetterbush, greenbriar, royal fern, cinnamon fern, and sphagnum moss.

Associated Species of Greatest Conservation Need

Mammals

- *Ursus americanus floridanus* — Florida Black Bear
- *Lutra canadensis lataxina* — River Otter
- *Mustela vison evergladensis* — Everglades Mink
- *Mustela vision mink* — Common Mink
- *Puma concolor coryi* — Florida Panther

Birds

- *Mycteria americana* — Wood Stork
- *Haliaeetus leucocephalus* — Bald Eagle
- *Buteo brachyurus* — Short-tailed Hawk
- *Falco peregrinus* — Peregrine Falcon

Amphibians

- *Amphimua pholeter* — One-toed Amphiuma
- *Pseudobranchus striatus lustricolus* — Gulf Hammock Dwarf Siren
- *Rana capito* — Gopher Frog

Reptiles

- *Kinosternon subrubrum steindachneri* — Florida Mud Turtle
- *Terrapene carolina major* — Gulf Coast Box Turtle
- *Terrapene carolina bauri* — Florida Box Turtle
- *Farancia erytrogramma* — Rainbow Snake

Conservation Threats

Threats to Bay Swamp habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to housing and urban development
- Groundwater withdrawal
- Incompatible fire
- Invasive animals
- Invasive plants
- Surface water withdrawal and diversion
- Roads

Threats specific to Bay Swamp included loss and degradation that occurs when this habitat is surrounded by development, eutrophication impacts when water from agricultural or developed landscapes is drained into these swamps, and insufficient fire. These impacts have allowed Bay

Swamp to expand into areas that were once herbaceous seepage communities, replacing herbaceous wetlands with closed-canopy forested wetlands.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered landscape mosaic or context	High
B	Altered species composition/dominance	High
C	Fragmentation of habitats, communities, ecosystems	High
D	Altered hydrologic regime	Medium
E	Altered soil structure and chemistry	Medium
F	Altered fire regime	Medium
G	Altered community structure	Medium
H	Altered water quality of surface water or aquifer: nutrients	Medium

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Invasive plants	**High**	B
2	Conversion to agriculture	**High**	A, C
3	Conversion to housing and urban development	**High**	A, C
4	Groundwater withdrawal	**Medium**	D
5	Surface water withdrawal	**Medium**	B, C, D
6	Incompatible grazing and ranching	**Low**	B, E
7	Invasive animals	**Low**	E
8	Incompatible fire	**Low**	A, F, G
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Bay Swamp habitat that were also identified as statewide threats are in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Bay Swamp and other freshwater habitats are below, though none were ranked of high priority for implementation. These actions were designed to reduce the degrading impacts of agriculture and development, and increase fire management of this habitat.

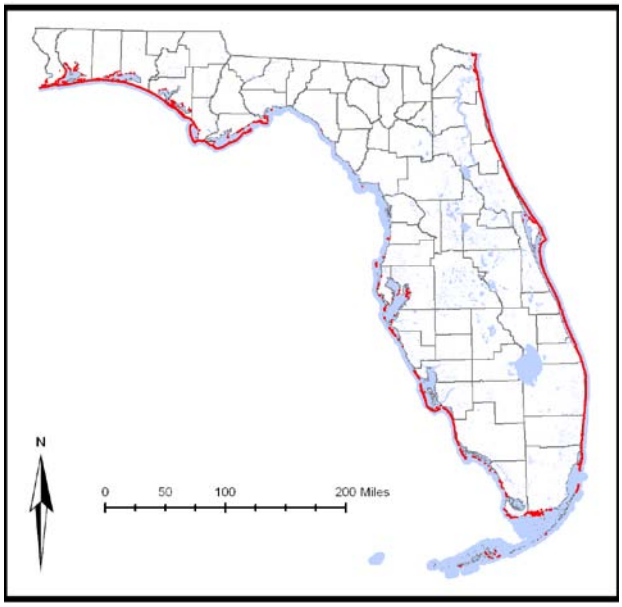
Conversion to Agriculture

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Create voluntary incentives for maintenance and conversion of lands to agricultural uses that use less water and result in lower nutrient outputs into Florida's waters and wetlands and create market-based incentives to compensate private landowners for the environmental services they provide to the state through management that increases water storage and nutrient reduction.	M	M	H

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Provide voluntary tax or other incentives, such as density transfers, for environmentally friendly comprehensive development plans for projects that front on rivers, and floodplains that would commit river frontage and riparian habitats to permanent conservation zones.	M	L	VH

Beach/Surf Zone



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 32,295 acres (13,069 ha) of Beach/Surf Zone habitat exist, of which 46% (14,858 ac; 6,013 ha) are in existing conservation or managed areas. Another 1% (312 ac; 126 ha) are Florida Forever projects and 5% (1,473 ac; 596 ha) are SHCA-identified lands. The remaining 48% (15,652 ac; 6,334 ha) are other private lands.

Habitat Description

FNAI type: Beach Dune

The Beach/Surf Zone is the long, often narrow strip of sand and shells between the tides. Daily flooding by salt water and moderate- to high-energy waves prohibit plant growth except for some inconspicuous algae. Low-energy beaches provide important spawning habitat for horseshoe crabs and feeding habitat for multiple species of shorebirds. Beach dunes are mounds of wind-blown sand that are periodically inundated by seawater during extreme high tides and storms. Vegetation on beach dunes varies regionally in Florida but is restricted to a few highly specialized terrestrial plants.

Florida beaches are important nesting sites for several species of shorebirds and wintering grounds for others. Beaches are also vital nesting sites for many sea turtles and support numerous other mammals and invertebrates. The surf zone is an important nursery and feeding habitat for many species of fish including Permit and Florida Pompano.

Associated Species of Greatest Conservation Need

Mammals

- *Peromyscus polionotus allophrys* — Choctawhatchee Beach Mouse
- *Peromyscus polionotus leucocephalus* — Santa Rosa Beach Mouse
- *Peromyscus polionotus niveiventris* — Southeastern Beach Mouse
- *Peromyscus polionotus peninsularis* — St. Andrews Beach Mouse
- *Peromyscus polionotus phasma* — Anastasia Island Beach Mouse
- *Peromyscus polionotus trissyllepsis* — Perdido Key Beach Mouse
- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Spilogale putorius* — Spotted Skunk
- *Trichechus manatus latirostris* — Florida Manatee
- *Eubalaena glacialis* — North Atlantic Right Whale
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Sula dactylatra* — Masked Booby
- *Pelecanus occidentalis* — Brown Pelican
- *Egretta rufescens* — Reddish Egret
- *Falco columbarius* — Merlin
- *Falco peregrinus* — Peregrine Falcon
- *Charadrius alexandrinus tenuirostris* — Cuban Snowy Plover
- *Charadrius wilsonia* — Wilson's Plover
- *Charadrius melodus* — Piping Plover
- *Haematopus palliates* — American Oystercatcher
- *Numenius phaeopus hudsonicus* — Whimbrel
- *Limosa fedoa* — Marbled Godwit
- *Calidris canutus rufa* — Red Knot
- *Calidris alba* — Sanderling
- *Calidris pusilla* — Semipalmated Sandpiper
- Ca*lidris mauri* — Western Sandpiper
- *Sterna nilotica* — Gull-billed Tern
- *Sterna caspia* — Caspian Tern
- *Sterna maxima* — Royal Tern
- *Sterna sandvicensis* — Sandwich Tern
- *Sterna dougallii* — Roseate Tern
- *Sterna antillarum* — Least Tern
- *Sterna anaethetus* — Bridled Tern
- *Sterna fuscata* — Sooty Tern
- *Anous stolidus* — Brown Noddy
- *Rynchops niger* — Black Skimmer

Reptiles

- *Crocodylus acutus* — American Crocodile

- *Malaclemys terrapin* Diamondback Terrapin
- *Chelonia mydas* Green Turtle
- *Eretmochelys imbricata* Hawksbill
- *Caretta caretta* Loggerhead
- *Lepidochelys kempii* Kemp's Ridley
- *Dermochelys coriacea* Leatherback
- *Eumeces egregius egregius* Florida Keys Mole Skink
- *Eumeces egregius insularis* Cedar Key Mole Skink

Fish

- *Ginglymostoma cirratum* Nurse Shark
- *Carcharhinus brevipinna* Spinner Shark
- *Carcharhinus isodon* Finetooth Shark
- *Carcharhinus leucas* Bull Shark
- *Carcharhinus limbatus* Blacktip Shark
- *Carcharhinus plumbeus* Sandbar Shark
- *Galeocerdo cuvier* Tiger Shark
- *Negaprion brevirostris* Lemon Shark
- *Rhizoprionodon terraenovae* Atlantic Sharpnose Shark
- *Sphyrna mokarran* Great Hammerhead
- *Sphyrna tiburo* Bonnethead
- *Sphyrna zygaena* Smooth Hammerhead
- *Carcharias taurus* Sand Tiger
- *Megalops atlanticus* Tarpon
- *Albula vulpes* Bonefish
- *Mugil curema* White Mullet
- *Mugil gyrans* Whirligig Mullet
- *Mugil sp.* Redeye Mullet
- *Pomatomus saltatrix* Bluefish
- *Rachycentron canadum* Cobia
- *Selar crumenophthalmus* Bigeye Scad
- *Trachinotus carolinus* Florida Pompano
- *Trachinotus falcatus* Permit
- *Trachinotus goodei* Palometa
- *Lutjanus griseus* Gray Snapper
- *Cynoscion nebulosus* Spotted Seatrout
- *Cynoscion regalis* Weakfish
- *Sciaenops ocellatus* Red Drum
- *Scomberomorus cavalla* King Mackerel
- *Scomberomorus maculatus* Spanish Mackerel
- *Etropus crossotus* Fringed Flounder
- *Paralichthys albigutta* Gulf Flounder
- *Paralichthys dentatus* Summer Flounder
- *Paralichthys lethostigma* Southern Flounder

Invertebrates

- *Donax variabilis* Variable Coquina
- *Limulus polyphemus* Horseshoe Crab
- *Coenobita clypeatus* Land Hermit Crab
- *Emerita benedicti* Mole Crab
- *Ocypode quadrata* Ghost Crab

Conservation Threats

Threats to the Beach/Surf Zone habitat that were also identified for multiple other terrestrial habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Climate variability
- Incompatible recreational activities
- Invasive animals
- Shoreline hardening

Threats to Beach/Surf Zone habitat that were also identified for multiple other marine and estuarine habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Coastal development
- Dam operations
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible recreational activities
- Incompatible wildlife and fisheries management strategies
- Industrial spills
- Invasive animals
- Invasive plants
- Key predator/herbivore losses
- Management of nature–beach nourishment
- Nutrient loads
- Roads, bridges and causeways
- Shoreline hardening
- Vessel impact

Beach/Surf Zone-specific land-based threats are similar to those for the Coastal Strand habitat. Because of the importance of these habitats for coastal SGCN, such as sea turtles, shorebirds, and beach mice, threats such as light pollution that can inhibit turtle nesting and increase predation for these and other species were highlighted. Dredging of new inlets and deposition of dredged materials for beach nourishment, dune restoration, and other purposes degrade these habitats and can directly impact these species, as can disturbance and predation by nuisance animals. While beach nourishment was primarily viewed as a threat, experts understood the related benefits of habitat restoration, particularly for sea turtles. Activities of residents and their pets living adjacent to Beach/Surf Zone and using the habitat can cause degradation. Military base closure threatens potential conservation protection for Beach/Surf Zone. This habitat also faces numerous water-based threats, such as those caused by changes in natural sediment movement, contamination from industrial spills or urban runoff, and incompatible boating and fishing recreational activities.

The following stresses (and sources of stress below) threaten this habitat in terrestrial habitats:

Stresses		Habitat Stress Rank
A	Habitat degradation/disturbance	Very High
B	Erosion/sedimentation	High
C	Excessive depredation and/or parasitism	High
D	Altered soil structure and chemistry	High
E	Insufficient size/extent of characteristic communities or ecosystems	Medium

The sources of stress, or threats, were used to generate conservation actions. The following sources of stress are threats identified for terrestrial habitats.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Incompatible recreational activities	**Very High**	A, C, D
2	Sea level rise	**High**	B, E
3	Shoreline hardening	**High**	A, B, D, E
4	Management of nature–nourishment	**High**	A, B, D, E
5	Light pollution	**High**	A, C
6	Invasive animals	**High**	C
7	Management of nature–inlet relocation and dredging	**High**	B, D
8	Nuisance animals	**Medium**	A, C
9	Channel modification/shipping lanes	**Medium**	A, B, E
10	Management of nature–beach raking	**Medium**	A, B
11	Management of nature–driving for maintenance	**Low**	A, C
Statewide Threat Rank of Habitat		**Very High**	

The following stresses (and sources of stress below) threaten this habitat in marine and estuarine habitats:

Stresses		Habitat Stress Rank
F	Erosion	Very High
G	Habitat destruction	Very High
H	Altered weather regime/sea level rise	High
I	Habitat disturbance	High
J	Altered structure	Medium
K	Habitat fragmentation	Medium

The following sources of stress are threats identified for marine and estuarine habitats:

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Climate variability	**Very High**	F, G, H, K
2	Coastal development	**Very High**	F, G, I, J, K
3	Roads, bridges and causeways	**Very High**	F, G, I, J, K
4	Shoreline hardening	**High**	F, G, I, J, K
5	Disruption of longshore transport of sediments	**High**	F, G, I, J, K
6	Management of nature (beach nourishment, impoundments)	**High**	I, J, K
7	Harmful algal blooms	**High**	I
8	Incompatible industrial operations	**High**	F, G, H, I, J, K
9	Invasive plants	**High**	I, J, K
10	Channel modification/shipping lanes	**High**	F, G, I, J
11	Nutrient loads (all sources)	**High**	I
12	Key predator/herbivore losses	**High**	I
13	Dam operations/incompatible release of water	**High**	F, I
14	Industrial spills	**Medium**	I
15	Invasive animals	**Medium**	I
16	Light pollution	**Medium**	I
17	Chemicals and toxins	**Medium**	I
18	Incompatible resource extraction: mining/drilling	**Medium**	F, G, I, J
19	Incompatible fishing pressure	**Medium**	I
20	Incompatible recreational activities	**Medium**	I
21	Inadequate stormwater management	**Medium**	F, I
22	Utility corridors	**Medium**	F, G
23	Sonic pollution	**Medium**	I
24	Fishing gear impacts	**Medium**	I
25	Vessel impacts	**Medium**	I
26	Solid waste	**Medium**	I, J, K
27	Incompatible wildlife and fisheries management strategies	**Medium**	I
28	Incompatible aquaculture operations	**Low**	I
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to the Beach/Surf Zone habitat that were also identified as statewide threats (see lists above in Conservation Threats section) are in the Chapter. Multiple Habitat Threats and Conservation Actions.

The actions below address specific threats identified with the Beach/Surf Zone habitat (sometimes in conjunction with a few additional habitats). Actions specific to this habitat were identified in both the terrestrial and marine workshops. These voluntary and incentive-based actions were designed to reduce the need for beach nourishment through reduction of activities that cause sediment movement and protection of shorelines from development and other voluntary and incentive-based actions that might require nourishment. Other actions are identified improvements needed to prevent chemical spills, and changes to and education about fishing and boating activities that will reduce threats to coastal SGCN.

TERRESTRIAL-BASED ACTIONS

Light Pollution

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Ensure through state and local cooperation that coastal lighting ordinances are updated as technology and information improves.	VH	M	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Support cooperative education programs developed and/or implemented by utility companies and local governments for coastal property owners to ensure that light ordinances protecting coastal wildlife are supported (e.g., availability of automatic light shut-off features for beach lights).	VH	L	M
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Support and expand the coastal light replacement efforts of the U.S. Fish and Wildlife Service to be implemented statewide where sea turtle nesting and beach mouse habitat exists.	H	M	H
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
H	Support sea turtle and beach mouse-friendly lighting in coastal habitats. Fund incentives for retrofitting existing light features.	VH	M	H
M	Support installation of appropriate light technology for conservation of sea turtles and other coastal species on military lands, Kennedy Space Center, and ports (domestic security facilities).	M	M	H

Nuisance Animals

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Increase funding to implement existing sea turtle management practices and ordinances regarding prevention of egg and hatchling predation. Promote the use of volunteer groups in association with the FWC to provide more capacity for implementation.	VH	L	M

Overall Rank	Education and Awareness	*Feasibility*	*Benefits*	Cost
M	Identify important habitat areas for nesting shorebirds (of Greatest Conservation Need), and reduce impacts from people and pets (as appropriate) from these areas through targeted education and signage.	VH	L	M
L	Educate public landowners with responsibilities for coastal zone wildlife conservation about USDA protocols for raccoon management.	H	L	L
L	Develop public education tools on and encourage removal of unconsumed pet foods from outdoor containers.	L	M	M
L	Educate home and business owners on the use of wildlife-proof garbage containers.	H	L	H
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
L	Encourage understanding of existing pet restraint rules.	M	L	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Future public lands management plans for coastal managed areas should consider inclusion of control plans for feral animals.	H	M	M
L	Develop techniques for waste management in areas where SGCN or habitats are subject to high depredation or disturbance rates by exotic and nuisance animals with populations elevated by access to garbage (providing a supplemental food source).	M	L	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
M	Assist counties, municipalities, and homeowner associations to develop and implement curbside pick-up of yard and household waste.	H	M	M

TERRESTRIAL-AND-MARINE-BASED ACTIONS

Management of Nature – Dredging

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
M	Assist in the development of statewide, system-specific dredge material disposal plans that identify long-term disposal sites, specify dredge deposition practices, and minimize or offset impacts to all fish and wildlife resources. Encourage linking the statewide dredge material management plan to port expansion management plans.	M	M	M
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Assist in the development of educational programs on natural coastal processes and the ecological benefits and impacts, and economic costs of beach nourishment efforts.	H	L	L
L	Provide technical expertise on impacts of beach dredging/nourishment projects.	L	M	M
L	Assist in the development of criteria for long-term monitoring of dredging and nourishment projects.	M	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
L	Discourage dredging of natural inlets and passes not designated for navigation.	L	M	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**

L	Develop one or several coalitions of local groups statewide to identify local restoration projects where dredge material can be used.	M	L	L
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Compare the cost of conducting dredge/nourishment projects in perpetuity to spending equal state/federal dollars on acquiring lands subject to erosion (barrier islands) and putting those lands into uses that are not dependent upon dredging.	H	L	L
L	Fund research on the impacts of beach nourishment on fish and wildlife resources.	H	L	L

MARINE-BASED ACTIONS

Disruption of Longshore Transport of Sediments

Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Provide outreach to the public and to land-use, planning, and regulation agencies so they have a better understanding of barrier island dynamics and natural sediment movement (FEMA-like map). Include cost-benefit information on environmental communities affected.	M	L	L
L	Assist in the development of educational tools about the ephemeral characteristics of natural inlets and provide technical expertise on the fish and wildlife resources associated with this habitat.	L	M	M
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Encourage restoration of natural sediment transport processes as an alternative to beach nourishment where possible.	L	H	M
L	Improve implementation of sediment management practices.	L	M	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
M	Assist in the revision of national flood insurance programs and provide technical expertise on fish and wildlife resources for areas of high sediment transport and unstable shorelines.	M	M	L
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Conduct an economic analysis of maintaining structures such as inlets and hardened shorelines that includes benefits and impacts to fish and wildlife resources.	M	H	M
M	Conduct regional studies on sediment transport budget and natural sediment processes (not site by site). Collect and map historic information on barrier islands and estuarine sand bars.	M	M	M

Management of Nature–Beach Nourishment

Overall Rank	**Capacity Building**	*Feasibility*	*Benefits*	**Cost**
M	Establish a statewide data clearinghouse or public-private partnership to house all beach nourishment project monitoring results to facilitate the evaluation of cumulative project effects and future project design (i.e., lessons learned). Review the economics of projects including natural resource values pre- and post-project construction. Synthesize the data collected from all projects.	M	M	M
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**

H	Assist in the development of educational materials about the impacts of coastal development; provide technical expertise on impacts to coastal fish and wildlife resources.	VH	M	M
M	Encourage beach resorts to protect turtle nests through awareness and education programs and by providing support for beach assessment teams (room and board). Provide funding for organizations that provide awareness support.	H	M	L
Overall Rank	**Land/Water Protection**	*Feasibility*	*Benefits*	**Cost**
VH	Acquire coastal lands for habitat protection and management to reduce the need for beach nourishment.	VH	VH	VH
H	Acquire more land where sea turtles are nesting and are known to nest. Support Florida Forever funding to accommodate a specific coastal zone acquisition component similar to the "Blue Acres" coastal protection program in New Jersey.	H	H	VH
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Investigate and develop, as necessary, sand management technologies to avoid using beach nourishment. Develop statewide BMPs for sand management.	M	M	M
L	Identify and prioritize beach dune restoration projects where possible and warranted. Be proactive as a means of avoiding the need for beach nourishment where possible. (Potential partner is the USACE.)	M	M	M
L	Establish a statewide beach dune restoration protocol for nourishment projects. (Determine if there are existing similar programs. If so, document their requirements and protocols.)	M	L	L
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Review state database to avoid known potential impacts and work with affected parties to develop avoidance, minimization, and mitigation strategies for future nourishment actions.	H	M	M

Industrial Spills

Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Assist in the revision of emergency response plans in cooperation with the county EOCs, FDEP, DCA, and USCG for coastal waters where water-borne transport of oil and chemicals occur. Encourage bi-annual updates.	H	M	M
M	Assist in the revision of emergency response plans in cooperation with the county EOCs, FDEP, DCA, USCG and EPA for coastal waters that may be subject to land-based spills of oil and chemicals. Encourage bi-annual updates.	H	M	M

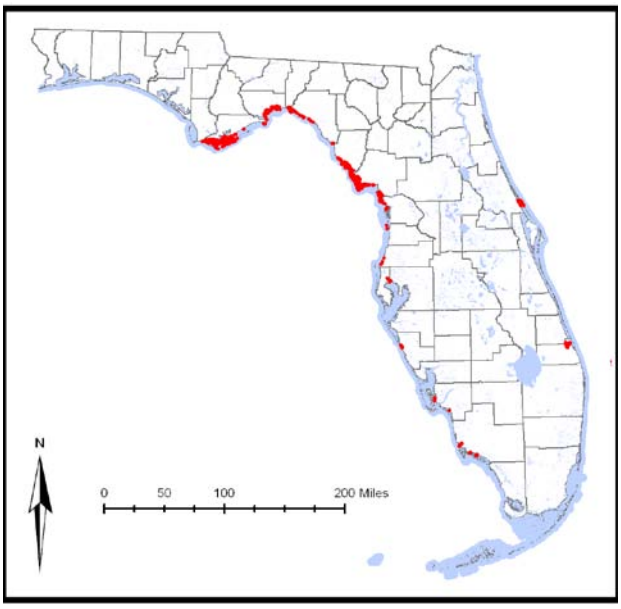
Incompatible Fishing Pressure

Overall Rank	**Capacity Building**	*Feasibility*	*Benefits*	**Cost**
M	Support an independent peer review of current fishery stock assessments of near-shore marine species.	H	M	H
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Develop and implement an outreach strategy for subsistence fishers to better understand their impacts on nearshore fish populations.	VH	L	M
Overall Rank	**Land/Water Protection**	*Feasibility*	*Benefits*	**Cost**
M	Review effectiveness of current no-take areas.	L	H	H

Incompatible Recreational Activities

Overall Rank	Education and Awareness	*Feasibility*	*Benefits*	Cost
M	Educate boaters, especially new boat operators, about sensitive areas and proper boating techniques, including anchoring, through an outreach program (kiosks, pamphlets, and signage). Develop Boater Guides for areas where they are currently unavailable and distribute at the time of boater registration and at boat rental offices.	M	M	H
L	Conduct an outreach program to educate beachgoers and other recreational users about the impact of collecting live shells.	H	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Encourage the use of buffers to sensitive wildlife and habitat areas. Develop multi-use plans that include use of sensitive areas and areas for human use.	H	M	H
L	Initiate a statewide underwater coastal cleanup.	M	L	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
M	Where information is lacking, conduct study(ies) to assess cumulative impacts of human use of beach habitats. Consider already shifted baselines.	M	M	H

Bivalve Reef



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), approximately 13,586 acres (5,498 ha) of oyster reef (a subtype of Bivalve Reef habitat) are accurately mapped. However, spatial data are lacking for most oyster and other Bivalve Reefs, thus minimal distribution is portrayed in this habitat map.

Habitat Description

FNAI type: Mollusk Reef

This habitat is comprised of dense, expansive concentrations of sessile mollusks that attach to hard substrates and each other. Bivalve Reefs occur in both intertidal and subtidal zones to depths of 40 feet (12 m). In Florida the most extensive examples of this habitat, dominated by oysters, are restricted to estuarine environments where salinity concentrations range from 15 to 30 parts per thousand. Events or processes that alter freshwater deliveries to estuaries are detrimental to this habitat. The Bivalve Reef habitat is a diverse ecological community that provides nursery grounds, refugia, and foraging areas to a wide variety of wildlife species.

Associated Species of Greatest Conservation Need

Mammals

- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Haematopus palliatus* — American Oystercatcher
- *Numenius phaeopus hudsonicus* — Whimbrel
- *Limosa fedoa* — Marbled Godwit
- *Calidris canutus rufa* — Red Knot
- *Calidris mauri* — Western Sandpiper

Reptiles

- *Malaclemys terrapin* — Diamondback Terrapin
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley

Fish

- *Negaprion brevirostris* — Lemon Shark
- *Sphyrna tiburo* — Bonnethead
- *Albula vulpes* — Bonefish
- *Opsanus beta* — Gulf Toadfish
- *Opsanus pardus* — Leopard Toadfish
- *Opsanus tau* — Oyster Toadfish
- *Centropomus undecimalis* — Common Snook
- *Epinephelus itajara* — Goliath Grouper
- *Lutjanus griseus* — Gray Snapper
- *Archosargus probatocephalus* — Sheepshead
- *Pogonias cromis* — Black Drum
- *Sciaenops ocellatus* — Red Drum
- *Prognathodes aculeatus* — Longsnout Butterflyfish
- *Stegastes partitus* — Bicolor Damselfish
- *Lachnolaimus maximus* — Hogfish
- *Stathmonotus hemphilli* — Blackbelly Blenny

Invertebrates

- *Crassostrea virginica* — Eastern Oyster
- *Fasciolaria lilium* — Banded Tulip

Conservation Threats

Threats to the Bivalve Reef habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping Lanes
- Coastal development

- Dam operations/incompatible release of water (quality, quantity, timing)
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible recreational activities
- Incompatible wildlife and fisheries management strategies
- Invasive animals
- Management of nature (beach nourishment and impoundments)
- Nutrient loads (urban)
- Roads, bridges and causeways
- Surface water and groundwater withdrawal

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered hydrologic regime	Very High
B	Altered structure	High
C	Altered water quality–physical, chemical	High
D	Habitat disturbance	High
E	Altered species composition	Medium
F	Altered water quality–nutrients	Medium
G	Altered water quality–contaminants	Medium
H	Erosion	Medium
I	Excessive depredation	Medium
J	Sedimentation	Medium

The sources of stress, or threats, were used to generate conservation actions.

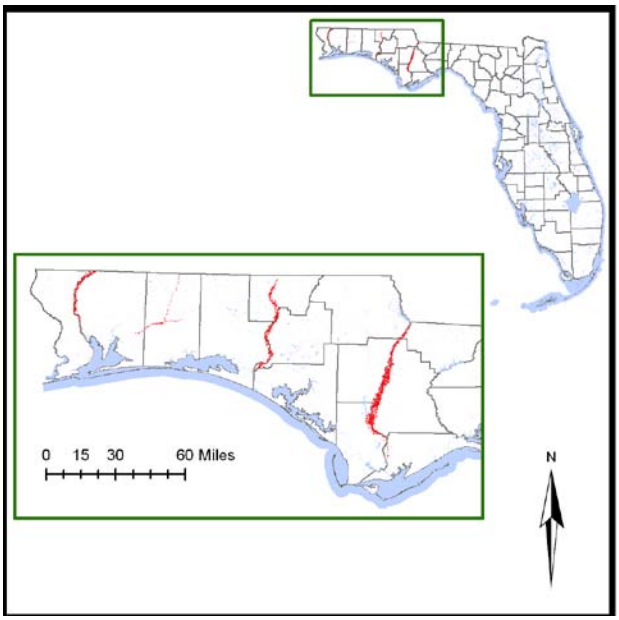
Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Inadequate stormwater management	**Very High**	A, B, C, D, F, G
2	Roads, bridges and causeways	**High**	A
3	Coastal development	**High**	A, J
4	Dam operations/incompatible release of water (quality, quantity, timing)	**High**	A, B, C, F, G
5	Harmful algal blooms	**High**	D, E, F
6	Surface water withdrawal	**High**	A, C
7	Channel modification/shipping lanes	**High**	A, J
8	Invasive animals	**High**	B, E, I
9	Nutrient loads (all sources)	**High**	F
10	Management of nature (beach nourishment, impoundments)	**High**	A, B, C
11	Incompatible recreational activities	**Low**	D
12	Incompatible industrial operations	**Low**	G
13	Incompatible wildlife and fisheries management strategies	**Low**	B, E

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
14	Incompatible fishing pressure	Low	E
15	Boating impacts	Low	B, D, H
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Nearly all threats to Bivalve Reefs were also identified as statewide threats (see list above). Actions for abatement are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. The sole habitat-specific threat to Bivalve Reefs is Boating impacts, which also affects several other marine and estuarine habitats. Consequently, actions to abate this threat will be the same or similar to the actions recommended for the other affected marine and estuarine habitats (e.g., Coastal Tidal River or Stream, Submerged Aquatic Vegetation, Subtidal Unconsolidated Marine/Estuary Sediment, Tidal Flat) and are not repeated here.

Bottomland Hardwood Forest



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and unknown trend. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 84,141 acres (34,051 ha) of Bottomland Hardwood Forest habitat exist, of which 58% (48,778 ac; 19,740 ha) are in conservation or managed areas. Another 5% (4,721 ac; 1,911 ha) are in Florida Forever projects and 25% (20,647 ac; 8,356 ha) are in SHCA-designated lands. The remaining 12% (9,995 ac; 4,045 ha) are other private lands.

Habitat Description

FNAI type: Floodplain Forest, Floodplain Swamp, Freshwater Tidal Swamp

These seasonally flooded wetland forests are composed of a diverse assortment of hydric hardwoods which occur on the rich alluvial soils of silt and clay deposited along the floodplain of several Panhandle rivers including the Apalachicola, Choctawhatchee, and Escambia. These communities are characterized by an overstory that includes water hickory, overcup oak, swamp chestnut oak, river birch, American sycamore, red maple, Florida elm, bald cypress, blue beech, and swamp ash. The understory can range from open and park-like to dense and nearly impenetrable. Understory plants can include bluestem palmetto, hackberry, swamp azalea, pink azalea lanceleaf greenbrier, poison ivy, peppervine, rattanvine, indigo bush, white grass, plume grass, redtop panicum, caric sedges, silverbells, crossvine, American wisteria, and wood grass. In Bottomland Hardwood Forests, soils and hydroperiods primarily determine the diverse temporary and

permanent species composition along with community structure. Additionally, the rich organic material that accumulates on the forest floor is carried off by flooding waters during the wet season, and therefore provides an essential source of minerals and nutrients for downstream ecosystems such as estuarine systems.

Associated Species of Greatest Conservation Need

Mammals

- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Ursus americanus floridanus* — Florida Black Bear
- *Lutra canadensis lataxina* — River Otter
- *Mustela vision mink* — Common Mink

Birds

- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Elanoides forficatus* — Swallow-tailed Kite
- *Ictinia mississippiensis* — Mississippi Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Buteo platypterus platypterus* — Broad-winged Hawk
- *Picoides villosus* — Hairy Woodpecker
- *Campephilus principalis* — Ivory-billed Woodpecker
- *Hylocichla mustelina* — Wood Thrush
- *Dendroica dominica stoddardi* — Stoddard's Yellow-throated Warbler
- *Oporornis formosus* — Kentucky Warbler
- *Wilsonia citrina* — Hooded Warbler

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Desmognathus auriculatus* — Southern Dusky Salamander
- *Hemidactylium scutatum* — Four-toed Salamander

Reptiles

- *Macrochelys temminckii* — Alligator Snapping Turtle
- *Terrapene carolina major* — Gulf Coast Box Turtle
- *Nerodia cyclopion* — Mississippi Green Water Snake
- *Farancia erytrogramma* — Rainbow Snake
- *Agkistrodon contortrix* — Copperhead

Fish

- *Acipenser oxyrinchus desotoi* — Gulf Sturgeon
- *Atractosteus spatula* — Alligator Gar
- *Hybognathus hayi* — Cypress Minnow
- *Etheostoma proeliare* — Cypress Darter

Invertebrates

- *Utterbackia peninsularis* Peninsular Floater
- *Sphodros rufipes* Red-legged Purse-web Spider

Conservation Threats

Threats to Bottomland Hardwood Forest habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Invasive animals
- Invasive plants
- Roads

No habitat-specific threats to Bottomland Hardwood Forest were identified.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered species composition/dominance	High
B	Altered community structure	Medium
C	Missing key communities, functional guilds, or seral stages	Medium
D	Altered hydrologic regime	Medium
E	Fragmentation of habitats, communities, ecosystems	Medium

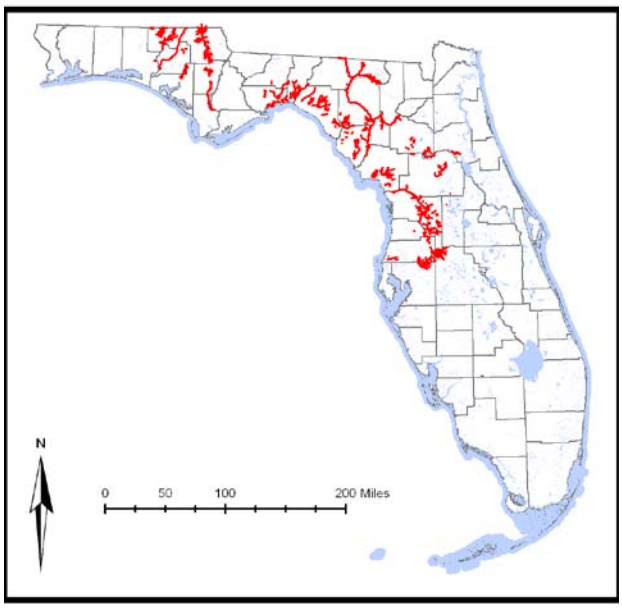
The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Roads	**Medium**	A
2	Invasive plants	**Medium**	A
3	Invasive animals	**Medium**	A
Statewide Threat Rank of Habitat		**Medium**	

Conservation Actions

Actions to abate the threats to Bottomland Hardwood Forest that were also identified as statewide threats (Invasive animals, Invasive plants, Roads) are in the Chapter Multiple Habitat Threats and Conservation Actions. Because the experts did not identify any Bottomland Hardwood Forest habitat-specific threats, no specific actions were identified.

Calcareous Stream



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (Appendix D. GIS Data Tables), there are approximately 2,071 miles (3,332 km) of Calcareous Streams in Florida.

Habitat Description

FNAI type: Spring-run Stream

The Calcareous Stream habitat occurs only in the north and central regions of the state and is comprised of 26 streams originating in or flowing through the Ocala Uplift region of north central Florida and the eastern panhandle, and the Dougherty Plain (Dougherty Karst) region in the central panhandle. Springs and spring runs form low-order tributaries to most of the Calcareous Streams. As a result, Calcareous Streams share many characteristics with the Spring and Spring Run habitat.

This habitat typically has a high pH, high carbonate level, and sand bottom with some limestone exposed. Most Calcareous Streams are clear and cool, although in areas where they flow through pinelands or scrub the streams will become stained by the tannins in the vegetation. Some Calcareous Streams are associated with sinks, where all or sections of the stream flow underground before resurfacing to flow overland. Surface and groundwater recharge is bidirectional; water in the river recharges the aquifer during flood conditions and the water in the aquifer recharges the river during drought conditions. Submerged plants are frequently dense, and can include tape grass, wild rice, and giant cutgrass. Calcareous Streams provide habitat to a variety of species including many snails, water snakes, and fish, and is critical to certain species of anadromous fish, such as Gulf

Sturgeon. Examples of streams in this category include the Suwannee River (downstream of the Big Shoals), Santa Fe River (downstream of the Big Rise), Ichetucknee, lower Withlacoochee (north) and Alapaha Rivers, Chipola River, Econfina Creek, Ocklawaha River, Hillsborough River and the lower, nontidal portions of most of the rivers draining into the Big Bend region on Florida's Gulf coast from the St. Marks River to the Waccasassa River.

Associated Species of Greatest Conservation Need

Mammals

- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Lutra canadensis lataxina* — River Otter
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Egretta caerulea* — Little Blue Heron
- *Elanoides forficatus* — Swallow-tailed Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Aramus guarauna* — Limpkin
- *Seiurus montacilla* — Louisiana Waterthrush

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Desmognathus auriculatus* — Southern Dusky Salamander

Reptiles

- *Macrochelys temminckii* — Alligator Snapping Turtle
- *Graptemys barbouri* — Barbour's Map Turtle
- *Pseudemys concinna suwanniensis* — Suwannee Cooter
- *Apalone mutica calvata* — Gulf Coast Smooth Softshell
- *Farancia erytrogramma* — Rainbow Snake

Fish

- *Acipenser oxyrinchus desotoi* — Gulf Sturgeon
- *Alosa alabamae* — Alabama Shad
- *Pteronotropis welaka* — Bluenose Shiner
- *Moxostoma n. sp. cf poecilurum* — Grayfin Redhorse
- *Ameiurus brunneus* — Snail Bullhead
- *Ameiurus serracanthus* — Spotted Bullhead
- *Morone saxatilis* — Striped Bass
- *Micropterus cataractae* — Shoal Bass

- *Micropterus notius* Suwannee Bass
- *Etheostoma olmstedi* Tessellated Darter

Invertebrates

- *Alasmidonta wrightiana* Ochlockonee Arc-mussel
- *Elliptio chipolaensis* Chipola Slabshell
- *Elliptio purpurella* Inflated Spike
- *Fusconaia escambia* Narrow Pigtoe
- *Lampsilis australis* Shiny-rayed Pocketbook
- *Lampsilis teres* Yellow Sandshell
- *Medionidus acutissimus* Alabama Moccasinshell
- *Medionidus penicillatus* Gulf Moccasinshell
- *Medionidus walkeri* Suwannee Moccasinshell
- *Pleurobema pyriforme* Oval Pigtoe
- *Quadrula infucata* Sculptured Pigtoe
- *Quadrula kleiniana* Suwannee Pigtoe
- *Villosa choctawensis* Choctaw Bean
- *Villosa villosa* Downy Rainbow
- *Elimia clenchi* Clench's Goniobasis
- *Procambarus suttkusi* A Crayfish
- *Procambarus youngi* Florida Longbeak Crayfish
- *Hexagenia limbata* A Burrowing Mayfly
- *Stenacron floridense* A Mayfly
- *Asioplax dolani* A Mayfly
- *Hetaerina americana* American Rubyspot
- *Neurocordulia molesta* Smoky Shadowfly
- *Neurocordulia obsoleta* Umber Shadowfly
- *Dromogomphus armatus* Southeastern Spinyleg
- *Gomphus geminatus* Twin-striped Clubtail
- *Gomphus vastus* Cobra Clubtail
- *Hydroptila molsonae* Molson's (Varicolored) Microcaddisfly
- *Ceraclea floridana* Florida (Scaly Wing Sedge) Ceraclean Caddisfly
- *Oecetis floridana* Florida Long-horn Sedge
- *Triaenodes furcella* Little-fork Triaenode Caddisfly
- *Chimarra florida* Floridian Finger-net Caddisfly

Conservation Threats

Threats to Calcareous Stream habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Chemicals and toxins
- Conversion to housing and urban development
- Incompatible forestry practices
- Incompatible resource extraction: mining/drilling
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban
- Roads

The Calcareous Stream-specific threats identified focused on water quality issues caused primarily by nutrient inputs and on invasive plant species. Nutrients from stormwater runoff, agricultural fertilizers, and septic systems result in eutrophication of this habitat, potentially altering species composition and other important ecosystem functions and processes. Methods to control invasive aquatic plants are more successful in still water than in flowing water systems, also leading to changes in species composition and other stresses.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered species composition/dominance	High
B	Altered water quality of surface water or aquifer: nutrients	High
C	Erosion/sedimentation	High
D	Altered water quality of surface water or aquifer: contaminants	Medium
E	Altered landscape mosaic or context	Medium
F	Altered hydrologic regime	Medium
G	Fragmentation of habitats, communities, ecosystems	Low
H	Habitat destruction or conversion	Low
I	Altered water salinity, pH, conductivity, or other physical water quality characteristics of surface water or aquifer	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Nutrient loads–urban	**High**	A, B
2	Invasive plants	**High**	A
3	Nutrient loads–agriculture	**High**	A, B
4	Invasive animals	**Medium**	A, C
5	Conversion to housing and urban development	**Medium**	B, C, E
6	Chemicals and toxins	**Medium**	D
7	Roads	**Medium**	C
8	Incompatible forestry practices	**Low**	A, C
9	Incompatible agricultural practices	**Low**	B, C
10	Incompatible resource extraction: mining/drilling	**Low**	C
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Calcareous Stream that were also identified as statewide threats (Nutrient loads–urban, Invasive plants, Nutrient loads–agriculture, Invasive animals,

Conversion to housing and urban development, Chemicals and toxins, Roads, Incompatible forestry practices, Incompatible resource extraction: mining/drilling) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Calcareous Stream and a few other habitats (i.e., Aquatic Cave, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. These actions were designed to prevent harm to stream ecosystems influenced by groundwater inflows by placing limits on the total permissible nutrient loads and to develop improved methods for applying herbicides in flowing water systems.

Nutrient Loads – Urban

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
H	Develop numeric nutrient criteria to monitor effects on groundwater ecosystems as well as biota where groundwater discharges to springs and other surface waters.	M	H	H

Invasive Plants

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
M	Research methods for control of aquatic invasive species in flowing waters where current control methods for those species are only effective in non-flowing waters.	VH	L	M

Nutrient Loads – Agriculture

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
H	Develop numeric nutrient criteria to monitor effects on groundwater ecosystems as well as biota where groundwater discharges to springs and other surface waters.	M	H	H

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Encourage tax or other incentives, such as density transfers, for environmentally friendly comprehensive development plans for projects that front on rivers and floodplains.	M	L	VH
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Encourage development of and use of a buffer zone between new development and river or floodplain edges, of a minimum distance (e.g., the 550 ft zone specified for the Wekiva River, FWS recommendations).	M	L	M

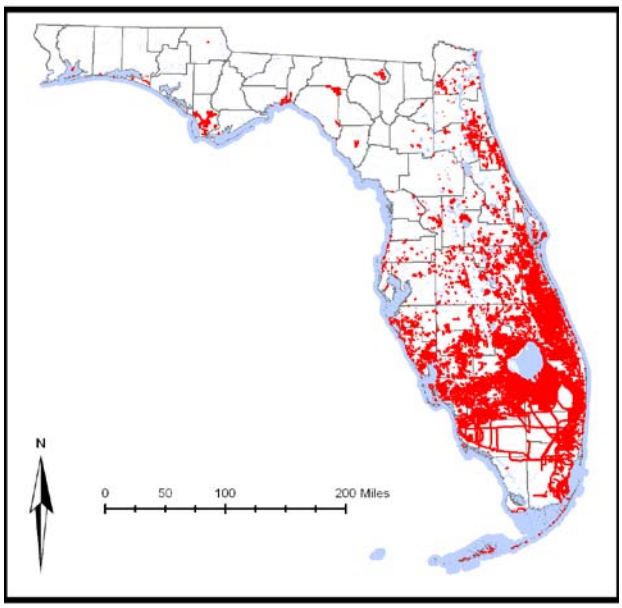
Chemicals and Toxins

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	For situations where they do not yet exist, develop management techniques and standards for private landowners that minimize runoff of chemicals and toxins into wetlands and aquatic systems.	H	L	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Conduct research defining appropriate sediment-quality standards for the various aquatic and marine systems for development and implementation of state sediment-quality standards. Fund research defining the cause-and-effect relationship between sediment contamination (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H
L	Conduct research defining standards for persistent organic contaminants for the various aquatic and marine systems for development and implementation of state water-quality standards. Fund research defining the cause-and-effect relationship between contamination from organics (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H

Roads

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
M	Work with the USFWS to improve coordination of the Technical Advisory Committee for the Stream Crossing Technical Center (SCTC).	VH	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Provide training to road maintenance personnel on methods for minimizing sediment movement to water bodies.	M	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
L	Support operation of the Stream Crossing Technical Center (SCTC) to promote recovery and conservation of aquatic ecosystems from interactions between unpaved road-stream crossings that result in sediment movement into streams.	H	L	M
L	Based on a stream crossing inventory and prioritization, develop funding opportunities for road stabilization projects in Florida counties.	H	L	H

Canal/Ditch



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and stable. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), approximately 27,594 miles (44,408 km) of Canal/Ditch are present in Florida.

Habitat Description

FNAI type: None

Canals are linear waterways, typically with steep sides, that frequently connect upstream wetlands or water sources with downstream habitats; they are typified by minimal or emergent vegetation. Ditches are shallow and roadside swales primarily serve as water catchments which support abundant wetland contiguous flora and fauna.

Canal/Ditch habitat in Florida serves many purposes including drainage, flood control, irrigation, navigation, and recreation. These waterways provide alternative habitat that would not otherwise be available. Species, such as the Panama City crayfish, have adapted to surviving in roadside ditches that may not always be recognized as a viable resource.

Associated Species of Greatest Conservation Need

Mammals

- *Blarina carolinensis shermani* — Sherman's Short-tailed Shrew
- *Eumops floridanus* — Florida Bonneted Bat
- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Lutra canadensis lataxina* — River Otter
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Ardea herodias occidentalis* — Great White Heron
- *Botaurus lentiginosus* — American Bittern
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Egretta tricolor* — Tricolored Heron
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill
- *Eudocimus albus* — White Ibis
- *Mycteria americana* — Wood Stork
- *Rostrhamus sociabilis plumbeus* — Snail Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Aramus guarauna* — Limpkin
- *Numenius phaeopus hudsonicus* — Whimbrel
- *Sterna antillarum* — Least Tern
- *Dendroica petechia gundlachi* — Cuban Yellow Warbler

Reptiles

- *Crocodylus acutus* — American Crocodile
- *Kinosternon subrubrum steindachneri* — Florida Mud Turtle
- *Kinosternon baurii* — Key Mud Turtle
- *Clemmys guttata* — Spotted Turtle
- *Deirochelys reticularia* — Chicken Turtle
- *Nerodia cyclopion* — Mississippi Green Water Snake
- *Thamnophis sauritus* — Lower Keys Ribbon Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Lampropeltis getula* — Common Kingsnake

Fish

- *Megalops atlanticus* — Tarpon
- *Anguilla rostrata* — American Eel
- *Umbra pygmaea* — Eastern Mudminnow
- *Acantharchus pomotis* — Mud Sunfish
- *Mugil cephalus* — Striped Mullet
- *Mugil curema* — White Mullet

- *Centropomus ensiferus* Swordspine Snook
- *Centropomus parallelus* Smallscale Fat Snook
- *Centropomus pectinatus* Tarpon Snook
- *Centropomus undecimalis* Common Snook
- *Dormitator maculatus* Fat Sleeper

Invertebrates

- *Villosa amygdala* Florida Rainbow
- *Procambarus apalachicolae* A Crayfish
- *Procambarus capillatus* A Crayfish
- *Procambarus econfinae* Panama City Crayfish
- *Procambarus escambiensis* A Crayfish
- *Procambarus latipleurum* A Crayfish
- *Procambarus rathbunae* A Crayfish
- *Procambarus rogersi rogersi* A Crayfish
- *Procambarus suttkusi* A Crayfish
- *Romulus globosus* Round-necked Romulus
- *Chelyoxenus xerobatis* Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Brachycercus nasutus* A Mayfly
- *Attenella attenuata* A Mayfly
- *Hexagenia limbata* A Burrowing Mayfly
- *Asioplax dolani* A Mayfly
- *Homoeoneuria dolani* Blue Sand-river Mayfly
- *Isonychia berneri* A Mayfly
- *Hetaerina americana* American Rubyspot
- *Neurocordulia molesta* Smoky Shadowfly
- *Neurocordulia obsoleta* Umber Shadowfly
- *Erpetogomphus designatus* Eastern Ringtail
- *Gomphus modestus* Gulf Coast Clubtail
- *Lestes inaequalis* Elegant Spreadwing
- *Macromia alleghaniensis* Allegheny River Cruiser
- *Cheumatopsyche petersi* Peters' Little Sister Sedge Caddisfly
- *Oxyethira janella* Little-entrance Oxyethiran Microcaddisfly
- *Oecetis floridana* Florida Long-horn Sedge
- *Oecetis parva* Little Longhorned Caddisfly
- *Chimarra florida* Floridian Finger-net Caddisfly
- *Agarodes libalis* Spring-loving Psiloneuran Caddisfly

Conservation Threats

Canal/Ditch presently serves as surrogate habitat for a few aquatic SGCN in lieu of native historic habitat that has now largely been eliminated. Examples include the suite of “tropical peripheral” fishes (including opossum pipefish and several rare gobiid species) that now inhabit and spawn in coastal canals in the Indian River Lagoon and lower east coast of Florida in lieu of historical natural freshwater streams. Similarly, a number of marine species such as tarpon, ladyfish, and many others utilize canals in south and central Florida during some stages of their life

cycles. In north Florida, the Panama City crayfish (a burrowing species once found in seasonally wet pine flatwoods in a small area of Bay County) now almost exclusively relies on shallow roadside swales and ditches because natural flatwoods in this area have been converted to developed land uses.

Although this situation clearly points to the need for conservation actions that involve restoring historic habitat for these species, in many cases where such habitat has been eliminated, this may not be feasible. Consequently, despite the fact that canals and ditches rank as a source of stress for many habitats and species, maintaining existing sub-optimal habitat for these species in canals and ditches and taking action to reduce stress levels in these environments is critical.

From the perspective of SGCN that utilize canals and ditches as a primary habitat or a critical habitat for certain life stages, the following stresses and sources of stress are most important to consider:

- Habitat destruction/conversion–Loss of existing ditch or swale habitat to curb and gutter or underground storm-sewer-type drainage systems associated with more intensive urban or suburban development (applies only in north region), or loss of "riparian" cover along canals/ditches as a result of canal maintenance practices (applies to central and south regions)

  Sources: Conversion to housing and development (north region), intensification of surface water diversion/drainage associated with more intensive development (north region), incompatible canal maintenance practices (e.g., removing all canal bank vegetation through herbicide applications, etc.) (all regions)

- Altered landscape mosaic–Destruction or conversion of wet flatwoods adjacent to roadside ditches (north region)

  Source: Conversion to housing and development (north region)

- Altered water quality–Nutrients

  Sources: Nutrient loads–agriculture (all regions), Nutrient loads–urban storm water (all regions)

- Altered water quality–Contaminants

  Sources: Chemicals/toxins–oil/grease and heavy metals from roads (north region), incompatible agricultural practices–pesticides in runoff or drainage water (all regions), incompatible residential practices–pesticides in runoff (all regions), mosquito control (north region)

- Altered hydrologic regime–Large pulses of flood water or storm runoff that disrupts life cycle requirements or alters or removes physical habitat

Sources: Management of dams/control structures (central/south regions), incompatible agricultural practices–management of runoff (all regions), incompatible residential practices–management of runoff (all regions)

Conservation Actions

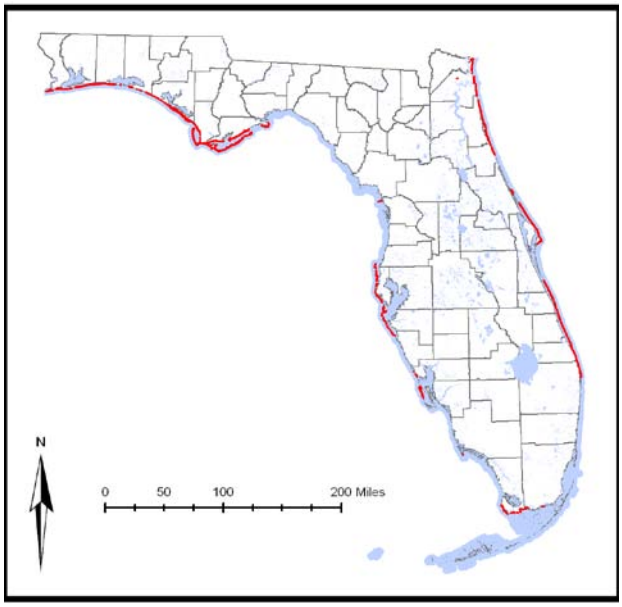
Actions to abate threats to Canal/Ditch habitat were not addressed directly in the actions workshops due to the experts' impression that it is not a natural habitat and more often acts as a threat to other habitats. However, one action was suggested in conjunction with the threat of invasive species that applies to this habitat. In addition, several desired outcomes were identified in the threat workshops that may guide actions developed to better manage this habitat for the needs of SGCN:

- Removal of or application of herbicide to native freshwater marsh vegetation should not be done in conjunction with canal maintenance in areas with known populations of SGCN
- Water releases should be managed to maintain adequate water velocities and dissolved oxygen needed to support fish and other aquatic life

Invasive Animals

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Promote canal designs that limit opportunities for movement and establishment of exotic aquatic species.	M	L	L

Coastal Strand



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 14,855 acres (6,012 ha) of Coastal Strand habitat exist, of which 76% (11,317 ac; 4,580 ha) are in conservation or managed areas. Another 1% (90 ac; 36 ha) are in Florida Forever projects and 3% (471 ac; 191 ha) are in SHCA-designated lands. The remaining 20% (2,977 ac; 1,205 ha) are other private lands.

Habitat Description

FNAI types: Beach Dune, Coastal Berm, Coastal Grassland, Coastal Rock Barren, Coastal Strand

This habitat encompasses dunes and more landward areas typically described as coastal strand, as well as areas that may be described as upper beach and coastal rock formations. Coastal Strand is the vegetated zone that typically occurs between open beach and maritime hammock habitats. Coastal Strand occurs on deep, well-drained, sandy soils that are largely wind-deposited and washed or sorted by wave action to some extent. This habitat generally occurs in long, narrow bands along high-energy shorelines, parallel to the open waters of the Atlantic Ocean, Gulf of Mexico, and some coastal bays or sounds in both north and south Florida. Vegetation in this habitat is strongly affected by wind, wave action, and salt spray and consists of low-growing vines, grasses,

and other herbaceous plants and salt-tolerant shrub species that, in some areas, may form dense thickets. Pioneer or early successional herbaceous vegetation characterizes foredune and upper beach areas with a gradual change to woody shrub species on the more protected and stabilized areas farther landward. Typical plant species of Coastal Strand include beach morning glory, railroad vine, sea oats, saw palmetto, Spanish bayonet, yaupon holly, wax myrtle, and sea grape; in southern Florida, cocoplum, nickerbean, and other more tropical species are present.

Associated Species of Greatest Conservation Need

Mammals

- *Sigmodon hispidus exsputus* — Lower Keys Cotton Rat
- *Peromyscus polionotus allophrys* — Choctawhatchee Beach Mouse
- *Peromyscus polionotus leucocephalus* — Santa Rosa Beach Mouse
- *Peromyscus polionotus niveiventris* — Southeastern Beach Mouse
- *Peromyscus polionotus peninsularis* — St. Andrews Beach Mouse
- *Peromyscus polionotus phasma* — Anastasia Beach Mouse
- *Peromyscus polionotus trissyllepsis* — Perdido Key Beach Mouse
- *Podomys floridanus* — Florida Mouse
- *Ursus americanus floridanus* — Florida Black Bear
- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Spilogale putorius* — Spotted Skunk
- *Mephitis mephitis* — Striped Skunk
- *Puma concolor coryi* — Florida Panther

Birds

- *Falco columbarius* — Merlin
- *Falco peregrinus* — Peregrine Falcon
- *Sterna anaethetus* — Bridled Tern
- *Sterna fuscata* — Sooty Tern
- *Anous stolidus* — Brown Noddy
- *Columbina passerine* — Common Ground-Dove
- *Aphelocoma coerulescens* — Florida Scrub-Jay
- *Passerina ciris ciris* — Painted Bunting

Reptiles

- *Terrapene carolina major* — Gulf Coast Box Turtle
- *Terrapene carolina bauri* — Florida Box Turtle
- *Malaclemys terrapin* — Diamondback Terrapin
- *Gopherus polyphemus* — Gopher Tortoise
- *Chelonia mydas* — Green Turtle
- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley
- *Dermochelys coriacea* — Leatherback
- *Sceloporus woodi* — Florida Scrub Lizard
- *Eumeces egregius egregius* — Florida Keys Mole Skink
- *Eumeces egregius insularis* — Cedar Key Mole Skink
- *Heterodon platirhinos* — Eastern Hognose Snake
- *Heterodon simus* — Southern Hognose Snake
- *Drymarchon couperi* — Eastern Indigo Snake

- *Lampropeltis getula* — Common Kingsnake
- *Tantilla relicta pamlica* — Coastal Dunes Crowned Snake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake

Invertebrates

- *Coenobita clypeatus* — Land Hermit Crab
- *Stizocera floridana* — Florida Forestiera Borer
- *Chelyoxenus xerobatis* — Gopher Tortoise Hister Beetle
- *Anomala flavipennis okaloosensis* — Panhandle Beach Anomala Scarab Beetle
- *Aphodius troglodytes* — Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* — Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* — Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Callophrys gryneus sweadneri* — Sweadner's Juniper Hairstreak
- *Hemiargus thomasi bethunebakeri* — Miami Blue
- *Anthanassa frisia* — Cuban Crescent

Conservation Threats

Threats to Coastal Strand habitat that were also identified for multiple other habitats are addressed in the Chapter. Multiple Habitat Threats and Conservation Actions. These threats include:

- Climate variability
- Conversion to housing and urban development
- Conversion to recreation areas
- Incompatible fire
- Incompatible recreational activities
- Invasive animals
- Invasive plants
- Roads
- Shoreline hardening

Threats specific to Coastal Strand are similar to those for the Beach/Surf Zone habitat. Because of the importance of these habitats for coastal SGCN, such as sea turtles, shorebirds, and beach mice, habitat-specific threats such as light pollution, that can inhibit turtle nesting and increase predation for these and other species, were highlighted. Deposition of dredged materials for beach nourishment, dune restoration, and other purposes degrade these habitats and can directly impact these species, as can disturbance and predation by nuisance animals. Activities of residents and their pets living adjacent to or utilizing Coastal Strand to access beach habitats can cause degradation. Military base closures threaten potential loss of protection of Coastal Strand. Unlike the adjacent seaward habitat, conversion of Coastal Strand to golf courses remains a significant source of habitat loss.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Erosion/sedimentation	Very High
B	Fragmentation of habitats, communities, ecosystems	High
C	Altered soil structure and chemistry	High
D	Habitat degradation/disturbance	High

Stresses		Habitat Stress Rank
E	Altered species composition/dominance	High
F	Excessive depredation and/or parasitism	Medium
G	Insufficient size/extent of characteristic communities or ecosystems	Medium
H	Habitat destruction or conversion	Medium
I	Altered fire regime	Low

The sources of the stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Shoreline hardening	**Very High**	A, B, C, G
2	Conversion to housing and urban development	**Very High**	A, B, C, G
3	Sea level rise	**High**	A, B, E
4	Conversion to recreation areas	**High**	A, B, C, G
5	Incompatible recreational activities	**High**	A, B, C, D
6	Roads	**High**	A, B, C, G
7	Light pollution	**High**	D, E, F
8	Climate variability	**High**	A, B, G
9	Incompatible residential activities	**High**	D, E
10	Invasive plants	**Medium**	A, D, E
11	Invasive animals	**Medium**	D, E
12	Nuisance animals	**Medium**	F
13	Management of nature–inlet relocation and dredging	**Medium**	A, B, C
14	Channel modification/shipping lanes	**Medium**	A, B
15	Military activities	**Medium**	A, B, G
16	Degraded habitat	**Low**	F
17	Management of nature–nourishment	**Low**	E
18	Key predator/herbivore/pollinator losses	**Low**	E
19	Chemicals and toxins	**Low**	E
20	Nutrient loads–Urban	**Low**	E
21	Altered wind due to buildings	**Low**	E
22	Incompatible fire	**Low**	E
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Coastal Strand that were also identified as statewide threats (see list above in Conservation Threats section) may be found in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Coastal Strand are below. These actions were designed to reduce the impacts of light, dredged material, and humans and nuisance animals on coastal SGCN, reduce habitat loss to golf courses, and assure that the management and closure of military bases be implemented to retain critical habitat for Florida's SGCN.

Conversion to Recreation Areas

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
M	Encourage incentives in county and regional planning for maintaining large tracts of native habitat in the development of recreational facilities.	M	M	H

Light Pollution

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Ensure through state and local cooperation that coastal lighting ordinances are updated as technology and information improves.	VH	M	L
Overall Rank	**Education and Awareness**	***Feasibility***	***Benefits***	**Cost**
M	Support cooperative education programs developed and/or implemented by utility companies and local governments for coastal property owners to ensure that light ordinances protecting coastal wildlife are followed (e.g., availability of automatic light shut-off features for beach lights).	VH	L	M
Overall Rank	**Land/Water/Species Management**	***Feasibility***	***Benefits***	**Cost**
M	Support and expand the coastal light replacement efforts of the U.S. Fish and Wildlife Service to be implemented statewide where sea turtle nesting and beach mice habitat exists.	H	M	H
Overall Rank	**Policy**	***Feasibility***	***Benefits***	**Cost**
H	Support incentives for retrofitting existing light features.	VH	M	H
M	Support installation of appropriate light technology for conservation of sea turtles and other coastal species on military lands, Kennedy Space Center, and ports (domestic security facilities) and continue application and enforcement on other public lands.	M	M	H

Incompatible Residential Activities

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Expand the scale of the Florida Yards and Neighborhoods program from certifying individual landowners to whole neighborhoods; certification should be renewed biennially and any time property ownership changes.	M	M	L

L	Provide incentives (through local governments) for covenants, codes and restrictions in residential areas that address issues of pesticide use, pet control, feeding of wildlife, household or yard waste disposal, landscape plants, irrigation use, prescribed fire tolerance, and light-use in coastal areas.	M	L	L
L	Identify and promote effective reward models for homeowners, maintenance companies, and municipalities for reducing impacts on neighboring conservation areas.	M	L	L
L	Provide incentives (through local governments) (e.g., fast track, density breaks) for developers that produce on-site, site-specific educational materials and standards that are maintained by homeowner associations.	M	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Develop and fund continuing education courses for the landscape maintenance industry that includes appropriate use of chemicals, irrigation, plants, and disposal of yard waste.	H	M	M
L	Provide information to homeowners about the nearest access points and areas for off-road vehicle use and the impacts of creating new access routes on coastal habitats.	M	L	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
L	Encourage understanding of and compliance with leash laws in coastal strand and beach zones through increased patrols and information dissemination during nesting season. Utilize volunteers and others to help.	M	L	L

Nuisance Animals

Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Identify important habitat areas for nesting and loafing shorebirds (of Greatest Conservation Need), and encourage people and their pets to avoid them (as appropriate) through targeted education, signage, and patrols.	VH	L	M
L	Educate public landowners with responsibilities for coastal zone wildlife conservation about USDA protocols for raccoon management.	H	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Increase funding to implement existing sea turtle management practices regarding prevention of egg and hatchling predation. Promote the use of volunteer groups in association with the FWC to provide more capacity for implementation.	VH	L	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Integrate feral animal management into public land management.	H	M	M
L	Develop and implement techniques for waste management in areas where SGCN or habitats are subject to high depredation or disturbance rates due to exotic or nuisance populations attracted or sustained by garbage.	M	L	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
M	Assist counties, municipalities, and homeowners associations to develop and implement curbside pick-up of yard and household waste.	H	M	M
L	Promote increased awareness and understanding of potential impacts of outdoor pet feeding on wildlife, and encourage homeowners to feed pets indoors.	L	M	M

L	Through cost-sharing and other incentive programs with local governments, ensure that home and business owners have wildlife-proof garbage containers.	H	L	H
L	Work with Homeowner Associations to amend their bylaws to address outdoor feeding of feral cats and raccoons.	M	L	L

Management of Nature–Dredging

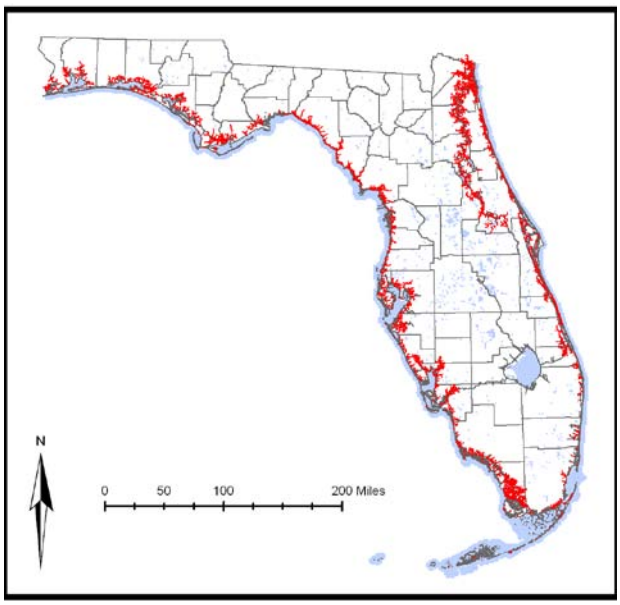
Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
M	Develop statewide, system-specific dredge material disposal plans that identify long-term disposal sites, specify dredge deposition practices, and minimize or offset impacts to all coastal wildlife. Tie the overall statewide dredge material management plan to port expansion management plan (recommended in Incompatible Industrial Operations).	M	M	M
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Develop educational programs about the importance of natural coastal processes and the economic cost of continually battling the natural movement of sand–direct these programs toward both the public and their elected officials.	H	L	L
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Develop one or several coalitions of local groups statewide to identify local restoration projects where dredge material can be used.	M	L	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
L	Develop and promote incentive programs to encourage avoidance of areas where development is dependent upon beach dredging/nourishment.	L	M	M
L	Promote long-term monitoring of impacts for dredging and nourishment projects.	M	L	L
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Compare the cost of conducting dredge/nourishment projects in perpetuity to spending equal state/federal dollars on acquiring lands subject to erosion (barrier islands) and putting those lands into uses that are not dependent upon dredging.	H	L	L
L	Fund research on the impacts of beach nourishment on wildlife. For example, how invertebrate and benthic communities are impacted by nourishment projects and the cumulative impacts of repeated nourishment.	H	L	L
L	Establish a database of locations and timing of dredge/nourishment projects so that effects of repeated nourishment may be identified.	H	L	L

Military Activities

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Establish a permanent consultative group of multi-agency wildlife and habitat professionals that work with USDOD on development of any statewide plans for base expansion, increased usage, and growth or closure needs to enhance positive or minimize any negative impacts on wildlife and conservation lands.	M	H	M
Overall Rank	**Land/Water Protection**	*Feasibility*	*Benefits*	**Cost**
VH	Work to develop partnerships to encourage conservation of significant habitats on lands encompassed by federal/state base closures.	H	VH	VH

H	Work with the USDOD to develop management and mitigation alternatives for any loss or degradation of Coastal Strand habitat from military activities on barrier islands.	VH	M	VH
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Create a cooperative program to ensure consistent implementation of management plans on federal lands with sufficient capacity for conservation management of wildlife and habitats on military lands in Florida (e.g., prescribed fire, invasive species control, monitoring). Agreements should include that USDOD provides sufficient access to critical habitats for management and monitoring purposes (e.g., identify a procedure for routine access to restricted areas for these purposes). (State agencies, NGO conservation organizations, and USDOD)	M	M	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Work to develop partnerships to encourage implementation of comprehensive management and mitigation plans that protect high-quality habitats and natural resources.	H	M	M

Coastal Tidal River or Stream



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), the combined total length of all of Florida's Coastal Tidal River or Stream is approximately 6,088 miles (9,798 km).

Habitat Description

FNAI type: None

Coastal Tidal River or Stream habitat includes the freshwater or brackish portions of a river or stream adjacent to an estuary or marine habitat in which the effects of tides cause the rise and fall of water levels. The effect of the tides at the upper limits of influence may lag several hours behind tides on the coast. The amount of water movement is controlled by the height of the tides, tidal range, downstream freshwater flow rates, rainfall, and wind. Saltwater wedges are formed in many of these systems, enabling numerous species a mechanism to move up or down river. Water flow is bidirectional in coastal tidal rivers and streams; as the tide rises, water flows toward the head of the river and, as the tide retreats, the water flows toward the coastal outlet. This habitat bridges the freshwater and marine realms, with aquatic communities ranging from tidal freshwater to tidal brackish; salinities can vary from freshwater to approximately that of seawater. This variation, along with temperature and water clarity, determines the flora and fauna of the Coastal Tidal River or Stream. Typical plants may include cord grass or submerged aquatic vegetation such as seagrasses and algae.

The Coastal Tidal River or Stream drains to the Gulf of Mexico or the Atlantic Ocean on Florida's entire coast and comprises the dominant stream habitat in the south Florida region. The longest or most extensive area of this habitat occurs in the lower St. Johns River. Other coastal bay systems such as Choctawhatchee Bay, Pensacola Bay, Tampa Bay, and Charlotte Harbor are also included in this habitat. Numerous small tidal creeks and coastal rivers are also included, especially in the Big Bend region of Florida's Gulf coast along with the lower portions of other large rivers including the Suwannee and Escambia.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Lutra canadensis lataxina* — River Otter
- *Trichechus manatus latirostris* — Florida Manatee
- *Eubalaena glacialis* — North Atlantic Right Whale
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Aythya affinis* — Lesser Scaup
- *Gavia immer* — Common Loon
- *Podiceps auritus coronutus* — Horned Grebe
- *Pelecanus occidentalis* — Brown Pelican
- *Ardea herodias occidentalis* — Great White Heron
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Egretta rufescens* — Reddish Egret
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill
- *Mycteria Americana* — Wood Stork
- *Haliaeetus leucocephalus* — Bald Eagle
- *Haematopus palliatus* — American Oystercatcher
- *Limosa fedoa* — Marbled Godwit
- *Sterna nilotica* — Gull-billed Tern
- *Sterna caspia* — Caspian Tern
- *Sterna maxima* — Royal Tern
- *Sterna sandvicensis* — Sandwich Tern
- *Sterna antillarum* — Least Tern

Reptiles

- *Crocodylus acutus* — American Crocodile
- *Macrochelys temminckii* — Alligator Snapping Turtle
- *Malaclemys terrapin* — Diamondback Terrapin
- *Pseudemys concinna suwanniensis* — Suwannee Cooter
- *Pseudemys nelsoni* — Florida Redbelly Turtle - Florida Panhandle
- *Nerodia clarkii clarkii* — Gulf Salt Marsh Snake

- *Nerodia clarkii compressicauda* Mangrove Salt Marsh Snake
- *Nerodia clarkii taeniata* Atlantic Salt Marsh Snake

Fish

- *Carcharhinus leucas* Bull Shark
- *Galeocerdo cuvier* Tiger Shark
- *Negaprion brevirostris* Lemon Shark
- *Rhizoprionodon terraenovae* Atlantic Sharpnose Shark
- *Pristis pectinata* Smalltooth Sawfish
- *Acipenser oxyrinchus oxyrinchus* Atlantic Sturgeon
- *Acipenser oxyrinchus desotoi* Gulf Sturgeon
- *Atractosteus spatula* Alligator Gar
- *Megalops atlanticus* Tarpon
- *Anguilla rostrata* American Eel
- *Alosa aestivalis* Blueback Herring
- *Alosa alabamae* Alabama Shad
- *Also mediocris* Hickory Shad
- *Alosa sapidissima* American Shad
- *Opsanus beta* Gulf Toadfish
- *Opsanus tau* Oyster Toadfish
- *Agonostomus monticola* Mountain Mullet
- *Mugil cephalus* Striped Mullet
- *Mugil curema* White Mullet
- *Mugil gyrans* Whirligig Mullet
- *Gambusis rhizophorae* Mangrove Gambusia
- *Microphis brachyurus* Opossum Pipefish
- *Syngnathus scovelli* Gulf Pipefish
- *Centropomus ensiferus* Swordspine Snook
- *Centropomus parallelus* Smallscale Fat Snook
- *Centropomus pectinatus* Tarpon Snook
- *Centropomus undecimalis* Common Snook
- *Morone saxatilis* Striped Bass
- *Epinephelus itajara* Goliath Grouper
- *Pomatomus saltatrix* Bluefish
- *Lutjanus griseus* Gray Snapper
- *Eugerres plumieri* Striped Mojarra
- *Archosargus probatocephalus* Sheepshead
- *Cynoscion nebulosus* Spotted Seatrout
- *Cynoscion regalis* Weakfish
- *Pogonias cromis* Black Drum
- *Sciaenops ocellatus* Red Drum
- *Gobiesox strumosus* Skilletfish
- *Dormitator maculatus* Fat Sleeper
- *Eleotris amblyopsis* Largescaled Spinycheek Sleeper
- *Gobiomorus dormitor* Bigmouth Sleeper
- *Awaous banana* River Goby
- *Ctenogobius pseudofasciatus* Slashcheek Goby
- *Paralichthys albigutta* Gulf Flounder
- *Paralichthys dentatus* Summer Flounder
- *Paralichthys lethostigma* Southern Flounder

Invertebrates

- *Ophiophragmus filograneus* Brittle Star
- *Sesarma benedicti* Benedict's Wharf Crab
- *Goniopsis cruentata* Mangrove Crab
- *Callinectes sapidus* Blue Crab
- *Oecetis floridana* Florida Long-horn Sedge
- *Chimarra florida* Floridian Finger-net Caddisfly

Conservation Threats

Threats to the Coastal Tidal River or Stream habitat that were also identified for multiple other freshwater and wetland habitats are addressed in Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Conversion to commercial/industrial development
- Conversion to housing and urban development
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban
- Roads

Threats to the Coastal Tidal River or Stream habitat that were also identified for multiple other marine and estuarine habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Coastal development
- Dam operations/incompatible release of water (quality, quantity, timing)
- Fishing gear impacts
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible recreational activities
- Incompatible resource extraction: mining/drilling
- Industrial spills
- Invasive animals
- Invasive plants
- Management of nature (beach nourishment and impoundments)
- Nutrient loads (urban)
- Roads, bridges and causeways
- Shoreline hardening
- Surface water and groundwater withdrawal
- Vessel impacts

Additional threats specific to this habitat include the operation of dams or water control structures, especially in south and central Florida, dredging and channel modification, loss of submarine springs, and shoreline hardening. The impacts of recreational activities from boating, especially impacts to manatees and seagrass communities in coastal rivers, and discarded fishing gear that threatens wildlife were specifically identified for this habitat.

The following stresses (and sources of stress below) threaten this habitat in freshwater habitats:

Stresses		Habitat Stress Rank
A	Altered species composition/dominance	High
B	Altered hydrologic regime	High
C	Altered landscape mosaic or context	High
D	Habitat destruction or conversion	Medium
E	Altered water quality of surface water or aquifer: nutrients	Medium
F	Altered water quality of surface water or aquifer: contaminants	Medium
G	Altered water salinity, pH, conductivity or other physical water quality characteristics of surface water of aquifer	Medium
H	Fragmentation of habitats, communities, ecosystems	Medium
I	Altered community structure	Medium
J	Erosion/sedimentation	Medium
K	Habitat degradation/disturbance	Low

The sources of stress, or threats, were used to generate conservation actions. The following sources of stress are threats identified for freshwater habitats:

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Surface water withdrawal	**High**	A, B, C, G, I
2	Channel modification/shipping lanes	**High**	A, B, D, G, I
3	Dam operations	**High**	A, B, G, H, I
4	Conversion to housing and urban development	**High**	B, C, D
5	Shoreline hardening	**High**	A, D, H, I
6	Management of nature–veg clearing/snagging for water conveyance	**Medium**	A, B, H, I
7	Roads	**Medium**	D
8	Chemicals and toxins	**Medium**	A, F
9	Conversion to commercial and industrial development	**Medium**	D
10	Nutrient loads–agriculture	**Medium**	A, E
11	Nutrient loads–urban	**Medium**	A, E
12	Invasive plants	**Medium**	A, I
13	Sea level rise	**Low**	B
14	Invasive animals	**Low**	A
Statewide Threat Rank of Habitat		**Very High**	

The following stresses (and sources of stress below) threaten this habitat in marine and estuarine habitats:

Stresses		Habitat Stress Rank
L	Altered hydrologic regime	Very High
M	Altered species composition	Very High
N	Altered water quality–contaminants	Very High
O	Altered water quality–physical, chemistry	Very High
P	Habitat destruction	Very High
Q	Habitat disturbance	Very High
R	Altered weather regime/sea level rise	High
S	Altered water quality–nutrients	High
T	Missing key communities or functional guilds/trophic shift	High
U	Sediment contamination	Medium
V	Sedimentation	Medium

The sources of stress, or threats, were used to generate conservation actions. The following sources of stress are threats identified for marine and estuarine habitats:

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Coastal development	**Very High**	L,M,P,T,U
2	Dam operations/incompatible release of water: (quality, quantity, timing)	**Very High**	L,M,N,O,Q,S,W
3	Channel modification/shipping lanes	**Very High**	L,O,P,Q,U,W
4	Inadequate stormwater management	**Very High**	L,M,N,O,Q,S,U
5	Shoreline hardening	**Very High**	L,P
6	Management of nature (beach nourishment, impoundments)	**High**	L,M,,O,Q,T
7	Chemicals and toxins	**High**	N,V
8	Industrial spills	**High**	N,Q,V
9	Incompatible industrial operations	**High**	L,M,N,T
10	Surface water withdrawal	**High**	L,M,O
11	Invasive animals	**High**	M,Q
12	Invasive plants	**High**	M,U
13	Incompatible resource extraction: mining/drilling	**High**	O
14	Climate variability	**High**	R
15	Nutrient loads (all sources)	**High**	S
16	Utility corridors	**Medium**	L,P
17	Vessel impacts	**Medium**	P,Q
18	Boating impacts	**Medium**	P,Q

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
19	Incompatible recreational activities	**Medium**	M,Q
20	Groundwater withdrawal	**Medium**	L,M,O
21	Incompatible fishing pressure	**Medium**	M,T
22	Solid waste	**Medium**	Q
23	Roads, bridges and causeways	**Medium**	L,P,U
24	Acoustic pollution	**Medium**	Q
25	Thermal pollution	**Medium**	O
26	Fishing gear impacts	**Medium**	Q
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Coastal Tidal River or Stream habitats that were also identified as statewide threats (see lists above in "Conservation Threats" section) are in the Chapter Multiple Habitat Threats and Conservation Actions. Actions for this habitat were developed in both the terrestrial/freshwater and marine workshops.

Several of the actions developed for a statewide threat were only applicable to Coastal Tidal River or Stream and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, and Terrestrial Cave) and are listed below. Additional actions were developed to address threats specific to this habitat. These actions are intended to prevent harm to aquatic ecosystems by managing the magnitude, duration, and frequency of fresh water inflows to coastal habitats and remediating the damage through targeted restoration projects, reducing sediment and nutrient loading through the development of advanced best management practices for urban activities, increasing the compatibility of urban development with conservation of coastal stream and associated riparian wetland and estuarine habitat, increasing scientific knowledge on the threats to submarine springs in coastal rivers, and improving enforcement for existing fishing and boating regulations.

TERRESTRIAL/FRESHWATER-BASED ACTIONS

Dam Operations

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Encourage interstate coordination of Strategy actions to ensure protection of all fish and wildlife resources when water management operations are altered.	M	H	L

L	Coordinate multi-agency review of USACE activities, including biological aspects (fish spawn guidelines, protection of fish and wildlife resources) of water control plans for interstate water projects, fish spawn guidelines, re-establishing natural seasonal fluctuation of flows.	H	L	M
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Work cooperatively with other agencies to restore appropriate salinity regimes to coastal habitats	H	M	VH
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Determine the appropriate hydrological flows and levels for water reservations on the Apalachicola, Yellow, Ochlockonee and other interstate rivers using ESWM (Ecologically Sustainable Water Management) approach.	M	H	H
M	Evaluate cumulative impacts of small rural impoundments on fish and wildlife.	M	M	M
L	Evaluate feasibility of incentive programs to remove small rural impoundments.	H	L	L

Conversion to Housing and Urban Development

Overall Rank	**Economic and Other Incentives**	*Feasibility*	*Benefits*	**Cost**
L	Encourage tax or other incentives, such as density transfers, for environmentally friendly comprehensive development plans for projects that front on rivers and floodplains.	M	L	VH
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Encourage establishment of and assist in development of criteria to create buffer zones between new development and river or floodplain edges.	M	L	M

Roads

Overall Rank	**Capacity Building**	*Feasibility*	*Benefits*	**Cost**
M	Encourage multi-agency participation in the Technical Advisory Committee for the Stream Crossing Technical Center (SCTC).	VH	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Provide training to road maintenance personnel on methods for minimizing sediment movement to water bodies.	M	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
L	Support the implementation of the Stream Crossing Technical Center (SCTC) to promote recovery and conservation of aquatic ecosystems from impacts of unpaved road-stream crossings.	H	L	M
L	Based on a stream crossing inventory and prioritization, develop funding opportunities for road stabilization projects in Florida counties.	H	L	H

Chemicals and Toxins

Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Develop management techniques and standards for private landowners that minimize runoff of chemicals and toxins into wetlands and aquatic systems.	H	L	M

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
L	Conduct research defining appropriate sediment quality standards for the various aquatic and marine systems for development and implementation of state sediment quality standards. Fund research defining the cause-and-effect relationship between sediment contamination (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H
L	Conduct research defining standards for persistent organic contaminants for the various aquatic and marine systems for development and implementation of state water quality standards. Fund research defining the cause-and-effect relationship between contamination from organics (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H

Invasive Plants

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
M	Research methods for control of aquatic invasive species in flowing waters.	VH	L	M

MARINE-BASED ACTIONS

Industrial Spills

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
M	Assist in the revision of emergency response plans in cooperation with the county EOCs, FDEP, DCA, and USCG for coastal waters where water-borne transport of oil and chemicals occur. Encourage bi-annual updates.	H	M	M
M	Assist in the revision of emergency response plans in cooperation with the county EOCs, FDEP, DCA, USCG and EPA for coastal waters that may be subject to land-based spills of oil and chemicals. Encourage bi-annual updates.	H	M	M

Surface/Groundwater withdrawal

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
M	Characterize and support restoration of appropriate flow regimes in estuarine systems and coastal tidal streams.	M	M	VH
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
H	Explore options and alternative methods to protect submarine springs.	H	H	L

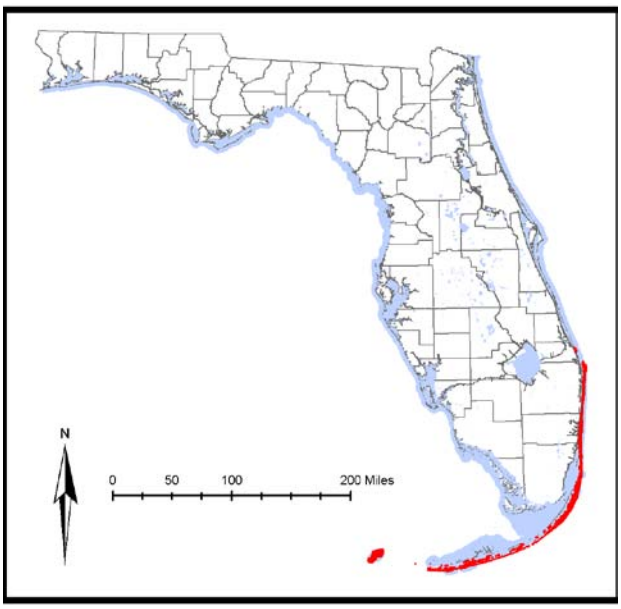
Incompatible Recreational Activities

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
M	Improve understanding of and voluntary compliance with watercraft speed limits/zones, and work with all affected parties to explore options for reassessing speed zones.	H	M	M
L	Improve understanding of, signage for, and voluntary compliance with manatee protection zones.	H	L	M

Fishing Gear Impacts

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
M	Continue to support and expand coastal clean-up. Expand into underwater habitats and statewide (include lead sinkers).	VH	L	M

Coral Reef



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), approximately 1,400,000 acres (566,560 ha) of Coral Reef are present in Florida.

Habitat Description

FNAI type: Coral Reef

A Coral Reef is an epibenthic community; a concentrated topographic complex of massive corals and other sessile organisms (algae, bryozoans) that build calcium carbonate (limestone) skeletons. The structural complexity provides habitat for a highly diverse flora and fauna that live all or portions of their lives on Coral Reefs.

Two major Coral Reef types are recognized: patch reefs and offshore bank reefs. Bank Reefs are further defined by zones (e.g., reef flat, spur and groove). The types of Coral Reefs found off the coast of Florida include the shallow-wave resistant reefs in the region from Dry Tortugas to Martin County; deeper (30-130 ft; 10-40 m) reefs in the same region; the Oculina Banks seaward of Palm Beach to Vero Beach. Deep water (165-265 ft; 50-80 m) structures such as Pulley Ridge and the Florida Middle Grounds occur along the west Florida shelf break in federal waters.

Associated Species of Greatest Conservation Need

Mammals

- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Fregata magnificens* — Magnificent Frigatebird
- *Sterna dougallii* — Roseate Tern
- *Sterna anaethetus* — Bridled Tern

Reptiles

- *Chelonia mydas* — Green Turtle
- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead

Fish

- *Ginglymostoma cirratum* — Nurse Shark
- *Rhincodon typus* — Whale Shark
- Carcharhinus falciformis — Silky Shark
- *Carcharhinus leucas* — Bull Shark
- *Carcharhinus limbatus* — Blacktip Shark
- *Carcharhinus perezii* — Reef Shark
- *Carcharhinus plumbeus* — Sandbar Shark
- *Galeocerdo cuvier* — Tiger Shark
- *Negaprion brevirostris* — Lemon Shark
- *Rhizoprionodon terraenovae* — Atlantic Sharpnose Shark
- *Sphyrna lewini* — Scalloped Hammerhead
- *Sphyrna mokarran* — Great Hammerhead
- *Pristis pectinata* — Smalltooth Sawfish
- *Aetobatus narinari* — Spotted Eagle Ray
- *Manta birostris* — Giant Manta
- *Megalops atlanticus* — Tarpon
- *Echidna catenata* — Chain Moray
- *Enchelycore nigricans* — Viper Moray
- *Gymnothorax funebris* — Green Moray
- *Gymnothorax miliaris* — Goldentail Moray
- *Gymnothorax moringa* — Spotted Moray
- *Gymnothorax vicinus* — Purplemouth Moray
- *Opsanus beta* — Gulf Toadfish
- *Opsanus pardus* — Leopard Toadfish
- *Antennarius striatus* — Striated Frogfish
- *Ogcocephalus corniger* — Longnose Batfish
- *Mugil curema* — White Mullet
- *Hemiramphus brasiliensis* — Ballyhoo
- *Bryx dunckeri* — Pugnose Pipefish
- *Cosmocampus albirostris* — Whitenose Pipefish
- *Cosmocampus elucens* — Shortfin Pipefish
- *Halicampus crinitus* — Banded Pipefish
- *Hippocampus reidi* — Longsnout Seahorse
- *Aulostomus maculatus* — Atlantic Trumpetfish

- *Fistularia tabacaria* Bluespotted Cornetfish
- *Centropomus undecimalis* Common Snook
- *Cephalopholis fulva* Coney
- *Dermatolepis inermis* Marbled Grouper
- *Epinephelus adscensionis* Rock Hind
- *Epinephelus drummondhayi* Speckled Hind
- *Epinephelus flavolimbatus* Yellowedge Grouper
- *Epinephelus guttatus* Red Hind
- *Epinephelus itajara* Goliath Grouper
- *Epinephelus morio* Red Grouper
- *Epinephelus nigritus* Warsaw Grouper
- *Epinephelus niveatus* Snowy Grouper
- *Epinephelus striatus* Nassau Grouper
- *Hypoplectrus aberrans* Yellowbelly Hamlet
- *Hypoplectrus gemma* Blue Hamlet
- *Hypoplectrus guttavarius* Shy Hamlet
- *Hypoplectrus indigo* Indigo Hamlet
- *Hypoplectrus nigricans* Black Hamlet
- *Hypoplectrus puella* Barred Hamlet
- *Hypoplectrus unicolor* Butter Hamlet
- *Liopropoma rubre* Peppermint Basslet
- *Mycteroperca bonaci* Black Grouper
- *Mycteroperca interstitialis* Yellowmouth Grouper
- *Mycteroperca microlepis* Gag
- *Mycteroperca phenax* Scamp
- M*ycteroperca venenosa* Yellowfin Grouper
- P*aranthias furcifer* Atlantic Creole-fish
- *Pseudogramma gregoryi* Reef Bass
- *Rypticus subbifrenatus* Spotted Soapfish
- *Schultzea beta* School Bass
- *Serranus annularis* Orangeback Bass
- *Serranus tabacarius* Tobaccofish
- *Serranus tigrinus* Harlequin Bass
- *Opistognathus macrognathus* Banded Jawfish
- *Apogon aurolineatus* Bridle Cardinalfish
- *Apogon binotatus* Barred Cardinalfish
- *Apogon lachneri* Whitestar Cardinalfish
- *Apogon maculatus* Flamefish
- *Apogon planifrons* Pale Cardinalfish
- *Apogon pseudomaculatus* Twospot Cardinalfish
- *Apogon quadrisquamatus* Sawcheek Cardinalfish
- *Apogon townsendi* Belted Cardinalfish
- *Astrapogon alutus* Bronze Cardinalfish
- *Astrapogon puncticulatus* Blackfin Cardinalfish
- *Phaeoptyx conklini* Freckled Cardinalfish
- *Phaeoptyx pigmentaria* Dusky Cardinalfish
- *Phaeoptyx xenus* Sponge Cardinalfish
- *Rachycentron canadum* Cobia
- *Alectis ciliaris* African Pompano
- *Caranx latus* Horse-eye Jack
- *Seriola dumerili* Greater Amberjack
- *Seriola rivoliana* Almaco Jack
- *Seriola zonata* Banded Rudderfish

- *Lutjanus analis* Mutton Snapper
- *Lutjanus apodus* Schoolmaster
- *Lutjanus cyanopterus* Cubera Snapper
- *Lutjanus griseus* Gray Snapper
- *Lutjanus jocu* Dog Snapper
- *Lutjanus mahogoni* Mahogany Snapper
- *Lutjanus synagris* Lane Snapper
- *Ocyurus chrysurus* Yellowtail Snapper
- *Rhomboplites aurorubens* Vermilion Snapper
- *Anisotremus surinamensis* Black Margate
- *Anisotremus virginicus* Porkfish
- *Haemulon album* Margate
- *Haemulon aurolineatum* Tomtate
- *Haemulon flavolineatum* French Grunt
- *Haemulon plumierii* White Grunt
- *Haemulon sciurus* Bluestriped Grunt
- *Calamus bajonado* Jolthead Porgy
- *Calamus calamus* Saucereye Porgy
- *Pagrus pagrus* Red Porgy
- *Equetus lanceolatus* Jackknife-fish
- *Equetus punctatus* Spotted Drum
- *Odontoscion dentex* Reef Croaker
- *Pareques acuminatus* High-hat
- *Pempheris schomburgkii* Glassy Sweeper
- *Chaetodon capistratus* Foureye Butterflyfish
- *Chaetodon ocellatus* Spotfin Butterflyfish
- *Chaetodon sedentarius* Reef Butterflyfish
- *Chaetodon striatus* Banded Butterflyfish
- *Prognathodes aculeatus* Longsnout Butterflyfish
- *Holacanthus bermudensis* Blue Angelfish
- *Holacanthus ciliaris* Queen Angelfish
- *Holacanthus tricolor* Rock Beauty
- *Pomacanthus arcuatus* Gray Angelfish
- *Pomacanthus paru* French Angelfish
- *Amblycirrhitus pinos* Redspotted Hawkfish
- *Abudefduf saxatilis* Sergeant Major
- *Chromis cyanea* Blue Chromis
- *Chromis enchrysura* Yellowtail Reeffish
- *Chromis insolata* Sunshinefish
- *Chromis multilineata* Brown Chromis
- *Chromis scotti* Purple Reeffish
- *Microspathodon chrysurus* Yellowtail Damselfish
- *Stegastes diencaeus* Longfin Damselfish
- *Stegastes leucostictus* Beaugregory
- *Stegastes partitus* Bicolor Damselfish
- *Stegastes planifrons* Threespot Damselfish
- *Stegastes variabilis* Cocoa Damselfish
- *Bodianus pulchellus* Spotfin Hogfish
- *Bodianus rufus* Spanish Hogfish
- *Clepticus parrae* Creole Wrasse
- *Halichoeres bathyphilus* Greenband Wrasse
- *Halichoeres bivittatus* Slippery Dick
- *Halichoeres caudalis* Painted Wrasse

- *Halichoeres cyanocephalus* Yellowcheek Wrasse
- *Halichoeres garnoti* Yellowhead Wrasse
- *Halichoeres maculipinna* Clown Wrasse
- *Halichoeres pictus* Rainbow Wrasse
- *Halichoeres poeyi* Blackear Wrasse
- *Halichoeres radiatus* Puddingwife
- *Lachnolaimus maximus* Hogfish
- *Thalassoma bifasciatum* Bluehead
- *Scarus coelestinus* Midnight Parrotfish
- *Scarus coeruleus* Blue Parrotfish
- *Scarus guacamaia* Rainbow Parrotfish
- *Scarus iseri* Striped Parrotfish
- *Scarus taeniopterus* Princess Parrotfish
- *Scarus vetula* Queen Parrotfish
- *Sparisoma atomarium* Greenblotch Parrotfish
- *Sparisoma aurofrenatum* Redband Parrotfish
- *Sparisoma chrysopterum* Redtail Parrotfish
- *Sparisoma rubripinne* Yellowtail Parrotfish
- *Sparisoma viride* Stoplight Parrotfish
- *Labrisomus bucciferus* Puffcheek Blenny
- *Labrisomus gobio* Palehead Blenny
- *Labrisomus guppyi* Mimic Blenny
- *Labrisomus haitiensis* Longfin Blenny
- *Labrisomus kalisherae* Downy Blenny
- *Labrisomus nigricinctus* Spotcheek Blenny
- *Malacoctenus aurolineatus* Goldline Blenny
- *Malacoctenus macropus* Rosy Blenny
- *Malacoctenus triangulatus* Saddled Blenny
- *Paraclinus grandicomis* Horned Blenny
- *Paraclinus nigripinnis* Blackfin Blenny
- *Starksia ocellata* Checkered Blenny
- *Starksia starcki* Key Blenny
- *Acanthemblemaria aspera* Roughhead Blenny
- *Emblemaria atlantica* Banner Blenny
- *Emblemaria pandionis* Sailfin Blenny
- *Emblemariopsis bahamensis* Blackhead Blenny
- *Emblemariopsis diaphana* Glass Blenny
- *Hemiemblemaria simula* Wrasse Blenny
- *Stathmonotus hemphilli* Blackbelly Blenny
- *Hypleurochilus bermudensis* Barred Blenny
- *Ophioblennius macclurei* Redlip Blenny
- *Coryphopterus dicrus* Colon Goby
- *Coryphopterus eidolon* Pallid Goby
- *Coryphopterus glaucofraenum* Bridled Goby
- *Coryphopterus hyalinus* Glass Goby
- *Coryphopterus lipernes* Peppermint Goby
- *Coryphopterus personatus* Masked Goby
- *Coryphopterus thrix* Bartial Goby
- *Elacatinus oceanops* Neon Goby
- *Lythrypnus nesiotes* Island Goby
- *Lythrypnus phorellus* Convict Goby
- *Lythrypnus spilus* Bluegold Goby
- *Priolepis hipoliti* Rusty Goby

- *Acanthurus bahianus* Ocean Surgeon
- *Acanthurus chirurgus* Doctorfish
- *Acanthurus coeruleus* Blue Tang
- *Balistes capriscus* Gray Triggerfish
- *Balistes vetula* Queen Triggerfish
- *Aluterus scriptus* Scrawled Filefish
- *Cantherhines pullus* Orangespotted Filefish
- *Monacanthus tuckeri* Slender Filefish
- *Lactophrys bicaudalis* Spotted Trunkfish
- *Lactophrys trigonus* Trunkfish
- *Lactophrys triqueter* Smooth Trunkfish
- *Canthigaster rostrata* Sharpnose Puffer
- *Chilomycterus schoepfii* Striped Burrfish
- *Diodon holocanthus* Balloonfish

Invertebrates

- *Ircinia campana* Vase Sponge
- *Spheciospongia vesparia* Loggerhead Sponge
- *Bartholomea annulata* Ringed Anenome
- *Condylactis gigantea* Pink-tip Anenome
- *Antipathes dichotoma* Black Coral
- *Antipathes pennacea* Black Coral
- *Discosoma sanctithomae* Warty False Coral
- *Rhodactis spp.* False Coral
- *Ricordea florida* . Florida False Coral
- *Gorgonia ventalina* Purple Sea Fan
- *Acropora cervicornis* Staghorn Coral
- *Acropora palmata* Elkhorn Coral
- *Agaricia agaricites* Lettuce Coral
- *Agaricia fragilis* Fragile Saucer Coral
- *Agaricia lamarcki* Sheet Coral
- *Leptoseris cucullata* Sunray Lettuce Coral
- *Stephanocenia michelinii* Blushing Star Coral
- *Eusmilia fastigiata* Smooth Flower Coral
- *Cladocora arbuscula* Tube Coral
- *Colpophyllia natans* Boulder Brain Coral
- *Diploria clivosa* Knobby Brain Coral
- *Diploria labyrinthiformis* Grooved Brain Coral
- *Diploria strigosa* Symmetrical Brain Coral
- *Favia fragum* Golf Ball Coral
- *Manicina areolata* Rose Coral
- *Montastraea annularis* Column Star Coral
- *Montastraea cavernosa* Great Star Coral
- *Solenastrea bournoni* Smooth Star Coral
- *Solenastrea hyades* Knobby Star Coral
- *Dendrogyra cylindrus* Pillar Coral
- *Dichocoenia stokesi* Pineapple Coral
- *Meandrina meandrites* Maze Coral
- *Isophyllastraea rigida* Rough Star Coral
- *Isophyllia sinuosa* Sinuous Cactus Coral
- *Mussa angulosa* Large Flower Coral
- *Mycetophyllia aliciae* Knobby Cactus Coral

- *Mycetophyllia danaana* Low-ridge Cactus Coral
- *Mycetophyllia ferox* Rough Cactus Coral
- *Mycetophyllia lamarckiana* Ridged Cactus Coral
- *Scolymia cubensis* Artichoke Coral
- *Scolymia lacera* Atlantic Mushroom Coral
- *Oculina diffusa* Diffuse Ivory Bush Coral
- *Oculina robusta* Robust Ivory Tree Coral
- *Madracis decactis* Ten-rayed Star Coral
- *Madracis formosa* Eight-rayed Star Coral
- *Madracis mirabilis* Yellow Pencil Coral
- *Madracis pharensis* Encrusting Star Coral
- *Porites astreoides* Mustard Hill Coral
- *Porites branneri* Blue Crust Coral
- *Porites porites* Finger Coral
- *Astrangia poculata* Northern Star Coral
- *Astrangia solitaria* Solitary Cup Coral
- *Phyllangia americana* Hidden Cup Coral
- *Siderastrea radians* Lesser Starlet Coral
- *Siderastrea siderea* Massive Starlet Coral
- *Palythoa caribaeorum* Golden Sea Mat
- *Zoanthus pulchellus* Green Sea Mat
- *Millepora alcicornis* Fire Coral
- *Millepora complanata* Fire Coral
- *Physalia physalis* Portuguese Man-o-war
- *Distichopora violacea* Violet Lace Coral
- *Stylaster filogranus* Frilly Lace Coral
- *Spondylus americanus* Atlantic Thorny Oyster
- *Octopus vulgaris* Octopus
- *Cypraea cervus* Atlantic Deer Cowrie
- *Cyphoma gibbosum* Flamingo Tongue
- *Charonia tritonis variegata* Atlantic Trumpet Triton
- *Strombus gigas* Queen Conch
- *Elysia crispata* Lettuce Slug
- *Comactinia filogranus* Red Arm Sea Feather
- *Nemaster spp*. Feather Stars
- *Diadema antillarum* Long-spined Urchin
- *Holothuria floridana* Florida Sea Cucumber
- *Ophiophragmus filograneus* Brittle Star
- *Asteroporpa annulata* Basket Star
- *Astrophyton muricatum* Basket Star
- *Hermodice carunculata* Fire (Bristle) Worm
- *Spirobranchus gigantea gigantea* Christmas Tree Worm
- *Clibanarius tricolor* Blue-legged or tricolor Hermit Crab
- *Lysmata wurdemanni* Peppermint Shrimp
- *Mithrax spinosissimus* Caribbean King Crab, Channel Clinging Crab
- *Stenorynchus seticornis* Yellowline Arrow Crab
- *Phimochirus operculatus* Polkadotted Hermit Crab
- *Periclimenes wurdemanni* Spotted Cleaner Shrimp
- *Panulirus argus* Spiny Lobster
- *Stenopus hispidus* Banded-coral Shrimp
- *Chiton tuberculatus* Olive Tiger Beetle
- *Didemnum vanderhorst* Tunicates
- *Eudistoma sp. indeterminata* Strawberry Tunicates

Conservation Threats

The threat to Coral Reef habitats caused by Key Predator/Herbivore Loss reflects the loss of *Diadema antillarum* sea urchins that has resulted in an overabundance of algae and threatens the health of the entire community. Other threats include over-fishing of the snapper/grouper complex, and intensive fishing of the spiny lobster and stone crab. Nutrient loading impacts species composition and community structure, and potentially interacts with parasites and pathogens to degrade the community further. Damage from groundings of boats and ships, and anchors of all size vessels have direct and cumulative impact on Coral Reefs.

Threats to the Coral Reef habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping Lanes
- Chemicals and toxins
- Climate variability
- Coastal development
- Dam management/incompatible release of water (quality, quantity, timing)
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible recreational activities
- Incompatible resource extraction: mining/drilling
- Industrial spills
- Invasive plants
- Key predator/herbivore loss
- Management of nature (beach nourishment and impoundments)
- Nutrient loads (urban)
- Roads, bridges and causeways
- Shoreline hardening
- Vessel impacts

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered structure	Very High
B	Altered species composition	Very High
C	Missing key communities or functional guilds/trophic shift	Very High
D	Keystone species missing or lacking in abundance	Very High
E	Habitat destruction	Very High
F	Altered weather regime/sea level rise	High
G	Altered water quality, physical, chemistry	High
H	Altered primary productivity	High
I	Altered water quality–contaminants	Medium
J	Altered water quality–nutrients	Medium
K	Habitat disturbance	Medium
L	Sedimentation	Medium

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Climate variability	**Very High**	A, B, C, D, E, F, G, H, I, J, K
2	Inadequate stormwater management	**Very High**	A, B, C, D, E, G, H, I, J, K
3	Coastal development	**Very High**	A, E, G
4	Nutrient loads (all sources)	**Very High**	A, B, C, D, G, H, J, K
5	Parasites/pathogens	**Very High**	A, B, C, D, E, H, K
6	Incompatible fishing pressure	**Very High**	A, B, C, D, E, H, K
7	Fishing gear impacts	**High**	A, B, C, D, E, K
8	Invasive plants	**High**	A, B, C, D, E, K
9	Key predator/herbivore losses	**High**	A, B, D, K
10	Dam operations/incompatible release of water (quality, quantity, timing)	**High**	B, E, G, H
11	Channel modification/shipping lanes	**High**	A, E, G
12	Roads, bridges and causeways	**High**	A, B, C, E, G, H, I, K
13	Vessel impacts	**High**	A, B, C, D, E, I, K
14	Boating impacts	**High**	A, B, C, D, E, G, I, K
15	Management of nature (beach nourishment, impoundments)	**High**	A, B, C, E, G, I, K
16	Incompatible aquarium trade	**High**	B, C, D, K
17	Chemicals and toxins	**High**	B, C, D, I, K
18	Incompatible resource extraction: mining/drilling	**High**	G
19	Shoreline hardening	**High**	E, G
30	Harmful algal blooms	**High**	G, H
21	Utility corridors	**Medium**	A, B, D, E, K
22	Incompatible recreational activities	**Medium**	A, B, E, I, K
23	Incompatible industrial operations	**Medium**	A, B, C, D, I, K
24	Disruption of longshore transport of sediments	**Medium**	G
25	Industrial spills	**Medium**	A, B, C, E, H, I, K
26	Placement of artificial structures	**Medium**	A, B, C, D, E, G, K
27	Military activities	**Medium**	E

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
28	Solid waste	Medium	A, E
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Coral Reef that were also identified as statewide threats (see list above), are in the Chapter Multiple Habitat Threats and Conservation Actions. Outcomes identified for this habitat address restoration of *Diadema* populations, reducing pollution inputs, and ensuring that ship anchorages are not sited over sensitive areas, and reducing the probability that vessels run aground.

Highest ranked actions identified for abating this source of stress focused on:

- Expanding the recommendations made by the Land Based Sources of Pollution Focus Team of the Southeast Florida Coral Reef Initiative statewide to include all estuarine and nearshore areas of the State
- Funding research and communication on parasites, pathogens, and biotoxins
- Establishing a funding source for remediation of damages from vessel impacts
- Development of a vessel anchoring management plan and use of mooring buoys

Additional actions included:

- Improving management of water control structures to restore freshwater flows to nearshore systems
- Developing additional methods using new technologies to keep vessels away from sensitive areas
- Supporting restoration of damaged areas and replacement of species lost

Dam Operations

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
M	Encourage improvement of management of water control structures to protect and enhance downstream environmental conditions.	M	M	M

Climate Variability

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
L	Continue and support research to better understand how coral reefs and other marine/estuarine habitats react to climate variability issues.	H	L	M

Nutrient Loads

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
H	Support Southeast Florida Coral Reef Initiative (SEFCRI).	VH	M	M

Parasites/Pathogens

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Develop regional biotoxin working groups, such as the one in the IRL, to address fish and wildlife disease events.	VH	M	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
H	Improve capabilities/sophistication for inspection, recognition, and treatment of aquatic organism diseases and parasites.	VH	M	M
H	Continue and support response teams/hotlines associated with disease outbreaks, traumas, strandings, fish kills for marine and estuarine species.	VH	M	M
L	Expand the number and capabilities of rehabilitation facilities for diseased and injured wildlife.	H	L	VH
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Conduct additional research for aquatic wildlife parasites and diseases and the impacts of biotoxins on fish and wildlife resources.	VH	M	H
H	Synthesize and consolidate understanding, and identify gaps in understanding, of marine flora/fauna diseases, pathogens, and biotoxin impacts on fish and wildlife resources.	VH	M	L
M	Research and examine use of parasites as indicators of estuarine and marine health.	VH	L	M

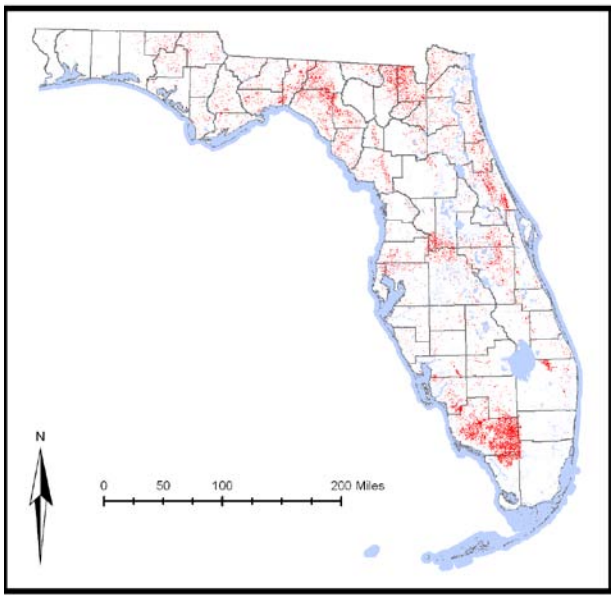
Key Predator/Herbivore Loss

Overall Rank	Research	*Feasibility*	*Benefits*	*Cost*
L	Fund research on bacterial/viral signature of healthy versus diseased specimens of selected species (i.e., urchins and corals)**.**	M	L	H

Vessel Impacts

Overall Rank	Land/Water/Species Management:	*Feasibility*	*Benefits*	Cost
VH	Support a marine/estuarine restoration trust fund.	M	VH	H
M	Develop a passive warning system for vessels to alert operators of sensitive or danger zones (shallows, reefs).	M	M	H
M	Encourage avoidance of anchorage and moorage in sensitive areas.	M	M	M
M	Identify appropriate areas for anchorage and moorings. Develop educational tools on low-impact mooring techniques.	M	M	M
L	Support a nursery(ies) for replacement stock of corals, submerged aquatic vegetation, etc.	M	L	H

Cypress Swamp



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current Condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 1,586,941 acres (642,212 ha) of Cypress Swamp habitat exist, of which 44% (689,955 ac; 279,215 ha) are in existing conservation or managed areas. Another 11% (173,971 ac; 70,404 ha) are in Florida Forever projects and 10% (163,702 ac; 66,248 ha) are in SHCA-designated lands. The remaining 35% (559,313 ac; 226,346 ha) are other private lands.

Habitat Description

FNAI type: Strand Swamp, Dome Swamp

These regularly inundated wetlands form a forested border along large rivers, creeks, and lakes, or occur in depressions as circular domes or linear strands. These communities are strongly dominated by either bald cypress or pond cypress, with very low numbers of scattered black gum, red maple, and sweetbay. Understory and ground cover are usually sparse due to frequent flooding but sometimes include such species as buttonbush, lizard's-tail, and various ferns.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Ursus americanus floridanus* — Florida Black Bear
- *Lutra canadensis lataxina* — River Otter
- *Mustela vison evergladensis* — Everglades Mink
- *Mustela vison halilimnetes* — Gulf Salt Marsh Mink
- *Mustela vison lutensis* — Atlantic Salt Marsh Mink
- *Puma concolor coryi* — Florida Panther
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Egretta thula* — Snowy Egret
- *Eudocimus albus* — White Ibis
- *Egretta caerulea* — Little Blue Heron
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Plegadis falcinellus* — Glossy Ibis
- *Mycteria americana* — Wood Stork
- *Elanoides forficatus* — Swallow-tailed Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Buteo brachyurus* — Short-tailed Hawk
- *Aramus guarauna* — Limpkin
- *Campephilus principalis* — Ivory-billed Woodpecker
- *Dendroica dominica stoddardi* — Stoddard's Yellow-throated Warbler
- *Protonotaria citrea* — Prothonotary Warbler

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Ambystoma cingulatum* — Flatwoods Salamander
- *Ambystoma tigrinum* — Tiger Salamander
- *Notophthalmus perstriatus* — Striped Newt
- *Desmognathus auriculatus* — Southern Dusky Salamander
- *Stereochilus marginatus* — Many-lined Salamander
- *Pseudacris ornata* — Ornate Chorus Frog
- *Rana virgatipes* — Carpenter Frog
- *Rana capito* — Gopher Frog

Reptiles

- *Kinosternon subrubrum steindachneri* — Florida Mud Turtle
- *Clemmys guttata* — Spotted Turtle
- *Terrapene carolina major* — Gulf Coast Box Turtle
- *Terrapene carolina bauri* — Florida Box Turtle
- *Deirochelys reticularia* — Chicken Turtle
- *Eumeces anthracinus* — Coal Skink
- *Nerodia cyclopion* — Mississippi Green Water Snake
- *Drymarchon couperi* — Eastern Indigo Snake

- *Lampropeltis getula* — Common Kingsnake
- *Crotalus horridus* — Timber Rattlesnake

Fish

- *Atractosteus spatula* — Alligator Gar
- *Hybognathus hayi* — Cypress Minnow
- *Umbra pygmaea* — Eastern Mudminnow
- *Acantharchus pomotis* — Mud Sunfish
- *Etheostoma proeliare* — Cypress Darter

Invertebrates

- *Cambarellus blacki* — Cypress Crayfish
- *Procambarus apalachicolae* — A Crayfish
- *Procambarus econfinae* — Panama City Crayfish
- *Procambarus latipleurum* — A Crayfish

Conservation Threats

Threats to the Cypress Swamp habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to housing and urban development
- Groundwater withdrawal
- Incompatible fire
- Incompatible forestry practices
- Incompatible resource extraction–mining/drilling
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban
- Roads
- Surface water withdrawal and diversion

Widespread ditching and diking of this habitat and hydrologic fragmentation due to construction of roads through and adjacent to this habitat are large sources of altered hydrologic regime. Groundwater withdrawal for municipal and agricultural purposes has impacted cypress wetlands in localized areas throughout Florida, but this threat is most severe in portions of central Florida. Incompatible forestry practices threaten this habitat due to physical and hydrological disturbance and the slow regeneration time of cypress trees. Currently, most cypress harvest is of young, small-diameter trees for landscape mulch. Nearly all cypress wetlands in unprotected lands have suffered from altered landscape context as the surrounding uplands and wet prairies have been converted to other land uses, primarily agriculture and urban/suburban development. In many parts of Florida, cypress wetlands are particularly vulnerable to and have been seriously impacted by a variety of invasive plants. Many cypress wetlands in both agricultural and urban settings receive nutrient-laden discharges from stormwater management systems, often leading to drastic changes in understory plant community composition and associated faunal changes. Additional threats specific to this habitat include the numerous water control structures affecting Cypress Swamps, particularly smaller dome swamps, statewide.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered hydrologic regime	High
B	Altered landscape mosaic or context	High
C	Altered soil structure and chemistry	High
D	Altered community structure	High
E	Altered species composition/dominance	High
F	Habitat destruction or conversion	Medium
G	Altered water quality of surface water or aquifer: nutrients	Medium
H	Missing key communities, functional guilds, or seral stages	Medium
I	Altered fire regime	Medium
J	Fragmentation of habitats, communities, ecosystems	Medium
K	Altered water and/or soil temperature	Low
L	Habitat degradation/disturbance	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Incompatible forestry practices	**High**	A, B, C, D, E, F, H
2	Surface water withdrawal	**High**	A, B, C, D, E, F
3	Nutrient loads–agriculture	**High**	E, G
4	Invasive plants	**High**	D, E
5	Conversion to housing and urban development	**High**	A, B
6	Invasive animals	**Medium**	C, D, E
7	Groundwater withdrawal	**Medium**	A, C, E
8	Roads	**Medium**	A, B, E
9	Conversion to agriculture	**Medium**	A, B
10	Incompatible vegetation harvest	**Low**	E
11	Nutrient loads–urban	**Low**	E, G
12	Incompatible fire	**Low**	B, E
13	Incompatible resource extraction: mining/drilling	**Low**	A, F
14	Incompatible grazing and ranching	**Low**	D, E, G
15	Incompatible agricultural practices	**Low**	A
16	Management of nature–water control structures	**Low**	A, B
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Cypress Swamp that were also identified as statewide threats (Incompatible forestry practices, Surface water withdrawal and diversion, Nutrient loads–agriculture, Invasive plants, Conversion to housing and urban development, Invasive animals, Groundwater withdrawal, Roads, Conversion to agriculture, Nutrient loads–urban, Incompatible fire, and Incompatible resource extraction–mining/drilling) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat that were only applicable to Cypress Swamp and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. Additional actions were developed to address threats specific to this habitat. These actions are intended to increase the spatial extent of Cypress Swamps in the landscape and improve the functionality of existing cypress wetlands through both regional and small-scale hydrologic restoration projects.

Incompatible Forestry Practices

Overall Rank	Education and Awareness	*Feasibility*	*Benefits*	Cost
L	Encourage labeling on cypress mulch alternatives that promotes their ecological value to consumers.	M	L	L
L	Through garden clubs, landscapers, and other avenues, promote acceptable alternatives to cypress mulch and make them readily available.	M	L	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Investigate various sources of possible funding for cypress regeneration studies	M	L	L
L	Recognizing that species move between wetland and upland habitats, assess the effectiveness of current BMP's regarding bedding near isolated wetlands.	M	L	L

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Encourage tax or other incentives, such as density transfers, for environmentally friendly comprehensive development plans for projects that front on rivers and floodplains.	M	L	VH

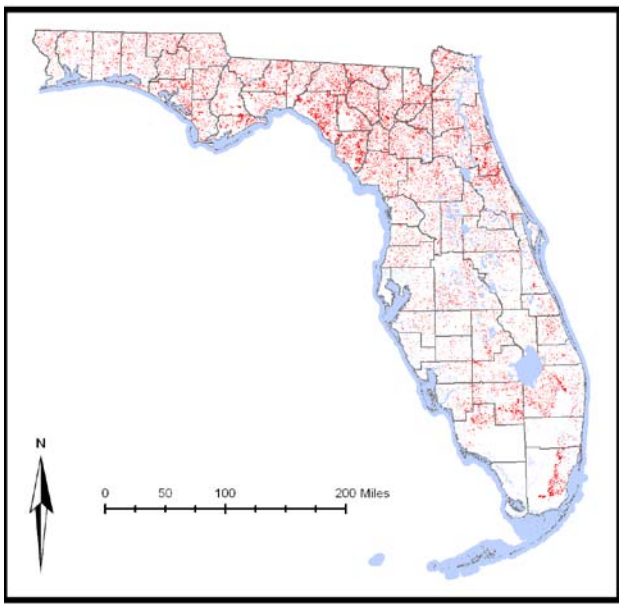
Conversion to Agriculture

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Create incentives for maintenance and conversion of lands to agricultural uses that use less water and result in lower nutrient outputs into Florida's waters and wetlands, and create market-based incentives to compensate private landowners for the environmental services they provide to the state through management that increases water storage and nutrient reduction.	M	M	H

Management of Nature – Water Control Structures

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Review existing Farm Bill programs and explore options for enhancing economic benefits to landowners that improve or remove water control structures.	VH	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Develop an awareness program for Drainage Districts created by Chapter 298 of the Florida Administrative Code ("298 Districts") to educate them about opportunities to improve fish and wildlife habitat conditions through operational and/or structural changes in their drainage systems.	H	L	M
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
L	Create a grant program (or utilize existing Farm Bill and other federal programs) to replace or retrofit existing stop log or manually controlled structures with V-notch weirs in agricultural drainage systems. Give priority to those control structures that are identified as acting as barriers to wildlife movement or sheet flow.	H	L	H
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
H	Form an interagency task force to streamline the permitting process for wetland restoration projects that restore hydrology.	VH	M	M

Disturbed/Transitional



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Unknown.
According to the best available GIS information at this time (see Appendix D. GIS Data Tables), approximately 2,807,185 acres (1,136,027 ha) of Disturbed/Transitional habitat exist. However, this is a very dynamic cover class. Areas are rapidly added to and lost from this category, due to both natural processes (e.g., succession, wildfire) and human enterprise (e.g., agriculture).

Habitat Description

FNAI type: None

This habitat category includes two principal types of Disturbed/Transitional habitat. The first type is comprised of a variety of situations where a natural upland community type has recently experienced an extensive disturbance resulting in the loss of nearly all of the vegetative cover (e.g., clear-cutting, land clearing, or severe fire) and is recovering through natural successional processes. This includes areas that range from bare soil to recently denuded areas where vegetative growth has resulted in a dense, mixed cover of herbaceous vegetation, shrubs, and vines. Species composition may approximate that of the pre-existing stand. These areas could be characterized as early-successional habitats.

The second type of Disturbed/Transitional habitat is comprised of upland or wetland site dominated by non-native invasive plants, most commonly trees. These invasives may have been

planted, or may have escaped cultivation and invaded native plant communities. These exotics include *Melaleuca*, Australian pine, Brazilian pepper, and *Eucalyptus*.

Associated Species of Greatest Conservation Need

Mammals

- *Blarina carolinensis shermani* — Sherman's Short-tailed Shrew
- *Sorex longirostris* — Southeastern Shrew
- *Condylura cristata* — Star-nosed Mole
- *Eumops floridanus* — Florida Bonneted Bat
- *Molossus molossus* — Pallas' Mastiff Bat
- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Sylvilagus palustris hefneri* — Lower Keys Marsh Rabbit
- *Sylvilagus floridanus* — Eastern Cottontail Rabbit
- *Sciurus niger avicennia* — Big Cypress Fox Squirrel
- *Sciurus niger niger* — Southeastern Fox Squirrel
- *Sciurus niger shermani* — Sherman's Fox Squirrel
- *Tamias striatus* — Eastern Chipmunk
- *Geomys pinetis pinetis* — Southeastern Pocket Gopher
- *Neofiber alleni* — Round-tailed Muskrat
- *Oryzomys palustris planirostris* — Pine Island Marsh Rice Rat
- *Oryzomys palustris sanibeli* — Sanibel Island Marsh Rice Rat
- *Oryzomys argentatus* — Silver Rice Rat
- *Sigmodon hispidus exsputus* — Lower Keys Cotton Rat
- *Sigmodon hispidus insulicola* — Insular Cotton Rat
- *Neotoma floridana smalli* — Key Largo Woodrat
- *Peromyscus gossypinus allapaticola* — Key Largo Cotton Mouse
- *Peromyscus polionotus allophrys* — Choctawhatchee Beach Mouse
- *Peromyscus polionotus leucocephalus* — Santa Rosa Beach Mouse
- *Peromyscus polionotus niveiventris* — Southeastern Beach Mouse
- *Peromyscus polionotus peninsularis* — St. Andrews Beach Mouse
- *Peromyscus polionotus phasma* — Anastasia Beach Mouse
- *Peromyscus polionotus trissyllepsis* — Perdido Key Beach Mouse
- *Podomys floridanus* — Florida Mouse
- *Ursus americanus floridanus* — Florida Black Bear
- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Mustela frenata olivacea* — Southeastern Weasel
- *Mustela frenata peninsulae* — Florida Long-tailed Weasel
- *Spilogale putorius* — Spotted Skunk
- *Mephitis mephitis* — Striped Skunk

- *Puma concolor coryi* Florida Panther
- *Odocoileus virginianus clavium* Key Deer

Birds

- *Colinus virginianus* Northern Bobwhite
- *Mycteria Americana* Wood Stork
- *Elanoides forficatus* Swallow-tailed Kite
- *Elanus leucurus* White-tailed Kite
- *Ictinia mississippiensis* Mississippi Kite
- *Buteo platypterus platypterus* Broad-winged Hawk
- *Buteo brachyurus* Short-tailed Hawk
- *Caracara cheriway* Crested Caracara
- *Falco sparverius paulus* Southeastern American Kestrel
- *Falco columbarius* Merlin
- *Falco peregrinus* Peregrine Falcon
- *Grus canadensis pratensis* Florida Sandhill Crane
- *Grus americana* Whooping Crane
- *Charadrius alexandrinus tenuirostris* Cuban Snowy Plover
- *Charadrius wilsonia* Wilson's Plover
- *Charadrius melodus* Piping Plover
- *Sterna antillarum* Least Tern
- *Columbina passerine* Common Ground-Dove
- *Athene cunicularia floridana* Florida Burrowing Owl
- *Chordeiles gundlachii* Antillean Nighthawk
- *Tyrannus dominicensis* Gray Kingbird
- *Lanius ludovicianus* Loggerhead Shrike
- *Vireo altiloquus* Black-whiskered Vireo
- *Aphelocoma coerulescens* Florida Scrub-Jay
- *Dendroica dominica stoddardi* Stoddard's Yellow-throated Warbler
- *Dendroica petechia gundlachi* Cuban Yellow Warbler
- *Dendroica discolor paludicola* Florida Prairie Warbler
- *Dendroica cerulea* Cerulean Warbler
- *Protonotaria citrea* Prothonotary Warbler
- *Helmitheros vermivorum* Worm-eating Warbler
- *Limnothlypis swainsonii* Swainson's Warbler
- *Seiurus montacilla* Louisiana Waterthrush
- *Oporornis formosus* Kentucky Warbler
- *Wilsonia citrina* Hooded Warbler
- *Aimophila aestivalis* Bachman's Sparrow
- *Ammodramus savannarum* Grasshopper Sparrow (migrant)
- *Ammodramus savannarum floridanus* Florida Grasshopper Sparrow
- *Ammodramus henslowii* Henslow's Sparrow
- *Ammodramus maritimus fisheri* Louisiana Seaside Sparrow
- *Ammodramus maritimus junicolus* Wakulla Seaside Sparrow
- *Ammodramus maritimus macgillivraii* Macgillivray's Seaside Sparrow
- *Ammodramus maritimus mirabilis* Cape Sable Seaside Sparrow
- *Ammodramus maritimus peninsulae* Scott's Seaside Sparrow
- *Passerina ciris* Painted Bunting
- *Sturnella magna* Eastern Meadowlark

Amphibians

- *Ambystoma cingulatum* Flatwoods Salamander

- *Ambystoma tigrinum* Tiger Salamander
- *Notophthalmus perstriatus* Striped Newt
- *Pseudacris ornata* Ornate Chorus Frog
- *Rana virgatipes* Carpenter Frog
- *Rana okaloosae* Florida Bog Frog
- *Rana capito* Gopher Frog

Reptiles

- *Terrapene carolina major* Gulf Coast Box Turtle
- *Terrapene carolina bauri* Florida Box Turtle
- *Gopherus polyphemus* Gopher Tortoise
- *Sceloporus woodi* Florida Scrub Lizard
- *Eumeces anthracinus* Coal Skink
- *Eumeces egregius egregius* Florida Keys Mole Skink
- *Eumeces egregius insularis* Cedar Key Mole Skink
- *Eumeces egregius lividus* Bluetail Mole Skink
- *Neoseps reynoldsi* Sand Skink
- *Storeria dekayi wrightorum* Midland Brown Snake
- *Storeria dekayi* Lower Keys Brown Snake
- *Thamnophis sauritus* Lower Keys Ribbon Snake
- *Virginia valeriae* Smooth Earth Snake (Highlands Co population only)
- *Heterodon platirhinos* Eastern Hognose Snake
- *Heterodon simus* Southern Hognose Snake
- *Diadophis punctatus acricus* Key Ringneck Snake
- *Farancia erytrogramma* Rainbow Snake
- *Drymarchon couperi* Eastern Indigo Snake
- *Pituophis melanoleucus mugitus* Florida Pine Snake
- *Lampropeltis calligaster* Mole Kingsnake
- *Lampropeltis getula* Common Kingsnake
- *Stilosoma extenuatum* Short-tailed Snake
- *Tantilla relicta pamlica* Coastal Dunes Crowned Snake
- *Tantilla oolitica* Rim Rock Crowned Snake
- *Agkistrodon contortrix* Copperhead
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake
- *Crotalus horridus* Timber Rattlesnake

Invertebrates

- *Chelyoxenus xerobatis* Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Callophrys gryneus sweadneri* Sweadner's Juniper Hairstreak
- *Hemiargus thomasi bethunebakeri* Miami Blue
- *Anthanassa frisia* Cuban Crescent
- *Junonia genoveva* Tropical Buckeye

Conservation Threats

While threats to its conservation as well as remedial actions were identified during Strategy Science Workshops I and II, the Disturbed/Transitional habitat category was not addressed in TNC

workshops that generated tables of ranked threats and actions, as seen in most other habitat categories. The decision to not rank threats and actions for this habitat was made (1) to maximize discussion time for higher-priority habitats and (2) because of some disagreement over recognition of this habitat type as important to wildlife conservation. Therefore, threats and actions are presented as simple bulleted lists, arranged in alphabetical order, with no prioritization.

The following stresses threaten this habitat:

- Absent or insufficient biological legacies
- Altered community structure
- Altered fire regime–timing, frequency, intensity, extent
- Altered hydrologic regime–timing, duration, frequency, extent
- Altered landscape pattern or mosaic
- Altered soil structure and chemistry
- Altered species composition/dominance
- Altered successional dynamics
- Altered water and/or soil temperature
- Altered water quality of surface water or aquifer: contaminants
- Altered water quality of surface water or aquifer: nutrients
- Erosion/sedimentation
- Excessive depredation and/or parasitism
- Fragmentation of habitats, communities, ecosystems
- Habitat degradation/ disturbance
- Insufficient size/extent of characteristic communities/ ecosystems
- Keystone species missing or lacking in abundance
- Missing key communities, functional guilds, or seral stages

The following sources of stress, or threats, were used to generate conservation actions.

- Chemicals and toxins
- Conversion to agriculture
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Conversion to recreation areas
- Incompatible fire
- Incompatible forestry operations
- Incompatible recreational activities
- Incompatible resource extraction–mining
- Incompatible wildlife and fisheries management strategies
- Invasive animals
- Invasive plants
- Lack of knowledge/ appreciation of early-successional habitat
- Nuisance animals
- Nutrient loads–agriculture
- Roads, bridges, and causeways

Conservation Actions

Actions to abate threats to Disturbed/Transitional were designed to reduce the impacts of on-site and adjacent management activities, and to increase the habitat's suitability to wildlife. Most of the threats to this habitat (see list above) were also identified for multiple other habitats, and are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. Exceptions

are Conversion to commercial and industrial development, Lack of knowledge/appreciation of early-successional habitat, and Nuisance animals.

The actions to abate threats that were identified for Disturbed/Transitional habitat are below, though none were prioritized for implementation.

Land/Water/Species Management

- Convert invasives-dominated sites into early-successional habitat, and maintain

Law and Policy

- Develop a plan to fund long-term post-reclamation management programs–include control of invasive flora and fauna
- Promote the use of mitigation banking

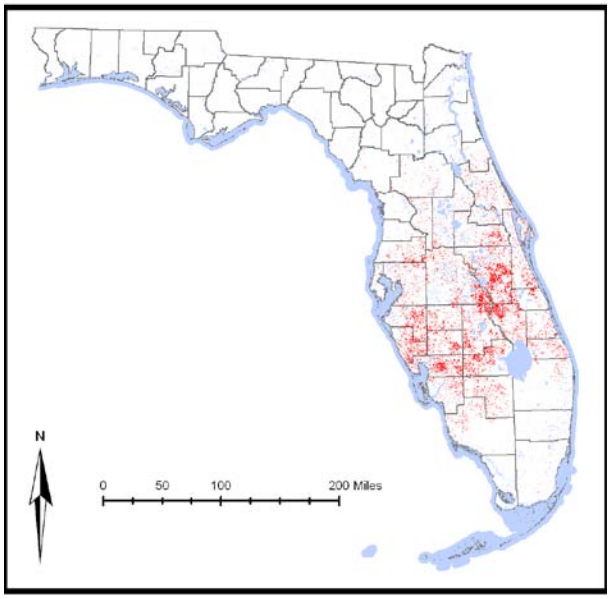
Research, Education and Awareness

- Increase development of biocontrol options for invasive plants to reduce need for herbicides
- Increase public and private training on the conservation value of these lands (e.g., via extension education)
- Target education for landowners and policy makers to benefit wildlife in their day-to-day activities
- Encourage wildlife-friendly land management (e.g., maintaining early-successional habitat, etc.)

Economic and Other Incentives

- Provide incentives to improve land for wildlife
- Provide economic incentives for “green” developments (e.g., give density breaks for developments that cluster housing)
- Provide awards to municipalities, organizations, and individuals that implement wildlife-friendly design and management practices
- Provide funds and materials for landowners to remove invasive exotics

Dry Prairie



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current Condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 1,215,099 acres (491,733 ha) of Dry Prairie habitat exist, of which 29% (353,768 ac; 143,165 ha) are in existing conservation or managed areas. Another 13% (163,613 ac; 66,212 ha) are in Florida Forever projects and 11% (131,803 ac; 53,339 ha) are in SHCA-designated lands. The remaining 47% (565,915 ac; 229,018 ha) are other private lands.

Habitat Description

FNAI type: Dry Prairie

Dry Prairies are large native grass- and shrub-lands occurring on very flat terrain interspersed with scattered cypress domes and strands, bayheads, isolated freshwater marshes, and hardwood hammocks. This community is characterized by many species of grasses, sedges, herbs, and shrubs, including saw palmetto, fetterbush, staggerbush, tar flower, gallberry, blueberry, wiregrass, carpet grasses, and various bluestems. The largest areas of these treeless plains historically occurred just north of Lake Okeechobee. In central and south Florida, palmetto prairies, which consist of former pine flatwoods where the overstory trees have been thinned or removed, are also included in this category. These sites contain highly scattered pines that cover less than 10 to 15 percent of an area.

Associated Species of Greatest Conservation Need

Mammals

- *Sylvilagus floridanus* — Eastern Cottontail Rabbit
- *Spilogale putorius* — Spotted Skunk
- *Puma concolor coryi* — Florida Panther

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Colinus virginianus* — Northern Bobwhite
- *Elanus leucurus* — White-tailed Kite
- *Caracara cheriway* — Crested Caracara
- *Falco sparverius paulus* — Southeastern American Kestrel
- *Grus canadensis pratensis* — Florida Sandhill Crane
- *Grus americana* — Whooping Crane
- *Columbina passerine* — Common Ground-Dove
- *Athene cunicularia floridana* — Florida Burrowing Owl
- *Aimophila aestivalis* — Bachman's Sparrow
- *Ammodramus savannarum* — Grasshopper Sparrow (migrant)
- *Ammodramus savannarum floridanus* — Florida Grasshopper Sparrow
- *Ammodramus henslowii* — Henslow's Sparrow
- *Sturnella magna* — Eastern Meadowlark

Amphibians

- *Rana capito* — Gopher Frog

Reptiles

- *Terrapene carolina bauri* — Florida Box Turtle
- *Gopherus polyphemus* — Gopher Tortoise
- *Heterodon platirhinos* — Eastern Hognose Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Pituophis melanoleucus mugitus* — Florida Pine Snake
- *Lampropeltis calligaster* — Mole Kingsnake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake

Invertebrates

- *Chelyoxenus xerobatis* — Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* — Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* — Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* — Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Atrytone arogos arogos* — Arogos Skipper
- *Atrytonopsis hianna loammi* — Southern Dusted Skipper

Conservation Threats

Threats to Dry Prairie habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Incompatible fire
- Incompatible forestry practices
- Incompatible resource extraction: mining/drilling
- Invasive plants
- Roads
- Surface water withdrawal

Threats specific to Dry Prairie included incompatible forestry practices because this habitat supports grassland bird SGCN that are not tolerant of adjacent dense pine stands. Habitat-specific threats from mining include both habitat loss and inadequate mitigation for habitat alteration that results in small, fragmented areas rather than more contiguous areas of this habitat. Military base closure threatens potential conservation protection for Dry Prairie.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Fragmentation of habitats, communities, ecosystems	High
B	Habitat destruction or conversion	High
C	Altered hydrologic regime	High
D	Altered fire regime	High
E	Insufficient size/extent of characteristic communities or ecosystems	High
F	Altered landscape mosaic or context	High
G	Altered community structure	Medium
H	Altered species composition/dominance	Medium
I	Habitat degradation/disturbance	Low

The sources of the stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Roads	**Very High**	A, B, C, D, E, F
2	Conversion to housing and urban development	**Very High**	A, B, C, D, E, F
3	Conversion to commercial and industrial development	**High**	A, B, E
4	Conversion to agriculture	**Medium**	A, B, C, E, F
5	Surface water withdrawal	**Medium**	A, C, D, F
6	Incompatible fire	**Medium**	D, F
7	Incompatible grazing and ranching	**Low**	D, F
8	Military activities	**Low**	A, B, E
9	Invasive plants	**Low**	D, F
10	Incompatible agricultural practices	**Low**	A, B, F
11	Incompatible forestry practices	**Low**	A, E
12	Incompatible resource extraction: mining/drilling	**Low**	A, B, E
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Dry Prairie that were also identified as statewide threats (Roads, Conversion to housing and urban development, Conversion to commercial and industrial development, Conversion to agriculture, Surface water withdrawal, Incompatible fire, Invasive plants, Incompatible forestry practices (also see actions below), Incompatible resource extraction: mining/drilling (also see actions below) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Dry Prairie are listed below. These actions were designed to reduce the impacts of adjacent forest management, mining and mine mitigation, and potential management or loss on Avon Park Air Force Range.

Military Activities

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Establish a permanent consultative group of multi-agency environmental professionals that work with USDOD on development of any statewide plans for base expansion, increased usage, and growth or closure needs to enhance positive, or minimize any negative, impacts on wildlife and conservation lands.	M	H	M
Overall Rank	**Land/Water Protection**	*Feasibility*	*Benefits*	**Cost**
VH	Work to develop partnerships to encourage conservation of significant habitats on lands encompassed by federal/state base closures.	H	VH	VH
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
H	Support a collaborative effort among the USFWS, Avon Park Air Force Range, Archbold Biological Station, and the FWC to develop and implement a mitigation and management plan to accommodate military needs and maintain habitat and species viability at APAFR.	VH	M	VH
M	Create a cooperative program to ensure consistent implementation of management plans on federal lands with sufficient capacity for conservation management of wildlife and habitats on military lands in Florida (e.g., prescribed fire, invasive species control, monitoring). Agreement should include that USDOD provides sufficient access to critical habitats for management and monitoring purposes (e.g., identify a procedure for routine access to restricted areas for these purposes). (State agencies, NGO conservation organizations, and USDOD)	M	M	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Work to develop partnerships to encourage the implementation of comprehensive management, and mitigation plans that protect high quality habitats and natural resources.	H	M	M

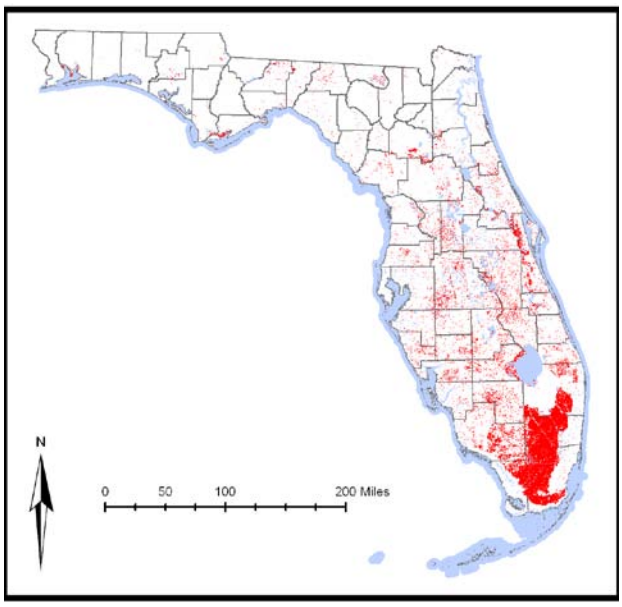
Incompatible Forestry Practices

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Ensure that bird viability is the priority in management decisions on public lands where silvicultural management is in conflict with maintaining viable populations of imperiled grassland and scrub birds.	M	L	L

Incompatible Resource Extraction: Mining

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
H	Create incentives (e.g., mitigation credits, permit streamlining) to encourage preservation of large contiguous patches of Dry Prairie and other sensitive upland habitats.	H	H	H
M	Create incentives to avoid loss of, and impacts to, SHCAs and sensitive habitats from mining, particularly wet and dry prairie, scrub, and bat caves.	H	M	H

Freshwater Marsh and Wet Prairie



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 2,941,170 acres (1,190,249 ha) of Freshwater Marsh and Wet Prairie habitat exist, of which 67% (1,959,950 ac; 793,164 ha) are in existing conservation or managed areas. Another 5% (145,462 ac; 58,866 ha) are in Florida Forever projects and 7% (200,677 ac; 81,211 ha) are in SHCA-designated lands. The remaining 21% (635,081 ac; 257,008 ha) are other private lands.

Habitat Description

FNAI type: Basin Marsh, Coastal Interdunal Swale, Depression Marsh, Marl Prairie, Wet Prairie, Floodplain Marsh, Sough, Swale

These wetland communities are dominated by a wide assortment of herbaceous plant species growing on sand, clay, marl, and organic soils in areas of variable water depths and inundation regimes. Generally, Freshwater Marsh habitat occurs in deeper, more strongly inundated situations and is characterized by tall emergents and floating-leaved species. Freshwater Marshes occur within flatwoods depressions, along broad, shallow lake and river shorelines, and scattered in open areas within hardwood, Dry Prairie, and Cypress Swamps. Portions of freshwater lakes, rivers, and canals that are dominated by floating-leaved plants such as lotus, spatterdock, duck weed, and water hyacinths are included in this category. Freshwater Marshes are common features of many river

deltas, such as the Escambia, Apalachicola and Choctawhatchee, where these rivers discharge into estuaries. Wet Prairies commonly occur in shallow, periodically inundated areas and are usually dominated by aquatic grasses, sedges, and their associates. Wet Prairies occur as scattered, shallow depressions within Dry Prairie and flatwoods habitat and on marl prairie areas in south Florida. Also included in this category are areas in southwest Florida with scattered dwarf cypress having less than 20 percent canopy coverage, and a dense ground cover of freshwater marsh plants. Various combinations of pickerel weed, sawgrass, maidencane, arrowhead, fire flag, cattail, spike rush, bulrush, white water lily, water shield, and various sedges dominate Freshwater Marshes and Wet Prairies. Many subcategories of this habitat, such as sawgrass marsh or maidencane prairie, have been described and named based on their dominant plant species.

Associated Species of Greatest Conservation Need

Mammals

- *Neofiber alleni* — Round-tailed Muskrat
- *Ursus americanus floridanus* — Florida Black Bear
- *Lutra canadensis lataxina* — River Otter
- *Mustela vison evergladensis* — Everglades Mink
- *Mustela vison halilimnetes* — Gulf Salt Marsh Mink
- *Mustela vison lutensis* — Atlantic Salt Marsh Mink
- *Puma concolor coryi* — Florida Panther
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Anas acuta* — Northern Pintail
- *Ardea herodias occidentalis* — Great White Heron
- *Botaurus lentiginosus* — American Bittern
- *Ixobrychus exilis* — Least Bittern
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Egretta tricolor* — Tricolored Heron
- *Egretta rufescens* — Reddish Egret
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill
- *Eudocimus albus* — White Ibis
- *Plegadis falcinellus* — Glossy Ibis
- *Mycteria americana* — Wood Stork
- *Elanoides forficatus* — Swallow-tailed Kite
- *Elanus leucurus* — White-tailed Kite
- *Rostrhamus sociabilis plumbeus* — Snail Kite
- *Ictinia mississippiensis* — Mississippi Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Caracara cheriway* — Crested Caracara
- *Coturnicops noveboracensis noveboracensis* — Yellow Rail
- *Laterallus jamaicensis* — Black Rail
- *Rallus elegans elegans* — King Rail
- *Aramus guarauna* — Limpkin

- *Grus canadensis pratensis* Florida Sandhill Crane
- *Grus americana* Whooping Crane
- *Recurvirostra americana* American Avocet
- *Calidris fuscicollis* White-rumped Sandpiper
- *Calidris melanotos* Pectoral Sandpiper
- *Ammodramus maritimus mirabilis* Cape Sable Seaside Sparrow

Amphibians

- *Pseudobranchus striatus lustricolus* Gulf Hammock Dwarf Siren
- *Ambystoma cingulatum* Flatwoods Salamander
- *Ambystoma tigrinum* Tiger Salamander
- *Notophthalmus perstriatus* Striped Newt
- *Stereochilus marginatus* Many-lined Salamander
- *Pseudacris ornata* Ornate Chorus Frog
- *Rana virgatipes* Carpenter Frog
- *Rana capito* Gopher Frog

Reptiles

- *Kinosternon subrubrum steindachneri* Florida Mud Turtle
- *Kinosternon baurii* Key Mud Turtle
- *Clemmys guttata* Spotted Turtle
- *Terrapene carolina major* Gulf Coast Box Turtle
- *Terrapene carolina bauri* Florida Box Turtle
- *Deirochelys reticularia* Chicken Turtle
- *Drymarchon couperi* Eastern Indigo Snake
- *Lampropeltis getula* Common Kingsnake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Fish

- *Atractosteus spatula* Alligator Gar
- *Umbra pygmaea* Eastern Mudminnow
- *Fundulus blairae* Western Starhead Topminnow
- *Acantharchus pomotis* Mud Sunfish
- *Enneacanthus chaetodon* Black Banded Sunfish
- *Etheostoma proeliare* Cypress Darter

Invertebrates

- *Oecetis parva* Little Longhorned Caddisfly

Conservation Threats

Threats to the Freshwater Marsh and Wet Prairie habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to housing and urban development
- Groundwater withdrawal
- Incompatible fire
- Incompatible forestry practices
- Incompatible recreational activities

- Incompatible resource extraction–mining/drilling
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban
- Roads
- Surface water withdrawal and diversion

As one of the most ubiquitous and widespread wetland types in Florida, the Freshwater Marsh and Wet Prairie habitat is subject to a wide array of threats, many of them highly ranked. Widespread ditching, diking, and hydrologic fragmentation caused by roads in or adjacent to this habitat are important sources of altered hydrologic regime. Groundwater withdrawal for municipal and agricultural purposes has impacted depressional marsh wetlands in localized areas throughout Florida, but this threat is most severe in portions of central Florida. Nearly all marsh and wet prairie systems in unprotected lands have suffered from direct habitat conversion and altered landscape context as the surrounding uplands and much of the wet prairie habitat have been converted to other land uses, primarily agriculture and urban/suburban development. Small wetlands are undervalued and frequently altered even though they are the only sites in which certain Florida species either live or reproduce. In south and central Florida, marsh and wet prairie wetlands are particularly vulnerable to and have been seriously impacted by a variety of invasive plants. Many marsh and wet prairie wetlands in both agricultural and urban settings receive nutrients from discharges from stormwater management systems which may lead to substantial changes in plant community composition and associated faunal changes. The experts noted that very little of the marsh and wet prairie habitat statewide is receiving adequate fire as a result of perceived difficulties in burning these habitats and lack of knowledge of the role of fire in herbaceous wetland ecosystems. Additional threats specific to this habitat include the numerous water control structures affecting marsh and wet prairie habitat, particularly in the Everglades region and in smaller isolated wetlands, statewide.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered hydrologic regime	High
B	Fragmentation of habitats, communities, ecosystems	High
C	Altered fire regime	High
D	Altered landscape mosaic or context	High
E	Altered water quality of surface water or aquifer: nutrients	High
F	Altered species composition/dominance	High
G	Habitat destruction or conversion	Medium
H	Altered community structure	Medium
I	Habitat degradation/disturbance	Medium
J	Keystone species missing or lacking in abundance	Medium
K	Insufficient size/extent of characteristic communities or ecosystems	Medium
L	Absent or insufficient biological legacies	Medium
M	Altered water salinity, pH, conductivity or other physical water quality characteristics of surface water or aquifer	Low
N	Altered water quality of surface water or aquifer: contaminants	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Conversion to agriculture	**Very High**	A, B, D, G, J, K
2	Conversion to housing and urban development	**Very High**	A, B, C, D, G, J, K
3	Surface water withdrawal	**High**	A, B, C, D, E, F, H, J, K, L
4	Incompatible fire	**High**	B, C, D, F, G, H, K, L
5	Nutrient loads–agriculture	**High**	E, F, H
6	Incompatible resource extraction: mining/drilling	**High**	A, B, D, E, G, K
7	Roads	**High**	A, B, C, D, F, G
8	Invasive plants	**High**	B, C, D, F, H, K
9	Incompatible recreational activities	**Medium**	C, H, I
10	Invasive animals	**Medium**	F, H
11	Management of nature–water control structures	**Medium**	A, B, C, D, F
12	Nutrient loads–urban	**Medium**	E, F, H
13	Groundwater withdrawal	**Medium**	A, D, F
14	Incompatible forestry practices	**Low**	A, B, G
15	Incompatible grazing and ranching	**Low**	C, E, F
16	Channel modification/shipping lanes	**Low**	G
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Freshwater Marsh and Wet Prairie that were also identified as statewide threats (see list above in Conservation Threats section), are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Freshwater Marsh and Wet Prairie and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. Additional actions were developed to address threats specific to this habitat. These actions are intended to support the ecological restoration efforts under way in the Everglades region, specifically, and more generally to increase the spatial extent of herbaceous wetlands in the landscape, improve the functionality of existing herbaceous wetlands through both regional and small-scale hydrologic restoration projects, raise awareness of the need for fire in herbaceous wetland systems, prevent harm to wetland ecosystems caused by discharge to and nutrient loading

of marshes and wet prairies, and decrease the amount of wetland acreage converted to other land uses by making development more compatible with wetland habitat conservation.

Conversion to Agriculture

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Create voluntary incentives for maintenance and conversion of lands to agricultural uses that use less water and result in lower nutrient outputs into Florida's waters and wetlands, and create market-based incentives to compensate private landowners for the environmental services they provide to the state through management that increases water storage and nutrient reduction.	M	M	H

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Provide tax reductions or other voluntary incentives, such as density transfers, for environmentally friendly comprehensive development plans for projects that front on rivers and floodplains.	M	L	VH

Surface Water Withdrawal

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
VH	Continue funding projects that address ecological restoration, including Comprehensive Everglades Restoration Plan, minimum Flows and Levels, water reservations, and other conservation programs	VH	VH	VH

Incompatible Fire

Overall Rank	Education and Awareness	*Feasibility*	*Benefits*	Cost
M	Develop and disseminate a focused education program for ranchers and plantation owners on the value of growing season burns and burning in wetlands. Review and improve existing agency outreach materials to address these issues.	H	M	L

Incompatible Resource Extraction – Mining/Drilling

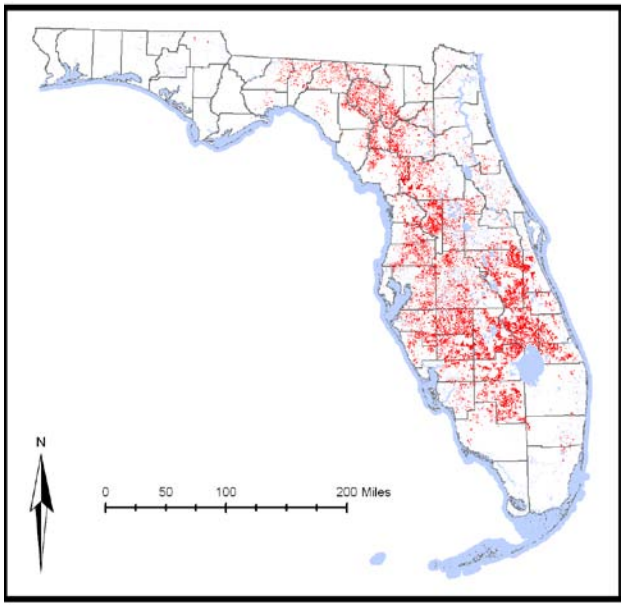
Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Create incentives to avoid loss of, and impacts to, SHCAs and sensitive habitats from mining, particularly wet and dry prairie, scrub, and bat caves.	H	M	H

Management of Nature – Water Control Structures

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Review existing Farm Bill programs and explore options for enhancing economic benefits to landowners that improve or remove water control structures.	VH	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Develop an awareness program for Drainage Districts created by Chapter 298 of the Florida Administrative Code ("298 Districts") to educate them about opportunities to improve fish and wildlife habitat conditions through operational and/or structural changes in their drainage systems.	H	L	M

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
H	Implement projects in the Comprehensive Everglades Restoration Plan.	H	H	VH
L	Create a grant program (or utilize existing Farm Bill and other federal programs) to replace or retrofit existing stop log or manually controlled structures with V-notch weirs in agricultural drainage systems. Give priority to those control structures identified as acting as barriers to wildlife movement or sheet flow.	H	L	H
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
H	Form an interagency task force to streamline the permitting process for wetland restoration projects that restore hydrology.	VH	M	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
M	Fund research to identify the habitat needs, movements, and impacts of wetland restoration on SGCN. Inventory water control structures, and identify the extent to which particular existing water control structures negatively affect species ecology.	VH	L	M
L	Recognizing that species move between wetland and upland habitats, assess the effectiveness of current BMP's regarding bedding near isolated wetlands.	H	L	L

Grassland/Improved Pasture



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status

Current condition: Good and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 2,931,999 acres (1,186,538 ha) of Grassland/Improved Pasture habitat exist, of which 6% (186,662 ac; 75,539 ha) are in existing conservation or managed areas. Another 7% (193,063 ac; 78,130 ha) are in Florida Forever projects, and 9% (262,558 ac; 106,253 ha) are in SHCA-designated lands. The remaining 78% (2,289,716 ac; 926,615 ha) are other private lands.

Habitat Description

FNAI type: None

This is an upland community where the predominant vegetative cover is very low-growing grasses and forbs, most commonly in monocultures of non-invasive, non-native species. Improved Pastures have typically been cleared, tilled, reseeded with specific grass types, and periodically improved with brush control and fertilizer application.

Associated Species of Greatest Conservation Need

Mammals

- *Condylura cristata* — Star-nosed Mole
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Sylvilagus floridanus* — Eastern Cottontail Rabbit
- *Sciurus niger shermani* — Sherman's Fox Squirrel
- *Geomys pinetis pinetis* — Southeastern Pocket Gopher
- *Spilogale putorius* — Spotted Skunk
- *Mephitis mephitis* — Striped Skunk
- *Puma concolor coryi* — Florida Panther

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Colinus virginianus* — Northern Bobwhite
- *Plegadis falcinellus* — Glossy Ibis
- *Mycteria americana* — Wood Stork
- *Elanoides forficatus* — Swallow-tailed Kite
- *Elanus leucurus* — White-tailed Kite
- *Ictinia mississippiensis* — Mississippi Kite
- *Caracara cheriway* — Crested Caracara
- *Falco sparverius paulus* — Southeastern American Kestrel
- *Falco columbarius* — Merlin
- *Falco peregrinus* — Peregrine Falcon
- *Grus canadensis pratensis* — Florida Sandhill Crane
- *Grus americana* — Whooping Crane
- *Calidris melanotos* — Pectoral Sandpiper
- *Columbina passerina* — Common Ground-Dove
- *Athene cunicularia floridana* — Florida Burrowing Owl
- *Lanius ludovicianus* — Loggerhead Shrike
- *Aphelocoma coerulescens* — Florida Scrub-Jay
- *Aimophila aestivalis* — Bachman’s Sparrow
- *Ammodramus savannarum* — Grasshopper Sparrow (migrant)
- *Ammodramus savannarum floridanus* — Florida Grasshopper Sparrow
- *Ammodramus henslowii* — Henslow’s Sparrow
- *Passerina ciris* — Painted Bunting
- *Sturnella magna* — Eastern Meadowlark

Amphibians

- *Ambystoma tigrinum* — Tiger Salamander
- *Pseudacris ornata* — Ornate Chorus Frog
- *Rana capito* — Gopher Frog

Reptiles

- *Terrapene carolina bauri* — Florida Box Turtle
- *Gopherus polyphemus* — Gopher Tortoise
- *Heterodon platirhinos* — Eastern Hognose Snake
- *Heterodon simus* — Southern Hognose Snake
- *Drymarchon couperi* — Eastern Indigo Snake

- *Pituophis melanoleucus mugitus* Florida Pine Snake
- *Lampropeltis calligaster* Mole Kingsnake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Invertebrates

- *Procambarus rogersi rogersi* A Crayfish
- *Chelyoxenus xerobatis* Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* Gopher Tortoise Onthophagus Commensal Scarab Beetle

Conservation Threats

Threats to Grassland/Improved Pasture habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to more intensive agriculture
- Conversion to housing and urban development
- Conversion to recreation areas
- Roads

No habitat-specific threats to Grassland/Improved Pasture were identified.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Fragmentation of habitats, communities, ecosystems	High
B	Habitat destruction or conversion	High
C	Altered species composition/dominance	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Roads	**High**	A, B
2	Conversion to housing and urban development	**High**	A, B
3	Conversion to agriculture	**Medium**	A, B
4	Conversion to recreation areas	**Low**	A, B
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Grassland/Improved Pasture that were also identified as statewide threats (Conversion to agriculture, Conversion to housing and urban development, Conversion to recreation areas, and Roads) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Because the experts did not identify any Grassland/Improved Pasture habitat-specific threats, no specific actions were identified. However, during the threats workshops, the participants identified several desired outcomes for this habitat that could form the basis for specific actions:

- While pasture is not a native landscape, pastures can provide significant wildlife habitat; therefore, conversion of pastures to more intense land uses should be discouraged, particularly in areas with karst geology. As much of this area is in private lands, incentives and/or cooperative agreements should be developed to identify and to retain or improve the functional values that these lands provide to wildlife.

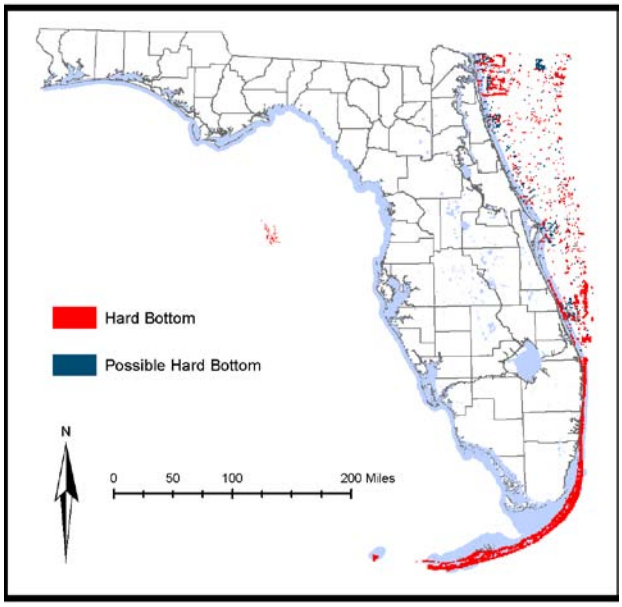
- Conversion of natural and semi-natural habitats to improved pasture should be discouraged through incentive programs and easements.

- The value of this habitat could be enhanced for species that use pasture but are not doing well overall. For example, kestrel nest boxes could be placed on rights-of-way, and animal burrows could be located and avoided by heavy equipment operators.

- More conservation land could be acquired (e.g., in Citrus County or adjacent to Withlacoochee State Forest) to protect habitat for burrowing owls, kestrels, and red-cockaded woodpecker.

- A network of contiguous habitats could be conserved, through voluntary restoration or preservation of patches of native vegetation at intervals across the range of this habitat.

Hard Bottom



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining.
Due to the lack of sufficient map data for this habitat category (see Appendix D. GIS Data Tables), no acreage estimates are currently available.

Habitat Description

FNAI type: Consolidated Substrate, Octocoral Bed, Sponge Bed

Hard Bottom is characterized as mixed communities of algae, sponges, octocorals and stony corals. This habitat occurs in subtidal, intertidal, and supratidal zones throughout Florida's coastal waters. Hard Bottom is composed of attendant epibenthic biota on a rocky substrate composed of coquina, limestone, or relic coral, molluscan, and annelid reefs. Coquina is a limestone composed of broken shell debris. Limestone rock (many different strata) occurs as high- or low-relief outcrops of calcium carbonate. Relic reefs are the skeletal remains of once-living reefs such as the Vermetid Reef built by worm-like gastropod mollusks, *Petaloconchus*. These reefs are only known to be found in shallow waters seaward of the outer islands in the Ten Thousand Islands area of southwest Florida.

Hard Bottom biological communities are structured by depth and latitude and inhabited by sessile, planktonic, epifaunal, and pelagic plants and animals; infaunal organisms are present in interstitial soft bottom substrate. In the region south of Stuart on the east coast and Bay Port on the west coast, subtidal hard bottom communities are characteristically inhabited by soft corals (octocorals) and sponges. Octocoral Beds have dense concentrations of sea fans, sea plumes, and sea feathers. Mobile species found in octocoral beds include flamingo tongue shell, purple shrimp,

and basket starfish. Sponge beds include the branching, vase, tube, Florida loggerhead, and sheepswool sponges. Other mobile fauna found in both the octocoral beds and the sponge beds include amphipods, isopods, burrowing shrimp, crabs, sand dollars, and many species of fish. Although the coral species found in Hard Bottom habitat are not reef-building, they do contribute to the three-dimensional nature of the areas by increasing the surface area for sessile organisms and by providing important refuges for a variety of fish and invertebrates.

Associated Species of Greatest Conservation Need

Mammals

- *Trichechus manatus latirostris* — Florida Manatee
- *Eubalaena glacialis* — North Atlantic Right Whale
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Aythya affinis* — Lesser Scaup
- *Gavia immer* — Common Loon
- *Podiceps auritus coronutus* — Horned Grebe
- *Egretta tricolor* — Tricolored Heron

Reptiles

- *Malaclemys terrapin* — Diamondback Terrapin
- *Chelonia mydas* — Green Turtle
- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley

Fish

- *Ginglymostoma cirratum* — Nurse Shark
- *Carcharhinus brevipinna* — Spinner Shark
- *Carcharhinus falciformis* — Silky Shark
- *Carcharhinus leucas* — Bull Shark
- *Carcharhinus limbatus* — Blacktip Shark
- *Carcharhinus obscurus* — Dusky Shark
- *Carcharhinus plumbeus* — Sandbar Shark
- *Galeocerdo cuvier* — Tiger Shark
- *Negaprion brevirostris* — Lemon Shark
- *Rhizoprionodon terraenovae* — Atlantic Sharpnose Shark
- *Sphyrna lewini* — Scalloped Hammerhead
- *Sphyrna mokarran* — Great Hammerhead
- *Sphyrna zygaena* — Smooth Hammerhead
- *Alopias superciliosus* — Bigeye Thresher
- *Pristis pectinata* — Smalltooth Sawfish
- *Manta birostris* — Giant Manta
- *Megalops atlanticus* — Tarpon
- *Echidna catenata* — Chain Moray
- *Enchelycore nigricans* — Viper Moray
- *Gymnothorax funebris* — Green Moray
- *Gymnothorax miliaris* — Goldentail Moray

- *Gymnothorax moringa* Spotted Moray
- *Gymnothorax vicinus* Purplemouth Moray
- *Uropterygias macularius* Marbled Moray
- *Opsanus beta* Gulf Toadfish
- *Opsanus pardus* Leopard Toadfish
- *Opsanus tau* Oyster Toadfish
- *Antennarius striatus* Striated Frogfish
- *Ogcocephalus corniger* Longnose Batfish
- *Ogcocephalus cubifrons* Polka-dot Batfish
- *Halicampus crinitus* Banded Pipefish
- *Aulostomus maculatus* Atlantic Trumpetfish
- *Centropomus undecimalis* Common Snook
- *Fistularia tabacaria* Bluespotted Cornetfish
- *Centropristis ocyurus* Bank Sea Bass
- *Centropristis philadelphica* Rock Sea Bass
- *Centropristis striata* Black Sea Bass
- *Cephalopholis cruentata* Graysby
- *Cephalopholis fulva* Coney
- *Dermatolepis inermis* Marbled Grouper
- *Epinephelus adscensionis* Rock Hind
- *Epinephelus drummondhayi* Speckled Hind
- *Epinephelus flavolimbatus* Yellowedge Grouper
- *Epinephelus guttatus* Red Hind
- *Epinephelus itajara* Goliath Grouper
- *Epinephelus morio* Red Grouper
- *Epinephelus mystacinus* Misty Grouper
- *Epinephelus nigritus* Warsaw Grouper
- *Epinephelus niveatus* Snowy Grouper
- *Epinephelus striatus* Nassau Grouper
- *Hypoplectrus aberrans* Yellowbelly Hamlet
- *Hypoplectrus guttavarius* Shy Hamlet
- *Hypoplectrus nigricans* Black Hamlet
- *Hypoplectrus puella* Barred Hamlet
- *Hypoplectrus unicolor* Butter Hamlet
- *Liopropoma eukrines* Wrasse Basslet
- *Mycteroperca bonaci* Black Grouper
- *Mycteroperca interstitialis* Yellowmouth Grouper
- *Mycteroperca microlepis* Gag
- *Mycteroperca phenax* Scamp
- *Paranthias furcifer* Atlantic Creole-Fish
- *Rypticus bistrispinus* Freckled Soapfish
- *Rypticus saponaceus* Greater Soapfish
- *Rypticus subbifrenatus* Spotted Soapfish
- *Serranus annularis* Orangeback Bass
- *Serranus baldwini* Lantern Bass
- *Serranus tabacarius* Tobaccofish
- *Serranus tigrinus* Harlequin bass
- *Opistognathus macrognathus* Banded Jawfish
- *Opistognathus whitehursti* Dusky Jawfish
- *Apogon aurolineatus* Bridle Cardinalfish
- *Apogon binotatus* Barred Cardinalfish
- *Apogon maculatus* Flamefish
- *Apogon planifrons* Pale Cardinalfish

- *Apogon pseudomaculatus* Twospot Cardinalfish
- *Apogon townsendi* Belted Cardinalfish
- *Astrapogon alutus* Bronze Cardinalfish
- *Astrapogon puncticulatus* Blackfin Cardinalfish
- *Phaeoptyx conklini* Freckled Cardinalfish
- *Phaeoptyx pigmentaria* Dusky Cardinalfish
- *Phaeoptyx xenus* Sponge Cardinalfish
- *Pomatomus saltatrix* Bluefish
- *Alectis ciliaris* African Pompano
- *Elagatis bipinnulata* Rainbow Runner
- *Selar crumenophthalmus* Bigeye Scad
- *Seriola dumerili* Greater Amberjack
- *Seriola rivoliana* Almaco Jack
- *Seriola zonata* Banded Rudderfish
- *Lutjanus analis* Mutton Snapper
- *Lutjanus apodus* Schoolmaster
- *Lutjanus buccanella* Blackfin Snapper
- *Lutjanus campechanus* Red Snapper
- *Lutjanus cyanopterus* Cubera Snapper
- *Lutjanus griseus* Gray Snapper
- *Lutjanus jocu* Dog Snapper
- *Lutjanus mahogoni* Mahogany Snapper
- *Lutjanus synagris* Lane Snapper
- *Lutjanus vivanus* Silk Snapper
- *Ocyurus chrysurus* Yellowtail Snapper
- *Rhomboplites aurorubens* Vermilion Snapper
- *Anisotremus surinamensis* Black Margate
- *Anisotremus virginicus* Porkfish
- *Haemulon album* Margate
- *Haemulon aurolineatum* Tomtate
- *Haemulon plumierii* White Grunt
- *Haemulon sciurus* Bluestriped grunt
- *Orthopristis chrysoptera* Pigfish
- *Archosargus probatocephalus* Sheepshead
- *Calamus bajonado* Jolthead Porgy
- *Calamus nodosus* Knobbed Porgy
- *Pagrus pagrus* Red Porgy
- *Bairdiella sanctaeluciae* Striped Croaker
- *Equetus lanceolatus* Jackknife-Fish
- *Equetus punctatus* Spotted Drum
- *Odontoscion dentex* Reef Croaker
- *Pareques acuminatus* High-Hat
- *Chaetodon striatus* Banded Butterflyfish
- *Prognathodes aculeatus* Longsnout Butterflyfish
- *Holacanthus bermudensis* Blue Angelfish
- *Holacanthus tricolor* Rock Beauty
- *Amblycirrhitus pinos* Redspotted Hawkfish
- *Abudefduf taurus* Night Sergeant
- *Chromis enchrysura* Yellowtail Reeffish
- *Chromis multilineata* Brown Chromis
- *Chromis scotti* Purple Reeffish
- *Stegastes adustus* Dusky Damselfish
- *Stegastes diencaeus* Longfin Damselfish

- *Stegastes leucostictus* Beaugregory
- *Stegastes variabilis* Cocoa Damselfish
- *Bodianus pulchellus* Spotfin Hogfish
- *Clepticus parrae* Creole Wrasse
- *Halichoeres bathyphilus* Greenband Wrasse
- *Halichoeres bivittatus* Slippery Dick
- *Halichoeres caudalis* Painted Wrasse
- *Halichoeres cyanocephalus* Yellowcheek Wrasse
- *Halichoeres garnoti* Yellowhead Wrasse
- *Halichoeres maculipinna* Clown Wrasse
- *Halichoeres poeyi* Blackear Wrasse
- *Halichoeres radiatus* Puddingwife
- *Lachnolaimus maximus* Hogfish
- *Thalassoma bifasciatum* Bluehead
- *Scarus coelestinus* Midnight Parrotfish
- *Scarus coeruleus* Blue Parrotfish
- *Scarus guacamaia* Rainbow Parrotfish
- *Scarus iseri* Striped Parrotfish
- *Scarus taeniopterus* Princess Parrotfish
- *Scarus vetula* Queen Parrotfish
- *Sparisoma atomarium* Greenblotch Parrotfish
- *Labrisomus bucciferus* Puffcheek Blenny
- *Labrisomus gobio* Palehead Blenny
- *Labrisomus guppyi* Mimic Blenny
- *Labrisomus haitiensis* Longfin Blenny
- *Labrisomus kalisherae* Downy Blenny
- *Labrisomus nigricinctus* Spotcheek Blenny
- *Malacoctenus aurolineatus* Goldline Blenny
- *Malacoctenus macropus* Rosy Blenny
- *Malacoctenus triangulatus* Saddled Blenny
- *Paraclinus grandicomis* Horned Blenny
- *Paraclinus nigripinnis* Blackfin Blenny
- *Starksia ocellata* Checkered Blenny
- *Acanthemblemaria chaplini* Papillose Blenny
- *Emblemaria atlantica* Banner Blenny
- *Hemiemblemaria simula* Wrasse Blenny
- *Stathmonotus hemphilli* Blackbelly Blenny
- *Hypleurochilus bermudensis* Barred Blenny
- *Ophioblennius macclurei* Redlip Blenny
- *Gobiesox strumosus* Skilletfish
- *Coryphopterus dicrus* Colon Goby
- *Coryphopterus glaucofraenum* Bridled Goby
- *Coryphopterus thrix* Bartial Goby
- *Gnatholepis thompsoni* Goldspot Goby
- *Gobiosoma grosvenori* Rockcut Goby
- *Lythrypnus nesiotes* Island Goby
- *Lythrypnus spilus* Bluegold Goby
- *Nes longus* Orangespotted Goby
- *Acanthurus bahianus* Ocean Surgeon
- *Acanthurus chirurgus* Doctorfish
- *Acanthurus coeruleus* Blue Tang
- *Paralichthys albigutta* Gulf Flounder
- *Balistes capriscus* Gray Triggerfish

- *Balistes vetula* Queen Triggerfish
- *Cantherhines pullus* Orangespotted Filefish
- *Monacanthus tuckeri* Slender Filefish
- *Lactophrys bicaudalis* Spotted Trunkfish
- *Lactophrys trigonus* Trunkfish
- *Canthigaster rostrata* Sharpnose Puffer
- *Diodon holocanthus* Balloonfish

Invertebrates

- *Ircinia campana* Vase Sponge
- *Spongia barbara* Yellow Sponge
- *Spheciospongia vesparia* Loggerhead Sponge
- *Agaricia agaricites* Lettuce Coral
- *Stephanocenia michelinii* Blushing Star Coral
- *Cladocora arbuscula* Tube Coral
- *Colpophyllia natans* Boulder Brain Coral
- *Diploria clivosa* Knobby Brain Coral
- *Diploria labyrinthiformis* Grooved Brain Coral
- *Diploria strigosa* Symmetrical Brain Coral
- *Favia fragum* Golf Ball Coral
- *Montastraea annularis* Column Star Coral
- *Montastraea cavernosa* Great Star Coral
- *Solenastrea bournoni* Smooth Star Coral
- *Solenastrea hyades* Knobby Star Coral
- *Dichocoenia stokesii* Pineapple Coral
- *Meandrina meandrites* Maze Coral
- *Isophyllastraea rigida* Rough Star Coral
- *Isophyllia sinuosa* Sinuous Cactus Coral
- *Mussa angulosa* Large Flower Coral
- *Manicina areolata* Rose Coral
- *Scolymia lacera* Atlantic Mushroom Coral
- *Oculina diffusa* Diffuse Ivory Bush Coral
- *Madracis decactis* Ten-rayed Star Coral
- *Porites astreoides* Mustard Hill Coral
- *Porites porites* Finger Coral
- *Phyllangia americana* Hidden Cup Coral
- *Siderastrea radians* Lesser Starlet Coral
- *Siderastrea siderea* Massive Starlet Coral
- *Zoanthus pulchellus* Green Sea Mat
- *Millepora alcicornis* Fire Coral
- *Lima scabra scabra* Flame Scallop
- *Crassostrea virginica* Eastern Oyster
- *Spondylus americanus* Atlantic Thorny Oyster
- *Octopus vulgaris* Octopus
- *Fasciolaria lilium* Banded Tulip
- *Pleuroploca gigantea* Horse Conch
- *Busycon sinistrum* Lightning Whelk
- *Cypraea cervus* Atlantic Deer Cowrie
- *Cyphoma gibbosum* Flamingo Tongue
- *Charonia tritonis variegata* Atlantic Trumpet Triton
- *Strombus gigas* Queen Conch
- *Oreaster reticulatis* Cushion Star, Bahama Star

- *Diadema antillarum* Long-spined Urchin
- *Lytechinus variegatus* Variegated Urchin
- *Tripneustes ventricosus* Sea Egg Urchin
- *Asteroporpa annulata* Basket Star
- *Astrophyton muricatum* Basket Star
- *Hermodice carunculata* Fire (Bristle) Worm
- *Lysmata wurdemanni* Peppermint Shrimp
- *Periclimenes yucatanicus* Spotted Cleaner Shrimp
- *Panulirus argus* Spiny Lobster
- *Callinectes sapidus* Blue Crab
- *Menippe nodifrons* Cuban Stone Crab
- *Gonodactylus spp.* Mantis Shrimp
- *Lysiosquilla scabricauda* Thumbsplitter Mantis Shrimp
- *Didemnum vanderhorst* Tunicates
- *Eudistoma species indeterminate* Strawberry Tunicates

Conservation Threats

Threats to Hard Bottom habitats are caused by changes in sediment accretion and removal from beach nourishment activities, damage from ship and boat groundings, cumulative impacts of anchors of all size vessels, and alteration of species composition and trophic interactions caused by parasites and pathogens.

Threats to Hard Bottom habitats that were also identified for multiple other habitats are addressed in Chapter Multiple Habitats Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Dam operations/incompatible release of water (quality, quantity, timing)
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible wildlife and fisheries management strategies
- Invasive animals
- Invasive plants
- Key predator/herbivore loss
- Management of nature (beach nourishment and impoundments)
- Roads, bridges and causeways
- Shoreline hardening
- Vessel impacts

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered species composition	High
B	Altered structure	High
C	Altered water quality–physical, chemistry	High
D	Altered weather regime/sea level rise	High
E	Habitat destruction	High

F	Habitat disturbance	High
G	Keystone species missing or lacking in abundance	High
H	Missing key communities or functional guilds/trophic shift	High
I	Sedimentation	Medium

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Parasites/pathogens	**High**	A, B, E, G, H
2	Disruption of longshore transport of sediments	**High**	E, F, I
3	Channel modification/shipping lanes	**High**	E, F, I
4	Incompatible industrial operations	**Medium**	C, E
5	Incompatible fishing pressure	**Medium**	A, G
6	Dam operations/incompatible release of water: (quality, quantity, timing)	**Medium**	A, C, F
7	Climate variability	**Medium**	D
8	Inadequate stormwater management	**Medium**	A, C, G
9	Key predator/herbivore losses	**Medium**	A, F
10	Harmful algal blooms	**Medium**	A, F, G
11	Invasive plants	**Medium**	A, H
12	Management of nature (beach nourishment, impoundments)	**Medium**	A, C, E, F, I
13	Fishing gear impacts	**Medium**	B, E, F
14	Incompatible wildlife and fisheries management strategies	**Medium**	A, G
15	Placement of artificial structures	**Medium**	A, B, E, H
16	Shoreline hardening	**Medium**	E
17	Vessel impacts	**Medium**	E
18	Chemicals and toxins	**Medium**	F
19	Invasive animals	**Medium**	A
20	Solid waste	**Medium**	E, F
21	Utility corridors	**Low**	B, E
22	Roads, bridges and causeways	**Low**	E
23	Boating impacts	**Low**	E
24	Incompatible aquarium trade	**Low**	A
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Hard Bottom that were also identified as statewide threats (see list above), are in Chapter Multiple Habitats Threats and Conservation Actions. Outcomes identified for this habitat address better understanding of the effects of beach nourishment and ensuring that ship anchorages are not sited over sensitive areas to reduce the probability that vessels run aground.

Highest ranked actions identified for abating this source of stress focus on:

- Establishing a funding source for remediation of damages from vessel impacts
- Development of a vessel anchoring management plan
- Improving the detection of pathogens, parasites, and biotoxins in marine organisms and the ability to rehabilitate impacted animals

Additional actions included:

- Evaluating whether parasites are indicators of estuarine and marine health
- Developing methods for keeping vessels away from sensitive areas
- Supporting restoration of damaged areas and replacement of species lost

The following actions, organized by action type, were identified to abate this threat:

Beach Nourishment/Impoundments

Overall Rank	Land/Water Species Management	*Feasibility*	*Benefits*	Cost
H	Review and revise criteria for statewide monitoring protocols to assess beach and offshore habitat impacts related to beach nourishment projects similar to BACI (Before-after-control-impacts: the analytical framework and adaptive management tool).	VH	M	L

Parasites/Pathogens

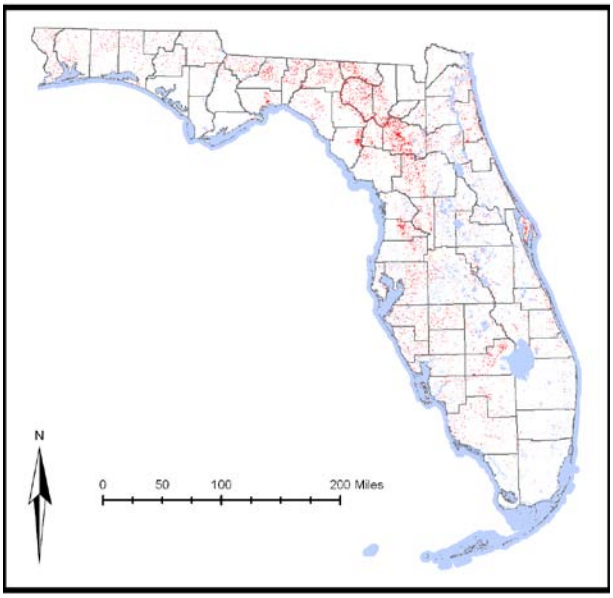
Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
H	Improve capabilities for/sophistication of inspection, recognition and treatment of aquatic organism diseases and parasites.	VH	M	M
H	Continue and support response teams/hotlines associated with disease outbreak, trauma, strandings, and mortality events for fish and wildlife species.	VH	M	M
L	Expand the number and capabilities of rehabilitation facilities for diseased and injured wildlife.	H	L	VH
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Conduct additional research on aquatic wildlife parasites and diseases, and the impacts of biotoxins on fish and wildlife resources.	VH	M	H
H	Synthesize and consolidate understanding, and identify gaps in understanding, of marine flora/fauna diseases, pathogens, and biotoxin impacts on fish and wildlife resources.	VH	M	L

M	Research and examine use of parasites as indicators of estuarine and marine health.	VH	L	M

Vessel Impacts

Overall Rank	**Land/Water/Species Management:**	*Feasibility*	*Benefits*	**Cost**
VH	Explore establish a marine/estuarine restoration fund.	M	VH	H
M	Develop a passive warning system for vessels to alert operators of sensitive or danger zones (shallows, reefs).	M	M	H
M	Encourage avoidance of anchorage and moorage in sensitive areas.	M	M	M
M	Identify appropriate areas for anchorage and moorings. Develop educational tools on low-impact mooring techniques.	M	M	M

Hardwood Hammock Forest



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Unknown. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 979,826 acres (396,522 ha) of Hardwood Hammock Forest habitat exist, of which 16% (159,557 ac; 64,570 ha) are in existing conservation or managed areas. Another 4% (36,874 ac; 14,922 ha) are in Florida Forever projects and 6% (62,053 ac; 25,112 ha) are SHCA-designated lands. The remaining 74% (721,342 ac; 291,917 ha) are other private lands.

Habitat Description

FNAI type: Xeric Hammock, Maritime Hammock, Slope Forest, Prairie Hammock, Upland Hardwood Forest

This class includes the major upland hardwood associations that occur statewide on fairly rich sandy soils. Variations in species composition and the local or spatial distributions of these communities are due in part to differences in soil moisture regimes, soil type, and geographic location within the state. Mesic and xeric variations are included within this association.

The mesic hammock community represents the climax vegetation type within many areas of northern and central Florida. Characteristic species in the extreme north include American beech, southern magnolia, Shumard oak, white oak, mockernut hickory, pignut hickory, sourgum,

basswood, white ash, mulberry, and spruce pine. Mesic hammocks of the peninsula are less diverse due to the absence of hardwood species that are adapted to more northerly climates, and are characterized by laurel oak, hop hornbeam, blue beech, sweetgum, cabbage palm, American holly, and southern magnolia.

Xeric hammocks occur on deep, well-drained, sandy soils where fire has been absent for long periods of time. These open, dry hammocks contain live oak, sand-live oak, bluejack oak, blackjack oak, southern red oak, sand-post oak, and pignut hickory.

Also included in this category are cabbage palm-live oak hammocks. This class is characterized by cabbage palms and live oaks occurring in small clumps within prairie communities. These hammocks typically have an open understory which may include such species as wax myrtle, water oak, and saw palmetto. Cabbage palm-live oak hammocks are also often found bordering large lakes and rivers, and are distributed throughout the prairie region of south central Florida and extend northward in the St. Johns River basin. Cabbage palms often form a fringe around hardwood "islands" located within improved pastures.

Associated Species of Greatest Conservation Need

Mammals

- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Tamias striatus* — Eastern Chipmunk
- *Ursus americanus floridanus* — Florida Black Bear
- *Mephitis mephitis* — Striped Skunk
- *Puma concolor coryi* — Florida Panther

Birds

- *Colinus virginianus* — Northern Bobwhite
- *Elanoides forficatus* — Swallow-tailed Kite
- *Ictinia mississippiensis* — Mississippi Kite
- *Buteo platypterus platypterus* — Broad-winged Hawk
- *Buteo brachyurus* — Short-tailed Hawk
- *Caracara cheriway* — Crested Caracara
- *Columbina passerine* — Common Ground-Dove
- *Melanerpes erythrocephalus* — Red-headed Woodpecker
- *Picoides villosus* — Hairy Woodpecker
- *Colaptes auratus auratus* — Northern Flicker
- *Tyrannus dominicensis* — Gray Kingbird
- *Vireo altiloquus* — Black-whiskered Vireo
- *Sitta carolinensis* — White-breasted Nuthatch
- *Hylocichla mustelina* — Wood Thrush
- *Dendroica dominica stoddardi* — Stoddard's Yellow-throated Warbler
- *Dendroica petechia gundlachi* — Cuban Yellow Warbler
- *Dendroica discolor paludicola* — Florida Prairie Warbler
- *Dendroica cerulea* — Cerulean Warbler

- *Protonotaria citrea* — Prothonotary Warbler
- *Helmitheros vermivorum* — Worm-eating Warbler
- *Limnothlypis swainsonii* — Swainson's Warbler
- *Seiurus montacilla* — Louisiana Waterthrush
- *Oporornis formosus* — Kentucky Warbler
- *Wilsonia citrina* — Hooded Warbler
- *Passerina ciris* — Painted Bunting

Reptiles

- *Terrapene carolina bauri* — Florida Box Turtle
- *Gopherus polyphemus* — Gopher Tortoise
- *Heterodon platirhinos* — Eastern Hognose Snake
- *Heterodon simus* — Southern Hognose Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Stilosoma extenuatum* — Short-tailed Snake
- *Tantilla relicta pamlica* — Coastal Dunes Crowned Snake
- *Crotalus horridus* — Timber Rattlesnake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake

Invertebrates

- *Sphodros rufipes* — Red-legged Purse-web Spider
- *Anthanassa frisia* — Cuban Crescent

Conservation Threats

Threats to Hardwood Hammock Forest habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Conversion to recreation areas
- Groundwater withdrawal
- Incompatible fire
- Incompatible resource extraction: mining/drilling
- Invasive animals
- Invasive plants
- Roads
- Surface water withdrawal

Threats specific to Hardwood Hammock Forest were limited to incompatible residential activities that include movement of fertilizer, herbicide, and invasive species from landscape maintenance, activities of people, their pets, and nuisance species, and disposal of yard and household waste.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Habitat destruction or conversion	High
B	Altered species composition/dominance	Medium

Stresses		Habitat Stress Rank
C	Altered hydrologic regime	Medium
D	Altered community structure	Medium
E	Fragmentation of habitats, communities, ecosystems	Medium
F	Erosion/sedimentation	Low
G	Altered landscape mosaic or context	Low
H	Altered fire regime	Low
I	Habitat degradation/disturbance	Low
J	Excessive depredation and/or parasitism	Low
K	Missing key communities, functional guilds, or seral stages	Low
L	Insufficient size/extent of characteristic communities	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Conversion to commercial and industrial development	**High**	A, C
2	Conversion to housing and urban development	**High**	A, C
3	Roads	**High**	A, C
4	Surface water withdrawal	**Medium**	B
5	Incompatible resource extraction: mining/drilling	**Medium**	A
6	Invasive plants	**Medium**	B
7	Incompatible agricultural practices	**Low**	C
8	Conversion to recreation areas	**Low**	A
9	Incompatible residential activities	**Low**	A, B
10	Incompatible fire	**Low**	B
11	Invasive animals	**Low**	B
12	Conversion to agriculture	**Low**	A
13	Groundwater withdrawal	**Low**	B
14	Humidity and temperature changes	**Low**	B
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

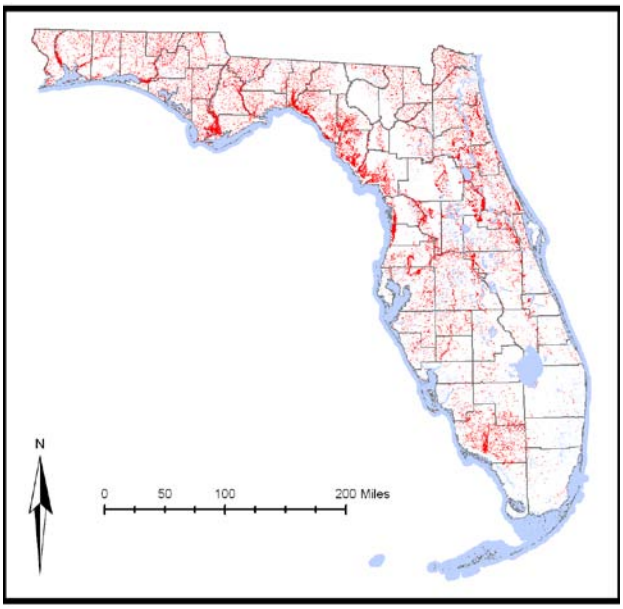
Actions to abate the threats to Hardwood Hammock Forest that were also identified as statewide threats (see list above in Conservation Threats section) are in the Chapter Multiple Habitat Threats and Conservation Actions

Actions to abate specific threats that were identified for Hardwood Hammock Forest are below, though none were ranked of high priority for implementation. These actions were designed to reduce the impacts from activities of residents adjacent to this habitat.

Incompatible Residential Activities

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Expand the scale of the Florida Yards and Neighborhoods program from certifying individual landowners to whole neighborhoods; certification should be renewed biennially and any time property ownership changes.	M	M	L
L	Provide incentives (through local governments) for covenants, codes, and restrictions in residential areas that address issues of pesticide use, pet control, feeding of wildlife, household or yard waste disposal, landscape plants, irrigation use, prescribed fire tolerance, and light-use in coastal areas.	M	L	L
L	Identify and promote effective reward models for homeowners, maintenance companies, and municipalities for reducing impacts on neighboring conservation areas.	M	L	L
L	Provide incentives (through local governments) (e.g., fast track, density breaks) for developers that produce on-site, site-specific educational materials and standards that are maintained by homeowner associations.	M	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Promote and fund continuing education courses for landscape maintenance industry that include appropriate use of chemicals, irrigation, plants, and disposal of yard waste.	H	M	M

Hardwood Swamp/Mixed Wetland Forest



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 3,250,491 acres (1,315,427 ha) of Hardwood Swamp/Mixed Wetland Forest habitat exist, of which 36% (1,175,787 ac; 475,824 ha) are in conservation or managed areas. Another 8% (274,280 ac; 110,997 ha) are in Florida Forever projects and 11% (346,382 ac; 140,176 ha) are in SHCA-designated lands. The remaining 45% (1,454,042 ac; 588,430 ha) are other private lands.

Habitat Description

FNAI type: Bottomland Forest, Basin Swamp

These wooded wetland communities are composed of either pure stands of hardwoods, or occur as a mixture of hardwoods and cypress where hardwoods achieve dominance. This association of wetland-adapted trees occurs throughout the state on organic soils and forms the forested floodplains of non-alluvial rivers, creeks, and broad lake basins. Tree species include a mixed overstory containing black gum, water tupelo, bald cypress, dahoon holly, red maple, swamp ash, cabbage palm, and sweetbay. Also included in this category are mixed wetland forest communities in which neither hardwoods nor conifers achieve dominance. The mix can include hardwoods with pine or cypress and can represent a mixed hydric site or a transition between hardwoods and conifers on hydric/mesic sites. Hardwood Swamp/Mixed Wetland Forests occur on

low-lying flatlands or scattered low spots in basins and depressions that will only flood in extreme conditions. The canopy is usually dense and closed, keeping air movement and light penetration relatively low and, thus, keeping the humidity high. Due to these damp conditions, this habitat infrequently burns.

Associated Species of Greatest Conservation Need

Mammals

- *Blarina carolinensis shermani* — Sherman's Short-tailed Shrew
- *Sorex longirostris* — Southeastern Shrew
- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Ursus americanus floridanus* — Florida Black Bear
- *Lutra canadensis lataxina* — River Otter
- *Mustela vison evergladensis* — Everglades Mink
- *Mustela vison halilimnetes* — Gulf Salt Marsh Mink
- *Mustela vison lutensis* — Atlantic Salt Marsh Mink
- *Mephitis mephitis* — Striped Skunk
- *Puma concolor coryi* — Florida Panther

Birds

- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Mycteria americana* — Wood Stork
- *Elanoides forficatus* — Swallow-tailed Kite
- *Ictinia mississippien*sis — Mississippi Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Buteo platypterus platypterus* — Broad-winged Hawk
- *Buteo brachyurus* — Short-tailed Hawk
- *Aramus guarauna* — Limpkin
- *Picoides villosus* — Hairy Woodpecker
- *Campephilus principalis* — Ivory-billed Woodpecker
- *Protonotaria citrea* — Prothonotary Warbler
- *Limnothlypis swainsonii* — Swainson’s Warbler
- *Wilsonia citrina* — Hooded Warbler

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Desmognathus auriculatus* — Southern Dusky Salamander
- *Stereochilus marginatus* — Many-lined Salamander
- *Eurycea chamberlaini* — Chamberlain's Dwarf Salamander
- *Rana virgatipes* — Carpenter Frog

Reptiles

- *Terrapene carolina major* — Gulf Coast Box Turtle
- *Drymarchon couperi* — Eastern Indigo Snake

Fish

- *Atractosteus spatula* — Alligator Gar
- *Notropis melanostomus* — Blackmouth Shiner
- *Umbra pygmaea* — Eastern Mudminnow
- *Acantharchus pomotis* — Mud Sunfish
- *Etheostoma proeliare* — Cypress Darter

Conservation Threats

Threats to Hardwood Swamp/Mixed Wetland Forest habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to housing and urban development
- Groundwater withdrawal
- Incompatible fire
- Incompatible forestry practices
- Incompatible recreational activities
- Invasive animals
- Invasive plants
- Roads
- Surface water withdrawal and diversion

Threats specific to Hardwood Swamp/Mixed Wetland Forest include changes to the fire and hydrological regimes that have resulted in loss of marsh or seepage wetlands embedded within this forested wetland habitat. Water control structures from weirs to dams and surface drainage from agricultural and developed areas into these wetlands have exacerbated water level and quality changes.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered hydrologic regime	High
B	Altered community structure	High
C	Altered species composition/dominance	High
D	Altered landscape mosaic or context	Medium
E	Habitat destruction or conversion	Medium
F	Fragmentation of habitats, communities, ecosystems	Medium
G	Missing key communities, functional guilds, or seral stages	Medium
H	Altered fire regime	Medium
I	Altered water quality of surface water or aquifer: nutrients	Low
J	Habitat degradation/disturbance	Low
K	Erosion/sedimentation	Low
L	Altered soil structure and chemistry	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Surface water withdrawal	**High**	A, C, D, F, H
2	Invasive plants	**High**	B, C, H
3	Incompatible forestry practices	**High**	B, C, G
4	Invasive animals	**Medium**	B, C
5	Roads	**Medium**	A, D, E, F, H
6	Incompatible fire	**Medium**	C, H
7	Conversion to agriculture	**Medium**	D, E
8	Conversion to housing and urban development	**Medium**	D, E
9	New dams	**Medium**	B, C, G
10	Incompatible vegetation harvest	**Low**	B, C
11	Groundwater withdrawal	**Low**	A
12	Dam operations	**Low**	B, C
13	Management of nature–water control structures	**Low**	A
14	Incompatible recreational activities	**Low**	C, E
15	Incompatible grazing and ranching	**Low**	C
16	Incompatible animal harvest	**Low**	C
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Hardwood Swamp/Mixed Wetland Forest that were also identified as statewide threats (Surface water withdrawal and diversion, Invasive plants, Incompatible forestry practices (also see actions below), Invasive animals, Roads, Incompatible fire, Conversion to agriculture (also see actions below), Conversion to housing and urban development (also see actions below), Groundwater withdrawal, Incompatible recreational activities) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Hardwood Swamp/Mixed Wetland Forest are below. These actions were designed to restore more natural fire and hydrological regimes, the latter through alteration of both local surface water drainage and retrofitting and restoring existing water control structures.

Conversion to Agriculture

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Encourage incentives for maintenance and conversion of lands to agricultural uses that use less water and result in lower nutrient outputs into Florida's waters and wetlands, and create market-based incentives to compensate private landowners for the environmental services they provide to the state through management that increases water storage and nutrient reduction.	M	M	H

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Encourage tax or other incentives, such as density transfers, for environmentally friendly comprehensive development plans for projects that front on rivers and floodplains.	M	L	VH

Dam Operations

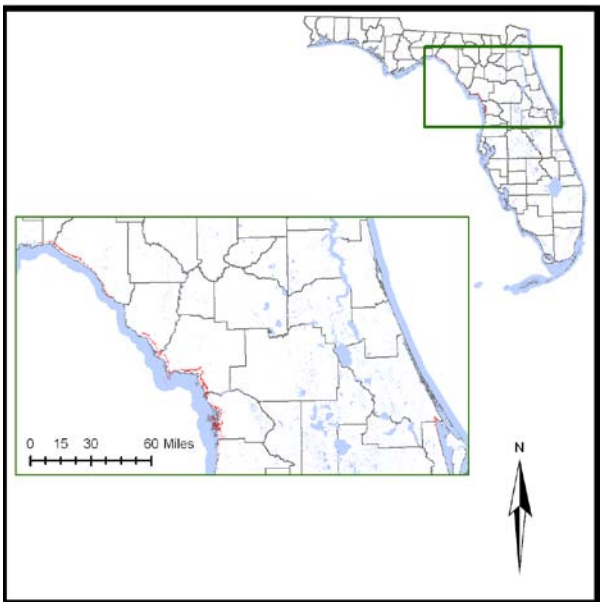
Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Coordinate interstate Strategy actions to ensure that all fish and wildlife resources in all states are protected when changing dam operations in shared basins. (USFWS)	M	H	L
L	Coordinate multiagency review of USACE activities, including biological aspects (fish spawn guidelines, protection of fish and wildlife resources) of water control plans for interstate water projects, fish spawn guidelines, re-establishing natural seasonal fluctuation of flows.	H	L	M
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Work with all affected parties to reassess the value in implementing the U.S. Forest Service plan to remove Rodman Dam and restore impacted aquatic and wetland habitat.	H	M	H
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Determine the appropriate hydrological flows and levels for water reservations on the Apalachicola, Yellow, Ochlockonee, and other interstate rivers using the ESWM (Ecologically Sustainable Water Management) approach.	M	H	H

Management of Nature – Water Control Structures

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Explore options for enhancing economic benefits to landowners that improve or remove water control structures.	VH	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Work with affected parties to reassess the value in implementing the U.S. Forest Service plan to remove Rodman Dam and restore the lower Ocklawaha River.	VH	L	VH
L	Establish a fund for fish and aquatic wildlife passage research and improvements to existing dams and other water control structures to facilitate movement of migratory species (e.g., Apalachicola Woodruff Dam work).	H	L	VH

L	Encourage incentive-based programs to replace or retrofit existing stop log or manually controlled structures with V-notch weirs in agricultural drainage systems. Give priority to those control structures that are identified as acting as barriers to wildlife movement or sheet flow.	H	L	H
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
H	Form an interagency task force to streamline the permitting process for wetland restoration projects on private lands and public lands that involve removing small, local water control structures.	VH	M	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
M	Fund research to identify the habitat needs and movement requirements of native SGCN aquatic species, inventory water control structures, and identify the extent to which particular existing water control structures negatively affect species ecology.	VH	L	M

Hydric Hammock



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 35,341 acres (14,302 ha) of Hydric Hammock habitat exist, of which 75% (26,409 ac; 10,687 ha) are in existing conservation or managed areas. Another 9% (3,271 ac; 1,324 ha) are in Florida Forever projects, and 2% (691 ac; 280 ha) are in SHCA-designated lands. The remaining 14% (4,970 ac; 2,011 ha) are other private lands.

Habitat Description

FNAI type: Hydric Hammock

Hydric Hammock occurs on soils that are poorly drained or have high water tables. This association is a still-water wetland, flooded less frequently and for shorter periods of time than mixed hardwood and cypress swamps. Outcrops of limestone are common in the Gulf coastal area. Typical plant species include laurel oak, live oak, cabbage palm, southern red cedar, and sweetgum. Canopy closure is typically 75 to 90 percent. The sub-canopy layer and ground layer vegetation is highly variable between sites. Wax myrtle is the most frequent shrub in Hydric Hammock. Other shrubs include yaupon, dahoon, and swamp dogwood. Ground cover may be absent or consist of a dense growth of ferns, sedges, grasses, and greenbriars. Sites are usually between mesic hammocks or pine flatwoods and river swamp, wet prairie, or marsh. Hydric Hammock is found in a narrow band along parts of the Gulf coast and along the St. Johns River where it often extends to the edge of coastal salt marshes.

Associated Species of Greatest Conservation Need

Mammals

- *Condylura cristata* — Star-nosed Mole
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Ursus americanus floridanus* — Florida Black Bear
- *Lutra canadensis lataxina* — River Otter

Birds

- *Colinus virginianus* — Northern Bobwhite
- *Elanoides forficatus* — Swallow-tailed Kite
- *Buteo brachyurus* — Short-tailed Hawk
- *Caracara cheriway* — Crested Caracara
- *Limnothlypis swainsonii* — Swainson's Warbler
- *Wilsonia citrina* — Hooded Warbler
- *Passerina ciris* — Painted Bunting

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Pseudobranchus striatus lustricolus* — Gulf Hammock Dwarf Siren
- *Ambystoma cingulatum* — Flatwoods Salamander
- *Pseudacris ornata* — Ornate Chorus Frog

Reptiles

- *Terrapene carolina major* — Gulf Coast Box Turtle
- *Terrapene carolina bauri* — Florida Box Turtle
- *Drymarchon couperi* — Eastern Indigo Snake
- *Lampropeltis getula* — Common Kingsnake

Invertebrates

- *Sphodros rufipes* — Red-legged Purse-web Spider

Conservation Threats

Threats to Hydric Hammock habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Climate variability
- Invasive plants

Habitat-specific threats to Hydric Hammock were identified because of potential military use of a new area along the Big Bend coastline that includes significant occurrences of this habitat.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered species composition/dominance	High
B	Habitat destruction or conversion	High
C	Altered hydrologic regime	Medium
D	Altered community structure	Medium
E	Erosion/sedimentation	Medium
F	Altered water quality of surface water or aquifer: nutrients	Medium

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Sea level rise	**High**	A, B
2	Invasive plants	**Medium**	A
3	Military activities	**Low**	A, B
Statewide Threat Rank of Habitat		**Medium**	

Conservation Actions

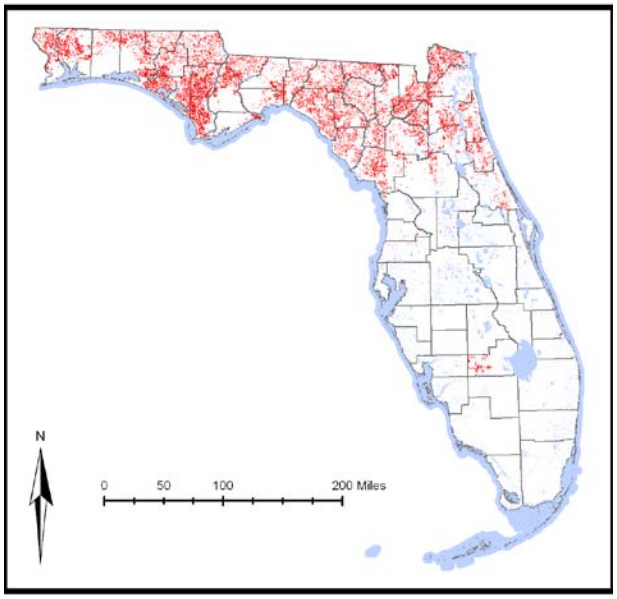
Actions to abate the threats to Hydric Hammock that were also identified as statewide threats (Climate variability, Invasive plants) are addressed in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions were developed to ensure that any expansion of military activity into this habitat would be sensitive to and appropriately mitigate for impacts to the habitat and SGCN it supports.

Military Activities

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Establish a permanent consultative group of multi-agency wildlife and habitat professionals that work with USDOD on development of any statewide plans for base expansion, increased usage, and growth or closure needs to enhance positive, or minimize any negative, impacts on wildlife and conservation lands.	M	H	M
Overall Rank	**Land/Water Protection**	*Feasibility*	*Benefits*	**Cost**
H	Encourage voluntary mitigation for any loss or degradation of Hydric Hammock habitat from military activities through acquisition of habitat protecting the same species that would be impacted.	VH	M	H

Industrial/Commercial Pineland



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (Appendix D. GIS Data Tables), 3,363,024 acres (1,360,968 ha) of Industrial/Commercial Pineland are in Florida. Of that total, 19% (634,848 acres; 256,914 ha) are in existing conservation or managed areas, 11% (358,029 acres; 144,889 ha) are on private lands encompassed by Florida Forever projects, 6% (196,264 acres; 79,425 ha) are within SCHA-identified lands, and the remaining 65% (2,173,883 acres; 879,739 ha) are within other private lands.

Habitat Description

FNAI type: None

This category includes industrial and commercial pine plantations that are almost exclusively artificially produced through silvicultural practices. Due to a climate conducive to rapid growth, Florida is part of one of the most productive timber-producing regions in the world; Florida's timberlands are a major contributor to the state's economy and provide critical water recharge areas within Florida. Industrial/Commercial Pineland habitat is characterized by high density, even-aged, single-species stands, planted in rows at regular intervals, across large areas. This habitat includes sites predominantly planted to slash pine, although longleaf pine and loblolly pine tracts also occur. Also included in this category are sand pine plantations, which often are

planted on sites with poorer soils; many of these areas occur on intensively prepared sites. Ground cover and shrub vegetation on Industrial/Commercial Pineland sites vary with the growth stage of the pine trees and management techniques used at the site. On early or recently planted sites, ground cover and shrub vegetation may be excessively dense, and may include species such as palmetto, gallberry, and wax myrtle. As the trees become taller and canopy cover becomes complete, ground cover and shrub vegetation becomes sparse. As Industrial/Commercial Pineland sites approach maturity other vegetation may disappear and the ground cover may consist of a thick layer of pine needles and other litter. Industrial/Commercial Pineland may provide habitat for a variety of species depending upon the growth stage of the forest and the management practices employed on-site. Species such as the Florida panther and the black bear may use this habitat as a corridor between primary habitats.

Associated Species of Greatest Conservation Need

Mammals

- *Sorex longirostris* — Southeastern Shrew
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Sciurus niger niger* — Southeastern Fox Squirrel
- *Sciurus niger shermani* — Sherman's Fox Squirrel
- *Ursus americanus floridanus* — Florida Black Bear
- *Mustela frenata olivacea* — Southeastern Weasel
- *Mustela frenata peninsulae* — Florida Long-tailed Weasel
- *Spilogale putorius* — Spotted Skunk
- *Mephitis mephitis* — Striped Skunk
- *Puma concolor coryi* — Florida Panther

Birds

- *Mycteria Americana* — Wood Stork
- *Elanoides forficatus* — Swallow-tailed Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Falco sparverius paulus* — Southeastern American Kestrel
- *Falco peregrinus* — Peregrine Falcon
- *Columbina passerine* — Common Ground-Dove
- *Melanerpes erythrocephalus* — Red-headed Woodpecker
- *Picoides villosus* — Hairy Woodpecker
- *Colaptes auratus auratus* — Northern Flicker
- *Limnothlypis swainsonii* — Swainson's Warbler
- *Aimophila aestivalis* — Bachman's Sparrow

Amphibians

- *Rana capito* — Gopher Frog

Reptiles

- *Clemmys guttata* — Spotted Turtle
- *Terrapene carolina bauri* — Florida Box Turtle

- *Gopherus polyphemus* Gopher Tortoise
- *Heterodon platirhinos* Eastern Hognose Snake
- *Drymarchon couperi* Eastern Indigo Snake
- *Pituophis melanoleucus mugitus* Florida Pine Snake
- *Lampropeltis calligaster* Mole Kingsnake
- *Lampropeltis getula* Common Kingsnake
- *Crotalus horridus* Timber Rattlesnake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Conservation Threats

Threats to Industrial/Commercial Pineland habitat that were also identified for multiple other habitats are addressed in Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Incompatible forestry practices
- Roads

Although intensively managing pine stands alters the native habitat conditions and reduces habitat quality for some SGCN, other species sometimes benefit from these conditions. Threats specific to Commercial/Industrial Pineland apply to loss of habitat quality for SGCN requiring a less altered pineland environment. Such losses in habitat quality vary by species and may result from inappropriate application of BMPs or other management actions that are not compatible with habitat needs for the species. These management actions may include bedding and other site preparation, dense stocking of single-age monocultures, short rotation lengths, overuse of herbicide instead of fire or other alternatives for vegetation management, major hydrological alterations, and insufficient invasive control efforts.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Habitat degradation/disturbance	High
B	Habitat destruction or conversion	High
C	Low genetic diversity in pines	Low

The sources of the stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Incompatible forestry practices	**High**	A
2	Conversion to housing and urban development	**High**	B
3	Conversion to commercial and industrial development	**High**	B
4	Roads	**Medium**	B
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

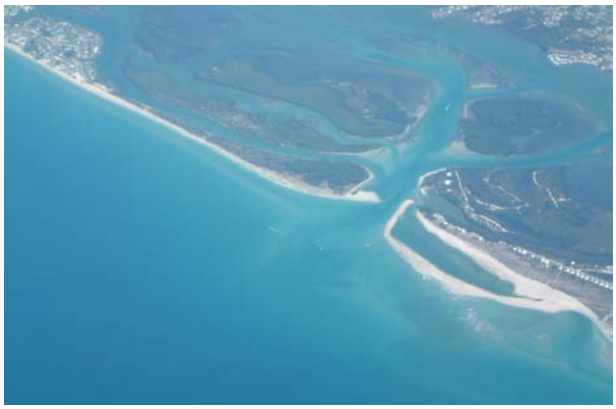
Actions to abate the threats to Industrial/Commercial Pineland that were also identified as statewide threats (Incompatible forestry practices [see habitat specific actions below], Conversion to housing and urban development, Conversion to commercial and industrial development, Roads) are in Chapter Multiple Habitat Threats and Conservation Actions.

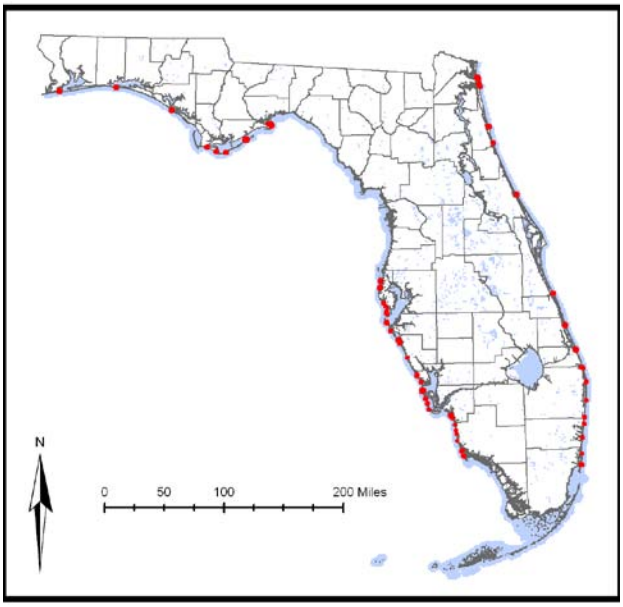
Actions to abate specific threats that were identified for Industrial/Commercial Pineland are below. These actions were designed to increase management consistency with habitat for wildlife SGCN and control of Japanese climbing fern where pine straw is harvested, but none were ranked as of high priority for implementation.

Incompatible Forestry Practices

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Provide incentives for increasing rotation length, reducing tree densities, and improving native ground cover on industrial and NIPF ownerships. Use incentive programs to compensate forest managers and owners for any profit lost due to use of longer rotations.	H	L	L
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Promote and encourage full and comprehensive utilization of the Sustainable Forestry Initiative (SFI).	M	M	L
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Research on alternatives to bedding for silvicultural production.	H	L	M
L	Research on productivity loss if bedding is not implemented (to identify whether subsidies might be necessary to reimburse for productivity loss)	H	L	L

Inlet





Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Unknown.
Due to the lack of sufficient map data for this habitat category, no acreage estimates are currently available.

Habitat Description

FNAI type: None

Inlets are natural or man-made cuts in the shoreline that link coastal and inland water bodies. This habitat is defined as the subtidal area within a two-kilometer radius of the central part (i.e., throat) of the Inlet. These features tend to be hot spots of biodiversity and are critical in the recruitment of many fish and invertebrate species. Inlets provide habitat for the settling larvae from coastal areas and provide an emigration conduit for outgoing juveniles. They also are essential spawning habitat for several marine fishes.

Associated Species of Greatest Conservation Need

Mammals

- *Trichechus manatus latirostris* — Florida Manatee
- *Eubalaena glacialis* — North Atlantic Right Whale
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Gavia immer* — Common Loon
- *Podiceps auritus coronutus* — Horned Grebe
- *Sula dactylatra* — Masked Booby
- *Pelecanus occidentalis* — Brown Pelican
- *Egretta caerulea* — Little Blue Heron
- *Egretta rufescens* — Reddish Egret
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill
- *Haliaeetus leucocephalus* — Bald Eagle
- *Charadrius alexandrinus tenuirostris* — Cuban Snowy Plover
- *Charadrius wilsonia* — Wilson's Plover
- *Charadrius melodus* — Piping Plover
- *Haematopus palliatus* — American Oystercatcher
- *Recurvirostra americana* — American Avocet
- *Limosa fedoa* — Marbled Godwit
- *Calidris alba* — Sanderling
- *Sterna nilotica* — Gull-billed Tern
- *Sterna caspia* — Caspian Tern
- *Sterna maxima* — Royal Tern
- *Sterna sandvicensis* — Sandwich Tern
- *Sterna dougallii* — Roseate Tern
- *Sterna antillarum* — Least Tern
- *Rynchops niger* — Black Skimmer

Reptiles

- *Crocodylus acutus* — American Crocodile
- *Malaclemys terrapin* — Diamondback Terrapin
- *Chelonia mydas* — Green Turtle
- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley
- *Nerodia clarkii clarkii* — Gulf Salt Marsh Snake
- *Nerodia clarkii compressicauda* — Mangrove Salt Marsh Snake
- *Nerodia clarkii taeniata* — Atlantic Salt Marsh Snake

Fish

- *Ginglymostoma cirratum* — Nurse Shark
- *Carcharhinus acronotus* — Blacknose Shark
- *Carcharhinus isodon* — Finetooth Shark
- *Carcharhinus leucas* — Bull Shark
- *Carcharhinus limbatus* — Blacktip Shark
- *Negaprion brevirostris* — Lemon Shark
- *Sphyrna lewini* — Scalloped Hammerhead
- *Sphyrna mokarran* — Great Hammerhead
- *Sphyrna tiburo* — Bonnethead
- *Pristis pristis* — Largetooth Sawfish
- *Acipenser oxyrinchus oxyrinchus* — Atlantic Sturgeon
- *Acipenser oxyrinchus desotoi* — Gulf Sturgeon
- *Anguilla rostrata* — American Eel
- *Uropterygias macularius* — Marbled Moray
- *Alosa aestivalis* — Blueback Herring

- *Alosa sapidissima* American Shad
- *Mugil gyrans* Whirligig Mullet
- *Mugil sp.* Redeye Mullet
- *Centropomus undecimalis* Common Snook
- *Centropristis striata* Black Sea Bass
- *Epinephelus itajara* Goliath Grouper
- *Epinephelus morio* Red Grouper
- *Mycteroperca bonaci* Black Grouper
- *Mycteroperca microlepis* Gag
- *Apogon aurolineatus* Bridle Cardinalfish
- *Apogon binotatus* Barred Cardinalfish
- *Apogon townsendi* Belted Cardinalfish
- *Astrapogon alutus* Bronze Cardinalfish
- *Astrapogon puncticulatus* Blackfin Cardinalfish
- *Rachycentron canadum* Cobia
- *Caranx latus* Horse-eye Jack
- *Trachinotus carolinus* Florida Pompano
- *Trachinotus falcatus* Permit
- *Lutjanus analis* Mutton Snapper
- *Lutjanus apodus* Schoolmaster
- *Lutjanus campechanus* Red Snapper
- *Lutjanus griseus* Gray Snapper
- *Lutjanus jocu* Dog Snapper
- *Lobotes surinamensis* Atlantic Tripletail
- *Anisotremus virginicus* Porkfish
- *Orthopristis chrysoptera* Pigfish
- *Archosargus probatocephalus* Sheepshead
- *Pogonias cromis* Black Drum
- *Sciaenops ocellatus* Red Drum
- *Prognathodes aculeatus* Longsnout Butterflyfish
- *Stegastes partitus* Bicolor Damselfish
- *Lachnolaimus maximus* Hogfish
- *Stathmonotus hemphilli* Blackbelly Blenny
- *Scomberomorus cavalla* King Mackerel
- *Etropus crossotus* Fringed Flounder
- *Paralichthys albigutta* Gulf Flounder
- *Canthigaster rostrata* Sharpnose Puffer

Invertebrates

- *Crassostrea virginica* Eastern Oyster
- *Arenicola cristata* Lugworm
- *Limulus polyphemus* Horseshoe Crab
- *Clibanarius vittatus* Thinstripe Hermit Crab
- *Lysmata spp.* Peppermint Shrimp
- *Panulirus argus* Spiny Lobster
- *Farfantepenaeus duorarum* Pink Shrimp
- *Callinectes sapidus* Blue Crab

Conservation Threats

Threats to the Inlet habitats that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Coastal development
- Dam operations/incompatible release of water (quality, quantity, timing)
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible recreational activities
- Industrial spills
- Invasive animals
- Invasive plants
- Management of nature (beach nourishment and impoundments)
- Nutrient loads (urban)
- Roads, bridges and causeways
- Surface water and groundwater withdrawal
- Vessel impacts

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Habitat disturbance	High
B	Altered species composition	Medium
C	Altered structure	Medium
D	Altered water quality–physical, chemistry	Medium
E	Erosion	Medium
F	Habitat destruction	Medium
G	Altered hydrologic regime	Medium
H	Keystone species missing or lacking in abundance	Medium
I	Sedimentation	Medium

The sources of stress, or threats, were used to generate conservation actions.

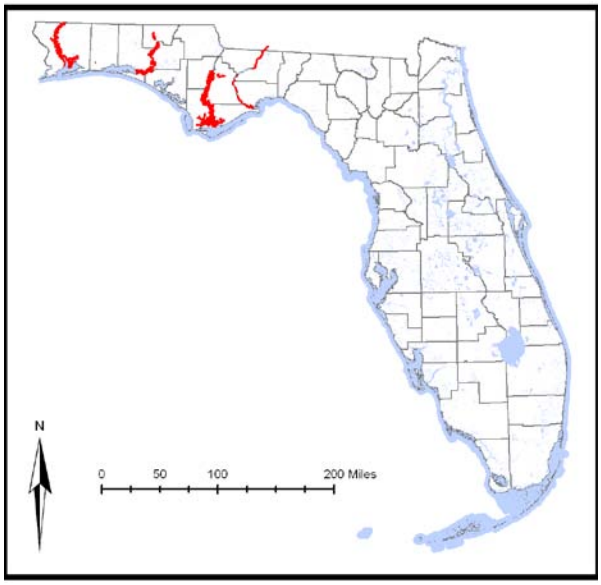
Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Channel modification/shipping lanes	**High**	A, D, E, F, G, I
2	Shoreline hardening	**High**	C, E, F, I
3	Dam operations/incompatible release of water: (quality, quantity, timing)	**High**	A, D, G, I
4	Disruption of longshore transport of sediments	**High**	E, I
5	Coastal development	**High**	B, C, D, F, G
6	Management of nature (beach nourishment, impoundments)	**High**	A, B, I
7	Boating impacts	**High**	A

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
8	Incompatible recreational activities	**High**	A
9	Light pollution	**High**	B
10	Industrial spills	**Medium**	A
11	Harmful algal blooms	**Medium**	B
12	Road, bridges and causeways	**Medium**	C, F, G
13	Inadequate stormwater management	**Medium**	B, D, G
14	Incompatible industrial operations	**Medium**	B, F
15	Invasive plants	**Medium**	B
16	Incompatible fishing pressure	**Medium**	B, H
17	Acoustic pollution	**Medium**	A
18	Vessel impacts	**Medium**	A, F
19	Utility corridors	**Medium**	A
20	Fishing gear impacts	**Medium**	A
21	Military activities	**Medium**	A
22	Invasive animals	**Medium**	A, B
23	Surface water withdrawal	**Medium**	D
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Inlet that were also identified as statewide threats (see list above), are in Chapter Multiple Habitats Threats and Conservation Actions. Many of the threats to the Inlet habitat category are the same as for several other marine and estuarine habitats. Consequently, actions to abate these threats will be the same or similar to the actions recommended for abating threats to several other marine and estuarine habitats (e.g., Beach/Surf Zone, Coastal Strand, Coral Reef, Hard Bottom, Mangrove Swamp, Submerged Aquatic Vegetation, Coastal Tidal River or Stream).

Large Alluvial Stream



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining**.** According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 1,019 miles (1,640 km) of Large Alluvial Stream habitat exist.

Habitat Description

FNAI type: Alluvial Stream, River Floodplain Lake, Swamp Lake

Alluvial streams originate in high uplands that are composed of sand and silt based clays, thereby giving these streams a natural high turbidity. These streams only occur in the north region of Florida and are characterized as having meandering channels with a mix of sand bottom, sand and gravel, and areas of bedrock or shoals. Large Alluvial Streams have flow rates and sediment loads that range from low to high (flood) stages, consequently causing water depth and other water quality parameters to fluctuate substantially with seasonal rainfall patterns. Flood stages which overflow the banks and inundate the adjacent floodplain and Bottomland Hardwood Forest communities usually occur one or two times each year during winter or early spring. Due to the high natural turbidity of these streams there is minimal vegetation which is mostly confined to channel edges or backwaters. Typical plants include spatterdock, duckweed, American lotus, and water hyssop. Examples of this stream category include the Escambia, Choctawhatchee, and Apalachicola rivers.

Associated Species of Greatest Conservation Need

Mammals

- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Lutra canadensis lataxina* — River Otter
- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Anas acuta* — Northern Pintail
- *Ixobrychus exilis* — Least Bittern
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Egretta tricolor* — Tricolored Heron
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Plegadis falcinellus* — Glossy Ibis
- *Mycteria americana* — Wood Stork
- *Elanoides forficatus* — Swallow-tailed Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Aramus guarauna* — Limpkin
- *Grus canadensis pratensis* — Florida Sandhill Crane
- *Recurvirostra americana* — American Avocet
- *Protonotaria citrea* — Prothonotary Warbler

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Desmognathus auriculatus* — Southern Dusky Salamander

Reptiles

- *Macrochelys temminckii* — Alligator Snapping Turtle
- *Graptemys barbouri* — Barbour's Map Turtle
- *Pseudemys concinna suwanniensis* — Suwannee Cooter
- *Farancia erytrogramma* — Rainbow Snake

Fish

- *Acipenser oxyrinchus desotoi* — Gulf Sturgeon
- *Atractosteus spatula* — Alligator Gar
- *Anguilla rostrata* — American Eel
- *Alosa alabamae* — Alabama Shad
- *Cyprinella callitaenia* — Bluestripe Shiner
- *Hybognathus hayi* — Cypress Minnow
- *Macrhybopsis n. sp. cf aestivalis* — Florida Chub/Speckled chub

- *Moxostoma n. sp. cf poecilurum* Grayfin Redhorse
- *Moxostoma carinatum* River Redhorse
- *Ameiurus brunneus* Snail Bullhead
- *Ameiurus serracanthus* Spotted Bullhead
- *Morone saxatilis* Striped Bass
- *Micropterus cataractae* Shoal Bass
- *Crystallaria asprella* Crystal Darter
- *Etheostoma proeliare* Cypress Darter
- *Etheostoma histrio* Harlequin Darter
- *Etheostoma stigmaeum* Speckled Darter

Invertebrates

- *Alasmidonta undulata* Triangle Floater
- *Amblema neislerii* Fat Threeridge
- *Anodonta heardi* Apalachicola Floater
- *Anodonta suborbiculata* Flat Floater
- *Elliptio mcmichaeli* Fluted Elephant-ear
- *Elliptio purpurella* Inflated Spike
- *Elliptoideus sloatianus* Purple Bankclimber
- *Fusconaia escambia* Narrow Pigtoe
- *Fusconaia rotulata* Round Ebonyshell
- *Glebula rotundata* Round Pearlshell
- *Lampsilis australis* Southern Sandshell
- *Lampsilis ornata* Southern Pocketbook
- *Lampsilis subangulata* Shiny-rayed Pocketbook
- *Lampsilis teres* Yellow Sandshell
- *Medionidus acutissimus* Alabama Moccasinshell
- *Medionidus simpsonianus* Ochlockonee Moccasinshell
- *Megalonaias nervosa* Washboard
- *Pleurobema pyriforme* Oval Pigtoe
- *Pleurobema strodeanum* Fuzzy Pigtoe
- *Ptychobranchus jonesi* Southern Kidneyshell
- *Quadrula infucata* Sculptured Pigtoe
- *Quincuncina burkei* Tapered Pigtoe
- *Utterbackia peggyae* Florida Floater
- *Villosa choctawensis* Choctaw Bean
- *Villosa villosa* Downy Rainbow
- *Elimia clenchi* Clench's Goniobasis
- *Dolania americana* American Sand-burrowing Mayfly
- *Brachycercus nasutus* A Mayfly
- *Hexagenia bilineata* A Mayfly
- *Pseudiron centralis* White Sand-river Mayfly
- *Asioplax dolani* A Mayfly
- *Isonychia sicca* A Mayfly
- *Hetaerina americana* American Rubyspot
- *Neurocordulia molesta* Smoky Shadowfly
- *Erpetogomphus designatus* Eastern Ringtail

Conservation Threats

Threats to the Large Alluvial Stream habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Chemicals and toxins
- Groundwater withdrawal
- Incompatible forestry practices
- Incompatible recreational activities
- Invasive animals
- Surface water withdrawal and diversion

Existing dams and associated water withdrawal pose a serious source of stress to the alluvial stream habitat on the Apalachicola River and a potential future threat on several additional rivers. Dams and other activities, including incompatible forestry practices and channel modification, can appreciably alter sediment dynamics in this habitat. Additional threats specific to this habitat include Dam operations and Management of nature (i.e., water control structures/dams and levees, especially on the large interstate rivers of the Florida panhandle, as well as channel modification for the Apalachicola River specifically).

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered species composition/dominance	Medium
B	Altered community structure	Medium
C	Habitat destruction or conversion	Medium
D	Fragmentation of habitats, communities, ecosystems	Medium
E	Altered hydrologic regime	Medium
F	Erosion/sedimentation	Medium
G	Altered water quality of surface water or aquifer: nutrients	Low
H	Altered water quality of surface water or aquifer: contaminants	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Dam operations	**High**	A, B, C, D, E, F
2	Management of nature–water control structures	**High**	A, B, C, D, E, F
3	Channel modification/shipping lanes	**High**	A, B, C, D, E, F
4	Invasive animals	**Medium**	A, B, C, F
5	Surface water withdrawal	**Medium**	D, E
6	Groundwater withdrawal	**Low**	E
7	Incompatible forestry practices	**Low**	A, B, C, D, E, F
8	Chemicals and toxins	**Low**	A

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
9	Incompatible recreational activities	Low	A, B, C, F
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Large Alluvial Stream that were also identified as statewide threats (Invasive animals, Surface water withdrawal and diversion, Groundwater withdrawal, Incompatible forestry practices, Chemicals and toxins, Incompatible recreational activities) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Large Alluvial Stream and a few other habitats, and are listed below. Additional actions were developed to address threats specific to this habitat. These actions were intended to reduce the impacts of dams and dam operations on movement and survival of aquatic species by retrofitting and restoring existing structures or by setting limits on the magnitude, duration, and frequency of downstream water releases required to support aquatic habitat.

Dam operations

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Coordinate interstate Strategy actions to ensure that all fish and wildlife resources in all states are protected when changing dam operations in shared basins. (USFWS)	M	H	L
L	Coordinate multiagency review of USACE activities, including biological aspects (fish spawn guidelines, protection of fish and wildlife resources) of water control plans for interstate water projects, fish spawn guidelines, re-establishing natural seasonal fluctuation of flows.	H	L	M
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
H	Raise the intake water from the Ochlockonee Dam to increase downstream dissolved oxygen content to natural levels.	VH	M	H
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Determine the appropriate hydrological flows and levels for water reservations on the Apalachicola, Yellow, Ochlockonee, and other interstate rivers using the ESWM (Ecologically Sustainable Water Management) approach.	M	H	H
M	Complete research on anadromous fish passage implementation and effectiveness on the Apalachicola River. Expand research to Lake Talquin Dam.	H	M	H
M	Evaluate cumulative impacts of small rural impoundments on fish and wildlife.	M	M	M
L	Evaluate feasibility of incentive programs to remove small rural impoundments.	H	L	L

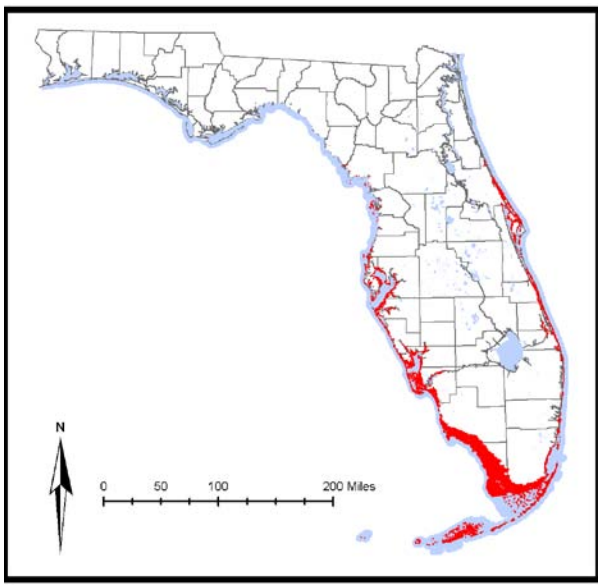
Management of nature – water control structures

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
L	Explore funding sources for fish and aquatic wildlife passage research and improvements to existing dams and other water control structures to facilitate movement of migratory species (e.g., Apalachicola Woodruff Dam work).	H	L	VH
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
M	Fund research to identify the habitat needs and movement requirements of native SGCN aquatic species, inventory water control structures, and identify the extent to which particular existing water control structures negatively affect species ecology.	VH	L	M
L	Fund research to investigate the cumulative impacts of small farm ponds on low-order streams in north Florida to determine the effectiveness of existing regulations and recommend changes to the regulatory/permitting process aimed at reducing cumulative impacts.	M	L	M

Chemicals and toxins

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Encourage voluntary incentives for private landowners to minimize runoff of chemicals and toxins into wetlands and aquatic systems.	H	L	M

Mangrove Swamp



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status

Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 588,434 acres (238,131 ha) of Mangrove Swamp habitat exist, of which 88% (515,783 ac; 208,730 ha) are in existing conservation or managed areas. Another 2% (10,376 ac; 4,199 ha) are in Florida Forever projects and 3% (16,997 ac; 6,878 ha) are in SHCA-designated lands. The remaining 7% (45,278 ac; 18,323 ha) are other private lands.

Habitat Description

FNAI type: Tidal Swamp

Mangroves form dense, brackish-water swamps along low-energy shorelines and in protected, tidally influenced bays of southern Florida. This community type is composed of freeze-sensitive tree species and, with some limited exceptions, mangroves which are distributed south of Cedar Key on the Gulf coast and south of St. Augustine on the Atlantic coast. These swamp communities are usually composed of red mangrove, black mangrove, and white mangrove. Depending on slopes and amounts of disturbance, mangrove swamps may progress in zones of single species from seaward (red mangrove) to landward (white mangrove) areas. Buttonwoods usually occur in areas above high tide. Often vines, such as rubber vines and morning-glory, clamber over mangroves, especially at swamp edges.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Sylvilagus palustris hefneri* — Lower Keys Marsh Rabbit
- *Oryzomys palustris planirostris* — Pine Island Marsh Rice Rat
- *Oryzomys palustris sanibeli* — Sanibel Island Marsh Rice Rat
- *Oryzomys argentatus* — Silver Rice Rat
- *Ursus americanus floridanus* — Florida Black Bear
- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Lutra canadensis lataxina* — River Otter
- *Mustela vison evergladensis* — Everglades Mink
- *Mustela vison halilimnetes* — Gulf Salt Marsh Mink
- *Mustela vison lutensis* — Atlantic Salt Marsh Mink
- *Odocoileus virginianus clavium* — Key Deer
- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Pelecanus occidentalis* — Brown Pelican
- *Fregata magnificens* — Magnificent Frigatebird
- *Ardea herodias occidentalis* — Great White Heron
- *Ixobrychus exilis* — Least Bittern
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Egretta tricolor* — Tricolored Heron
- *Egretta rufescens* — Reddish Egret
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill
- *Eudocimus albus* — White Ibis
- *Plegadis falcinellus* — Glossy Ibis
- *Mycteria americana* — Wood Stork
- *Elanoides forficatus* — Swallow-tailed Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Falco peregrinus* — Peregrine Falcon
- *Rallus longirostris insularum* — Mangrove Clapper Rail
- *Rallus longirostris scottii* — Florida Clapper Rail
- *Haematopus palliatus* — American Oystercatcher
- *Recurvirostra americana* — American Avocet
- *Sterna caspia* — Caspian Tern
- *Anous stolidus* — Brown Noddy
- *Columba leucocephala* — White-crowned Pigeon
- *Coccyzus minor* — Mangrove Cuckoo
- *Tyrannus dominicensis* — Gray Kingbird
- *Vireo altiloquus* — Black-whiskered Vireo
- *Dendroica petechia gundlachi* — Cuban Yellow Warbler
- *Dendroica discolor paludicola* — Florida Prairie Warbler

Reptiles

- *Crocodylus acutus* American Crocodile
- *Terrapene carolina bauri* Florida Box Turtle
- *Malaclemys terrapin* Diamondback Terrapin
- *Caretta caretta* Loggerhead
- *Lepidochelys kempii* Kemp's Ridley
- *Nerodia clarkii compressicauda* Mangrove Salt Marsh Snake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Fish

- *Ginglymostoma cirratum* Nurse Shark
- *Carcharhinus brevipinna* Spinner Shark
- *Carcharhinus falciformis* Silky Shark
- *Carcharhinus isodon* Finetooth Shark
- *Carcharhinus plumbeus* Sandbar Shark
- *Negaprion brevirostris* Lemon Shark
- *Pristis pectinata* Smalltooth Sawfish
- *Manta birostris* Giant Manta
- *Megalops atlanticus* Tarpon
- *Gymnothorax moringa* Spotted Moray
- *Mugil cephalus* Striped Mullet
- *Menidia conchorum* Key Silverside
- *Rivulus marmoratus* Mangrove Rivulus
- *Gambusia rhizophorae* Mangrove Gambusia
- *Hippocampus erectus* Lined Seahorse
- *Centropomus parallelus* Smallscale Fat Snook
- *Centropomus pectinatus* Tarpon Snook
- *Centropomus undecimalis* Common Snook
- *Dermatolepis inermis* Marbled Grouper
- *Epinephelus adscensionis* Rock Hind
- *Epinephelus guttatus* Red Hind
- *Epinephelus niveatus* Snowy Grouper
- *Epinephelus striatus* Nassau Grouper
- *Mycteroperca bonaci* Black Grouper
- *Rachycentron canadum* Cobia
- *Lutjanus griseus* Gray Snapper
- *Lutjanus mahogoni* Mahogany Snapper
- *Eugerres plumieri* Striped Mojarra
- *Equetus lanceolatus* Jackknife-fish
- *Equetus punctatus* Spotted Drum
- *Sciaenops ocellatus* Red Drum
- *Prognathodes aculeatus* Longsnout Butterflyfish
- *Stegastes partitus* Bicolor Damselfish
- *Labrisomus nuchipinnis* Hairy Blenny
- *Stathmonotus hemphilli* Blackbelly Blenny
- *Dormitator maculatus* Fat Sleeper
- *Erotelis smaragdus* Emerald Sleeper
- *Paralichthys albigutta* Gulf Flounder

Invertebrates

- *Ircinia campana* Vase Sponge
- *Spheciospongia vesparia* Loggerhead Sponge

- *Cladocora arbuscula* Tube Coral
- *Manicina areolata* Rose Coral
- *Solenastrea bournoni* Smooth Star Coral
- *Solenastrea hyades* Knobby Star Coral
- *Isophyllia sinuosa* Sinuous Cactus Coral
- *Scolymia lacera* Atlantic Mushroom Coral
- *Oculina diffusa* Diffuse Ivory Bush Coral
- *Astrangia poculata* Northern Star Coral
- *Astrangia solitaria* A Coral
- *Crassostrea virginica* Eastern Oyster
- *Isognomon alatus* Tree Oyster
- *Isognomon bicolor* Tree Oyster
- *Isognomon radiatus* Tree Oyster
- *Littoraria angulifera* Mangrove Periwinkle
- *Fasciolaria lilium* Banded Tulip
- *Busycon sinistrum* Lightning Whelk
- *Elysia crispata* Lettuce Slug
- *Oreaster reticulatis* Cushion Star, Bahama Star
- *Holothuria floridana* Florida Sea Cucumber
- *Ophiophragmus filograneus* Brittle Star
- *Limulus polyphemus* Horseshoe Crab
- *Cardisoma guanhumi* Great Land Crab (Blue Land Crab)
- *Aratus pisonii* Mangrove Crab
- *Goniopsis cruentata* Mangrove Crab
- *Uca minax* Red-jointed Fiddler, Brackish Water Fiddler
- *Uca pugilator* Sand Fiddler
- *Uca pugna*x Mud Fiddler
- *Panulirus argus* Spiny Lobster
- *Heterachthes sablensis* Cape Sable Longhorn
- *Didemnum vanderhorst* Tunicate
- *Eudistoma species indeterminata* Strawberry Tunicate

Conservation Threats

Habitat-specific threats to Mangrove Swamp include reduction in freshwater flows from dam operations, lack of tidal fluctuation caused by mosquito impoundments, loss of mangroves from inappropriate pruning by coastal property owners, and coastal development.

Threats to Mangrove Swamp habitats that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Coastal development
- Dam operations/incompatible release of water (quality, quantity, timing)
- Fishing gear impacts
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible recreational activities
- Incompatible wildlife and fisheries management strategies
- Industrial Spills

- Invasive animals
- Invasive plants
- Management of nature (beach nourishment and impoundments)
- Nutrient loads (urban)
- Roads, bridges and causeways
- Shoreline hardening
- Surface water and groundwater withdrawal
- Vessel impacts

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered hydrologic regime	Very High
B	Habitat destruction	Very High
C	Altered structure	High
D	Altered water quality–contaminants	High
E	Altered weather regime/sea level rise	High
F	Altered species composition	High
G	Habitat disturbance	High
H	Habitat fragmentation	High

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Coastal development	**Very High**	A,B, C, D, G, H
2	Roads, bridges and causeways	**High**	A, B, D, F, G, H
3	Harmful algal blooms	**High**	B, F, G
4	Incompatible industrial operations	**High**	B, D, F, G, H
5	Invasive plants	**High**	B, C, F, G
6	Shoreline hardening	**High**	A, B, F, G, H
7	Invasive animals	**High**	B, F, G
8	Dam operations/incompatible release of water (quality, quantity, timing)	**High**	A, B, D, F, G
9	Incompatible wildlife and fisheries management strategies	**High**	B,C
10	Climate variability	**High**	A, B, E, H
11	Parasites/pathogens	**High**	B, F, G
12	Channel modification/shipping lanes	**High**	A, B, F, G, H
13	Incompatible aquaculture operations	**High**	B, H
14	Chemicals and toxins	**High**	B, D, F, G
15	Nutrient loads (all sources)	**High**	D, F, G
16	Acoustic pollution	**High**	B
17	Inadequate stormwater management	**Medium**	A, B, D, F, G
18	Industrial spills	**Medium**	B, D, F, G

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
19	Boating impacts	**Medium**	B, C, F, G, H
20	Incompatible fishing pressure	**Medium**	F, G, H
21	Solid waste	**Medium**	B, C, G, H
22	Management of nature (beach nourishment, impoundments)	**Medium**	A, B, F, G
23	Fishing gear impacts	**Medium**	B, C, G
24	Surface water withdrawal	**Medium**	A, F, G
25	Utility corridors	**Medium**	B, C, G
26	Groundwater withdrawal	**Medium**	A, F, G
27	Incompatible recreational activities	**Medium**	B, D, F, G
28	Thermal pollution	**Medium**	F, G
29	Placement of artificial structures	**Medium**	B, C
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Mangrove Swamp that were also identified as statewide marine and estuarine threats (see list above) are in the Chapter Multiple Habitat Threats and Conservation Actions. However, experts identified outcomes to reduce damaging mangrove trimming, restore appropriate freshwater flows, and reconnect existing salt marsh/mangrove impoundments to tide and manage to maximize resource values while maintaining adequate levels of mosquito control.

Highest ranked actions identified for abating this source of stress focus on:

- Improving the detection of pathogens, parasites, and biotoxins in marine organisms and the ability to rehabilitate impacted animals

Additional actions included:

- Providing training on appropriate mangrove trimming to landscape maintenance and wetlands professionals
- Evaluating whether parasites are indicators of estuarine and marine health.

The following actions, organized by action type were identified to abate this threat:

Climate Change

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
L	Using GIS, identify modifications to mangroves and marshes, use restoration techniques to reverse modifications, and include consideration of sea level rise in restoration goal.	L	M	VH

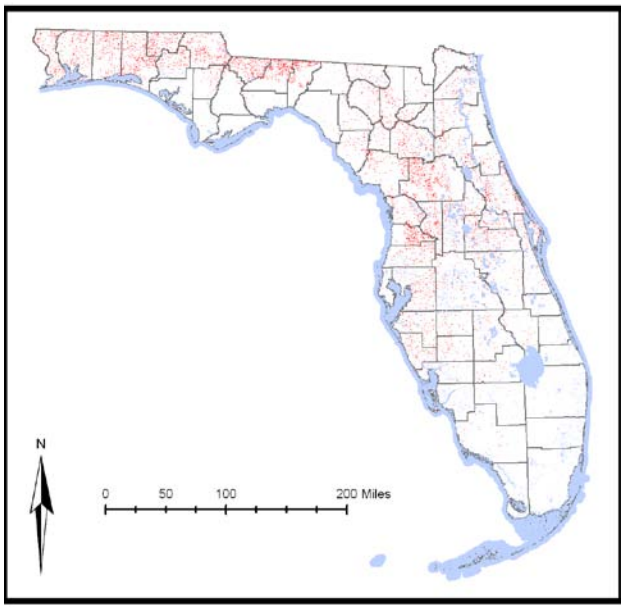
Coastal Development

Overall Rank	Education and Awareness	*Feasibility*	*Benefits*	Cost
M	Issue continuing education credits for proper mangrove trimming. This could be for professional wetland scientists, certified ecologists, landscape architects, arborists, landscapers. Improve knowledge of mangroves through certification program. Link with herbicide application CEU's to ensure increased participation.	VH	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Improve understanding of watercraft speed limits/zones, and work with all affected parties to explore options for reassessing speed zones.	H	M	M

Parasites/Pathogens

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
H	Improve capabilities for/sophistication of inspection, recognition, and treatment of aquatic organism diseases and parasites.	VH	M	M
H	Continue and support response teams/hotlines associated with disease outbreak, trauma, strandings, and mortality events for fish and wildlife species.	VH	M	M
L	Expand the number and capabilities of rehabilitation facilities for diseased marine mammals and reptiles.	H	L	VH
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Conduct additional research for aquatic wildlife parasites and diseases. and the impacts of biotoxins on fish and wildlife resources.	VH	M	H
H	Synthesize and consolidate understanding, and identification of gaps in understanding, of marine flora/fauna diseases, pathogens, biotoxins, including slime mold on seagrasses and oyster disease.	VH	M	L
M	Research and examine use of parasites as indicators of estuarine and marine health.	VH	L	M

Mixed Hardwood-Pine Forest



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 879,766 acres (356,029 ha) of Mixed Hardwood-Pine Forest habitat exist, of which 16% (141,495 ac; 57,261 ha) are in conservation or managed areas. Another 3% (30,783 ac; 12,457 ha) are in Florida Forever projects and 6% (49,009 ac; 19,833 ha) are in SHCA-designated lands. The remaining 75% (658,479 ac; 266,477 ha) are other private lands.

Habitat Description

FNAI type: Upland Mixed Forest

This community is the southern extension of the Piedmont southern mixed hardwoods, and occurs mainly on the rolling hills of sandy clay soils of the northern Panhandle. Younger stands may be predominantly pines, whereas a complex of various hardwoods become co-dominants as the system matures over time through plant succession. The overstory consists of shortleaf and loblolly pine, American beech, mockernut hickory, southern red oak, water oak, American holly, and dogwood.

Also included in this category are other upland forests that occur statewide and contain a mixture of conifers and hardwoods as the co-dominant overstory component. These communities contain well developed associations of longleaf pine, slash pine, and loblolly pine in mixed company with live oak, laurel oak, and water oak, together with other hardwood species

characteristic of the Hardwood Hammock Forest community type. In this habitat, the ground is usually covered with a thick layer of leaf mulch which helps in the retention of moisture. Adding to the mesic condition is a thick canopy with low air flow and light penetration. Due to this damp environment, Mixed Hardwood-Pine Forests seldom burn.

Associated Species of Greatest Conservation Need

Mammals

- *Blarina carolinensis shermani* — Sherman's Short-tailed Shrew
- *Sorex longirostris* — Southeastern Shrew
- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Sciurus niger niger* — Southeastern Fox Squirrel
- *Sciurus niger shermani* — Sherman's Fox Squirrel
- *Tamias striatus* — Eastern Chipmunk
- *Ursus americanus floridanus* — Florida Black Bear
- *Mustela frenata olivacea* — Southeastern Weasel
- *Mustela frenata peninsulae* — Florida Long-tailed Weasel
- *Puma concolor coryi* — Florida Panther

Birds

- *Colinus virginianus* — Northern Bobwhite
- *Ictinia mississippiensis* — Mississippi Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Buteo platypterus platypterus* — Broad-winged Hawk
- *Melanerpes erythrocephalus* — Red-headed Woodpecker
- *Picoides villosus* — Hairy Woodpecker
- *Colaptes auratus auratus* — Northern Flicker
- *Hylocichla mustelina* — Wood Thrush
- *Dendroica dominica stoddardi* — Stoddard's Yellow-throated Warbler
- *Dendroica cerulea* — Cerulean Warbler
- *Helmitheros vermivorum* — Worm-eating Warbler
- *Seiurus montacilla* — Louisiana Waterthrush
- *Oporornis formosus* — Kentucky Warbler
- *Wilsonia citrina* — Hooded Warbler

Amphibians

- *Ambystoma cingulatum* — Flatwoods Salamander
- *Ambystoma tigrinum* — Tiger Salamander
- *Notophthalmus perstriatus* — Striped Newt
- *Desmognathus monticola* — Seal Salamander
- *Desmognathus apalachicolae* — Apalachicola Dusky Salamander
- *Hemidactylium scutatum* — Four-toed Salamander

- *Eurycea chamberlaini* Chamberlain's Dwarf Salamander
- *Eurycea cf. quadridigitata* Bog Dwarf Salamander
- *Pseudacris ornata* Ornate Chorus Frog
- *Rana okaloosae* Florida Bog Frog
- *Rana capito* Gopher Frog

Reptiles

- *Terrapene carolina bauri* Florida Box Turtle
- *Gopherus polyphemus* Gopher Tortoise
- *Eumeces anthracinus* Coal Skink
- *Storeria dekayi wrightorum* Midland Brown Snake
- *Heterodon platirhinos* Eastern Hognose Snake
- *Heterodon simus* Southern Hognose Snake
- *Drymarchon couperi* Eastern Indigo Snake
- *Pituophis melanoleucus mugitus* Florida Pine Snake
- *Lampropeltis getula* Common Kingsnake
- *Stilosoma extenuatum* Short-tailed Snake
- *Agkistrodon contortrix* Copperhead
- *Crotalus horridus* Timber Rattlesnake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Invertebrates

- *Callophrys gryneus sweadneri* Sweadner's Juniper Hairstreak

Conservation Threats

Because of serious problems interpreting this habitat in the workshops, no threats could be identified and hence no conservation actions were developed. As identified in TNC's Final Report (Gordon et al., 2005), it is recommended that the mapping for this habitat be revisited and/or the habitat itself re-classified. In all three of the regional threats workshops, experts concurred that Mixed Hardwood-Pine Forest is not a habitat unto itself. When experts examined the distribution of this cover type, they suggested that it represents either areas of degraded pinelands into which hardwoods have invaded and require fire or other restoration to reduce the hardwoods, or floodplain forest and other hardwood-dominated systems into which pines have invaded, perhaps because of altered hydrology. The experts suggested that each pixel of this habitat type be reclassified the same as the adjacent pixel of a hardwood or pineland site, and the assumption was made that they adequately covered the stresses and sources for these areas when they assessed the other cover types. It is recommended that the threats and conservation actions for the habitats identified as more accurately depicting this cover type should be extrapolated to this "habitat" or that this habitat be eliminated as a separate category and/or subsumed into other habitats.

While threats to its conservation as well as remedial actions were identified during earlier workshops, the Mixed Hardwood-Pine Forest habitat category was not addressed in TNC workshops that generated tables of ranked threats and actions, as seen in most other habitat categories. The decision to not rank threats and actions for this habitat was made (1) to maximize discussion time for higher-priority habitats and (2) because of some disagreement over recognition

of this habitat type as important to wildlife conservation. Therefore, threats and actions are presented as simple bulleted lists, arranged in alphabetical order, with no prioritization.

The following stresses threaten this habitat:

- Altered community structure
- Altered landscape mosaic or context
- Altered fire regime
- Altered species composition/dominance
- Fragmentation of habitats, communities, ecosystems
- Habitat degradation/disturbance
- Habitat destruction or conversion
- Insufficient size/extent of characteristic communities or ecosystems
- Missing key communities, functional guilds, or seral stages

The sources of stress, or threats, were used to generate conservation actions.

- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Conversion to recreation areas
- Incompatible fire
- Incompatible forestry practices
- Incompatible recreational activities
- Incompatible wildlife and fisheries management
- Invasive animals
- Invasive plants
- Roads

Conservation Actions

Actions to abate threats to Hardwood-Pine Forest were designed to increase the awareness and appreciation of this habitat by professionals and the public. Many actions point to the need for more information and definition of this habitat. All threats were also identified as statewide (see sources of stress above) and are in the Chapter Multiple Habitat Threats and Conservation Actions.

Specific actions to abate threats that were identified for Mixed Hardwood-Pine Forest habitat are below, though none were prioritized for implementation.

Land/Water Protection

- Support and encourage land protection that utilize easements

Land/Water/Species Management

- Encourage use of the “master logger program” and expand to smaller timber companies
- Develop a plan to fund management programs long term after reclamation–include invasive flora and fauna

Law and Policy

- Minimize connectivity impacts to wildlife through supporting effective land-use planning

Research, Education and Awareness

- Better define and map the current condition, and develop management practices to achieve the future condition of this habitat
- Research plans for restoration of this habitat and its hydrology
- Research management practices for controlling invasive species
- Educate landowners about management practices for controlling invasive species
- Increase public/private training and awareness about value of these lands
- Continue to educate landowners about the proper use of BMPs

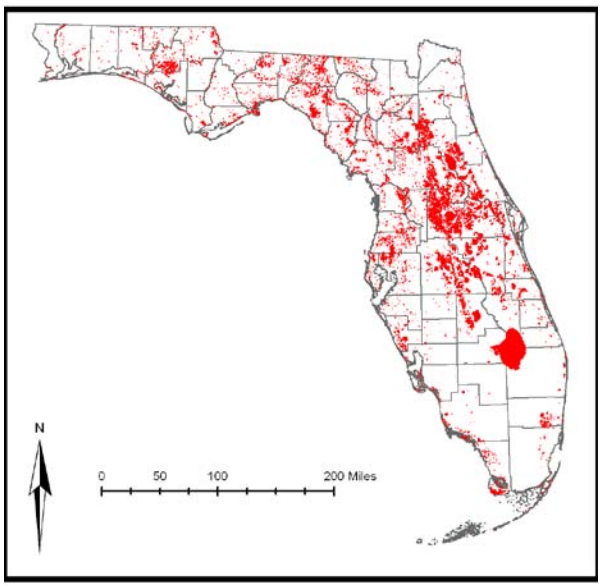
Economic and Other Incentives

- Provide landowner incentive (public and private) for protection and restoration of habitat

Capacity Building

- Form and facilitate partnerships, alliances, and networks of organizations willing to research, conserve and manage this habitat

Natural Lake



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 1,510,216 acres (611,163 ha) of Natural Lake habitat exist.

Habitat Description

FNAI type: Clastic Upland Lake, Sandhill Lake, Sinkhole Lake

Florida has approximately 7,800 Natural Lakes with a surface area of one acre (0.4 ha) or more. Very few of these lakes were formed by riverine processes. However, the great majority were formed or enlarged by dissolution of the underlying limestone by acidic surface waters. Slumping of the overburden resulted in a surface depression. Most Natural Lakes in Florida retain an intimate connection with groundwater, and lack a natural surface outflow. They may be connected to aquatic caves by underground fissures or bedding planes, and thus provide additional habitat for animal species found in those subterranean habitats, or they may have bottom substrates of silt or sand. Most of these lakes have highly variable water levels. Despite their origin, many Florida lakes are not alkaline, and are vulnerable to acidification. They also commonly are nutrient-deficient, thus are vulnerable to nutrient inputs.

Florida's lakes are usually less than 45 feet (14 m) deep, with sand, silt, or organic bottom substrates. Depending on the water chemistry, vegetation in the lakes can vary from nonexistent, to a fringe of emergent plants at the shoreline, to a complete covering of floating plants. Indeed, introduced aquatic weeds are a major threat to this habitat. Some Florida lakes have held water continuously for 8,000 years, and two exceed 30,000 years in age.

This habitat category is comprised exclusively of standing water bodies of natural origin, some of which have been altered by the construction of water control structures. Natural Lakes are essentially permanent, although many of them dry completely during droughts.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Lutra canadensis lataxina* — River Otter
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Anas acuta* — Northern Pintail
- *Gavia immer* — Common Loon
- *Pelecanus occidentalis* — Brown Pelican
- *Botaurus lentiginosus* — American Bittern
- *Ixobrychus exilis* — Least Bittern
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Egretta tricolor* — Tricolored Heron
- *Egretta rufescens* — Reddish Egret
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill
- *Eudocimus albus* — White Ibis
- *Plegadis falcinellus* — Glossy Ibis
- *Mycteria americana* — Wood Stork
- *Rostrhamus sociabilis plumbeus* — Snail Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Falco peregrinus* — Peregrine Falcon
- *Rallus elegans elegans* — King Rail
- *Aramus guarauna* — Limpkin
- *Grus canadensis pratensis* — Florida Sandhill Crane
- *Grus americana* — Whooping Crane
- *Rynchops niger* — Black Skimmer

Amphibians

- *Pseudobranchus striatus lustricolus* — Gulf Hammock Dwarf Siren
- *Ambystoma tigrinum* — Tiger Salamander
- *Notophthalmus perstriatus* — Striped Newt

- *Desmognathus auriculatus* Southern Dusky Salamander
- *Pseudacris ornata* Ornate Chorus Frog
- *Rana virgatipes* Carpenter Frog
- *Rana capito* Gopher Frog

Reptiles

- *Macrochelys temminckii* Alligator Snapping Turtle
- *Kinosternon subrubrum steindachneri* Florida Mud Turtle
- *Pseudemys nelsoni* Florida Redbelly Turtle - Florida Panhandle
- *Deirochelys reticularia* Chicken Turtle
- *Nerodia cyclopion* Mississippi Green Water Snake
- *Farancia erytrogramma* Rainbow Snake

Fish

- *Enneacanthus chaetodon* Black Banded Sunfish

Invertebrates

- *Anodonta heardi* Apalachicola Floater
- *Anodonta suborbiculata* Flat Floater
- *Utterbackia peggyae* Florida Floater
- *Utterbackia peninsularis* Peninsular Floater
- *Procambarus erythrops* Santa Fe (Sim's Sink) Cave Crayfish
- *Procambarus franzi* Orange Lake Cave Crayfish
- *Procambarus leitheuseri* Coastal Lowland Cave Crayfish
- *Procambarus lucifugus alachua* Alachua Light-fleeing Cave Crayfish
- *Procambarus morrisi* Putnam County Cave Crayfish
- *Procambarus orcinus* Woodville (Karst) Cave Crayfish
- *Procambarus pallidus* Pallid Cave Crayfish
- *Troglocambarus maclanei* North Florida Spider Cave Crayfish
- *Hexagenia limbata* A Burrowing Mayfly
- *Hexagenia orlando* A Burrowing Mayfly
- *Nannothemis bella* Elfin Skimmer
- *Oecetis porteri* Porter's Long-horn Sedge
- *Triaenodes florida* Floridian Triaenode Caddisfly

Conservation Threats

Threats to the Natural Lake habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Chemicals and toxins
- Conversion to agriculture
- Conversion to commercial/industrial development
- Conversion to housing and urban development
- Groundwater withdrawal
- Incompatible recreational activities
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban
- Surface water withdrawal and diversion

Many of the threats to this habitat stem directly or indirectly from lakefront development which is ubiquitous on natural lakes throughout Florida. Like many wetland habitats, Natural Lakes, even those relatively unaffected by direct threats, suffer from an altered landscape context as surrounding uplands have been developed for housing and agricultural development. Additional threats specific to this habitat include the operation of dams or control structures, especially on lakes in central and south Florida.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered landscape mosaic or context	High
B	Altered hydrologic regime	High
C	Altered species composition/dominance	High
D	Altered water quality of surface water or aquifer: nutrients	High
E	Erosion/sedimentation	Medium
F	Altered community structure	Medium
G	Habitat degradation/disturbance	Medium
H	Insufficient size/extent of characteristic communities or ecosystems	Medium
I	Habitat destruction or conversion	Medium
J	Altered water quality of surface water or aquifer: contaminants	Medium

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Invasive plants	**High**	C
2	Dam operations	**High**	B, C
3	Nutrient loads–urban	**High**	C, D, E, F
4	Conversion to housing and urban development	**High**	A, C, D, F, I
5	Surface water withdrawal	**Medium**	B, C
6	Nutrient loads–agriculture	**Medium**	C, D, E, F
7	Invasive animals	**Medium**	C
8	Conversion to commercial and industrial development	**Medium**	A, C, D, I
9	Conversion to agriculture	**Medium**	A, H
10	Chemicals and toxins	**Medium**	J
11	Groundwater withdrawal	**Low**	B
12	Incompatible recreational activities	**Low**	G
13	Incompatible residential activities	**Low**	G
14	Management of nature–aquatic plant treatment	**Low**	F
15	Incompatible agricultural practices	**Low**	B, C, D, E

Sources of Stress	Habitat Source Rank	Related Stresses (see above)
Statewide Threat Rank of Habitat	**High**	

Conservation Actions

Actions to abate the threats to Natural Lakes that were also identified as statewide threats (Invasive plants, Nutrient loads–urban, Conversion to housing and urban development, Surface water withdrawal and diversion, Nutrient loads–agriculture, Invasive animals, Conversion to commercial/industrial development, Conversion to agriculture, Chemicals and toxins, Groundwater withdrawal, Incompatible recreational activities) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Natural Lakes and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. Additional actions were developed to address threats specific to this habitat. These actions are intended to improve the condition of lake-fringe wetland habitat by managing lake levels to more closely resemble a natural hydrologic regime, maintain the amounts of littoral vegetation on lake edges necessary to sustain ecosystem function, improve the compatibility of lakefront development with wildlife habitat conservation, and increase our knowledge of the impact of chemicals and toxins on lake ecosystems.

Dam Operations

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Coordinate interstate Strategy actions to ensure that all fish and wildlife resources in all states are protected when changing dam operations in shared basins (USFWS).	M	H	L
L	Coordinate multiagency review of USACE activities, including biological aspects (fish spawn guidelines, protection of fish and wildlife resources) of water control plans for interstate water projects, fish spawn guidelines, re-establishing natural seasonal fluctuation of flows.	H	L	M
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Integrate lake management activities to coordinate multiple species and habitat conservation, restoration, and invasive plant management (FWC).	H	M	M
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
H	Continue developing and implementing hydrologic management plans that restore the natural seasonal fluctuation to lakes in order to successfully manage sediment-dwelling wildlife.	M	H	L
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Develop a position paper on the impacts of lake level stabilization and absence of dry-season drawdown on littoral zone vegetation and dependent wildlife, and sediment accumulation in managed natural lakes.	H	L	L

L	Evaluate feasibility of incentive programs to remove small rural impoundments.	H	L	L

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Encourage conservation of lake frontage, riparian habitats and their floodplains.	M	L	VH

Conversion to Agriculture

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Create incentives for maintenance and conversion of lands to agricultural uses that use less water and result in lower nutrient outputs into Florida's waters and wetlands, and create market-based incentives to compensate private landowners for the environmental services they provide to the state through management that increases water storage and nutrient reduction.	M	M	H

Chemicals and Toxins

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Develop management techniques and recommendations for private landowners that minimize runoff of chemicals and toxins into wetlands and aquatic systems.	H	L	M
L	Develop management techniques and design protocols to minimize exposure of wading birds and other wetland wildlife to contaminants.	H	L	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Conduct research defining appropriate sediment quality standards for the various aquatic and marine systems. Fund research defining the relationship between sediment contamination (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H
L	Conduct research defining standards for persistent organic contaminants for the various aquatic and marine systems. Fund research defining the relationship between contamination from organics (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H

Incompatible Recreational Activities

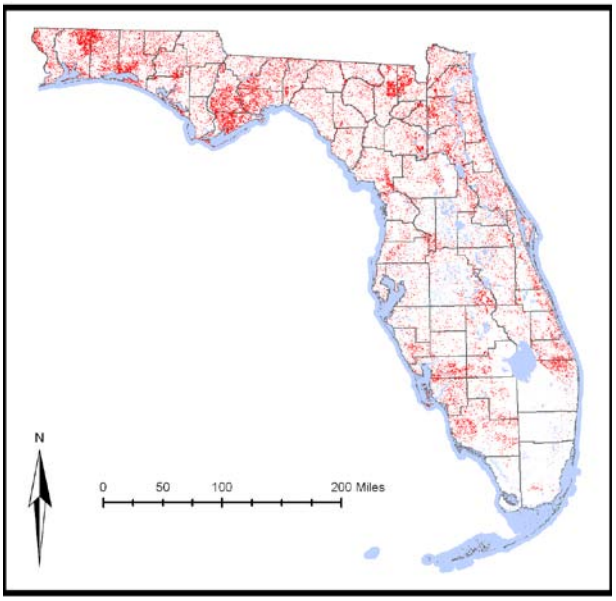
Overall Rank	Policy	*Feasibility*	*Benefits*	Cost
H	Identify a specified percentage of littoral vegetation clearing that does not reduce lake ecological integrity, and explore incentives for reaching that percentage on public and private lands.	M	H	M

Incompatible Residential Activities

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Expand the scale of the Florida Yards and Neighborhoods program from certifying individual landowners to whole neighborhoods; certification should be renewed biennially and any time property ownership changes.	M	M	L

L	Support incentives for residential property owners to resolve issues of incompatible use of Natural Lakes, including pesticide use, pet control, feeding of wildlife, household or yard waste disposal, landscape plants, irrigation use, prescribed fire tolerance, and lighting in coastal areas.	M	L	L
L	Identify and promote effective reward models for homeowners, maintenance companies, and municipalities for reducing impacts on neighboring conservation areas.	M	L	L
L	Develop a voluntary program directed at developers to provide on-site site-specific educational materials and recommendations to homeowner associations about incompatible residential activities.	M	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Encourage and support continuing education opportunities for landscape maintenance industry that includes appropriate use of chemicals, irrigation, plants, and disposal of yard waste.	H	M	M
L	Develop and implement management techniques for management of shoreline vegetation to reduce movement of sediment into water bodies.	M	L	M
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
L	Develop and promote management techniques that allow homeowners not to exceed recommended safe pesticide levels.	L	L	L

Natural Pineland



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status

Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 3,095,165 acres (1,252,569 ha) of Natural Pinelands are present in Florida. Of that total, 30% (917,949 acres; 371,481 ha) are in existing conservation or managed areas, 7% (206,899 acres; 83,729 ha) are on private lands encompassed by Florida Forever projects, 8% (235,176 acres; 95,172 ha) are SCHA-identified lands, and the remaining 56% (1,735,141 acres; 702,187 ha) are within other private lands.

Habitat Description

FNAI type: Mesic Flatwoods, Scrubby Flatwoods, Wet Flatwoods, Upland Pine Forest

This category includes natural pine forests, excluding pine rocklands, sandhills, and sand pine scrub, which are listed as separate categories. Natural Pineland habitats include mesic, hydric and scrubby flatwoods, and upland pine forests. Before human settlement, much of north and central Florida was covered by Natural Pineland. Much of this habitat type has been altered by humans as a result of conversion to agriculture and pine plantations, alteration of fire regimes, and introduced species. Pine flatwoods occur on flat sandy terrain where the overstory is characterized by longleaf pine, slash pine, or pond pine. The type of pineland habitat present is usually related to

soil differences and small variations in topography. Hydroperiod is an important factor determining what kind of pineland is represented. Generally, flatwoods dominated by longleaf pine occur on well-drained sites while pond pine-dominated sites occur in poorly drained areas, and slash pine-dominated sites occupy intermediate or moderately moist areas. The understory and ground cover within these three communities are somewhat similar and include several common species such as saw palmetto, gallberry, wax myrtle, and a wide variety of grasses and herbs. Generally, wiregrass and runner oak dominate longleaf pine sites; fetterbush and bay trees are found in pond pine areas, while saw palmetto, gallberry, and rusty lyonia occupy slash pine flatwoods sites. Scrubby flatwoods habitat typically occurs on drier ridges, many of which formed originally on or near old coastal dunes. Longleaf pine or slash pine dominates the overstory, whereas the ground cover is similar to that present in xeric oak scrub habitat. Cypress domes, bay heads, titi swamps, and freshwater marshes are commonly interspersed in isolated depressions throughout natural pineland habitats. A wide variety of animals utilize this habitat including the white-tailed deer, eastern diamondback rattlesnake, red-cockaded woodpecker, and pine woods tree frog. Fire is an important factor that helps to maintain and shape Natural Pineland communities; almost all of the plants and animals found here are adapted to having fires occur at least every one to eight years.

Associated Species of Greatest Conservation Need

Mammals

- *Sorex longirostris* — Southeastern Shrew
- *Eumops floridanus* — Florida Bonneted Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus cinereus* — Hoary Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Sylvilagus palustris hefneri* — Lower Keys Marsh Rabbit
- *Sciurus niger avicennia* — Big Cypress Fox Squirrel
- *Sciurus niger niger* — Southeastern Fox Squirrel
- *Sciurus niger shermani* — Sherman's Fox Squirrel
- *Podomys floridanus* — Florida Mouse
- *Ursus americanus floridanus* — Florida Black Bear
- *Mustela frenata olivacea* — Southeastern Weasel
- *Mustela frenata peninsulae* — Florida Long-tailed Weasel
- *Mustela vison evergladensis* — Everglades Mink
- *Mustela vison halilimnetes* — Gulf Salt Marsh Mink
- *Mustela vison lutensis* — Atlantic Salt Marsh Mink
- *Spilogale putorius* — Spotted Skunk
- *Mephitis mephitis* — Striped Skunk
- *Puma concolor coryi* — Florida Panther
- *Odocoileus virginianus clavium* — Key Deer

Birds

- *Elanoides forficatus* — Swallow-tailed Kite
- *Ictinia mississippiensis* — Mississippi Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Buteo brachyurus* — Short-tailed Hawk

- *Falco sparverius paulus* Southeastern American Kestrel
- *Columbina passerine* Common Ground-Dove
- *Melanerpes erythrocephalus* Red-headed Woodpecker
- *Picoides villosus* Hairy Woodpecker
- *Picoides borealis* Red-cockaded Woodpecker
- *Colaptes auratus auratus* Northern Flicker
- *Aphelocoma coerulescens* Florida Scrub-Jay
- *Sitta carolinensis* White-breasted Nuthatch
- *Dendroica dominica stoddardi* Stoddard's Yellow-throated Warbler
- *Limnothlypis swainsonii* Swainson's Warbler
- *Wilsonia citrina* Hooded Warbler
- *Aimophila aestivalis* Bachman's Sparrow
- *Ammodramus henslowii* Henslow's Sparrow

Amphibians

- *Ambystoma cingulatum* Flatwoods Salamander
- *Ambystoma tigrinum* Tiger Salamander
- *Notophthalmus perstriatus* Striped Newt
- *Hyla andersonii* Pine Barrens Treefrog
- *Pseudacris ornata* Ornate Chorus Frog
- *Rana capito* Gopher Frog

Reptiles

- *Kinosternon baurii* Key Mud Turtle
- *Clemmys guttata* Spotted Turtle
- *Terrapene carolina major* Gulf Coast Box Turtle
- *Terrapene carolina bauri* Florida Box Turtle
- *Deirochelys reticularia* Chicken Turtle
- *Gopherus polyphemus* Gopher Tortoise
- *Eumeces anthracinus* Coal Skink
- *Storeria dekayi* Lower Keys Brown Snake
- *Thamnophis sauritus* Lower Keys Ribbon Snake
- *Heterodon platirhinos* Eastern Hognose Snake
- *Heterodon simus* Southern Hognose Snake
- *Diadophis punctatus acricus* Key Ringneck Snake
- *Drymarchon couperi* Eastern Indigo Snake
- *Lampropeltis calligaster* Mole Kingsnake
- *Lampropeltis getula* Common Kingsnake
- *Stilosoma extenuatum* Short-tailed Snake
- *Tantilla oolitica* Rim Rock Crowned Snake
- *Crotalus horridus* Timber Rattlesnake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Invertebrates

- *Procambarus apalachicolae* A Crayfish
- *Procambarus capillatus* A Crayfish
- *Procambarus econfinae* Panama City Crayfish
- *Procambarus escambiensis* A Crayfish
- *Procambarus latipleurum* A Crayfish
- *Procambarus rogersi rogersi* A Crayfish
- *Chelyoxenus xerobatis* Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* Gopher Tortoise Aphodius Commensal Scarab Beetle

- *Copris gopheri* Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Atrytone arogos arogos* Arogos Skipper
- *Atrytonopsis hianna loammi* Southern Dusted Skipper
- *Ephyriades brunneus floridensis* Florida Duskywing
- *Eumaeus atala* Atala
- *Strymon acis bartrami* Bartram's Hairstreak
- *Anaea troglodyta floridalis* Florida Leafwing

Conservation Threats

Threats to Natural Pineland habitat that were also identified for multiple other habitats are addressed in Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Conversion to recreation areas
- Groundwater withdrawal
- Incompatible fire
- Incompatible forestry practices
- Incompatible recreational activities
- Incompatible resource extraction: mining/drilling
- Invasive animals
- Invasive plants
- Roads
- Surface water withdrawal

Threats specific to Natural Pinelands included the siting of utility corridors through this habitat, particularly on public lands, which results in fragmentation and loss of habitat. This habitat is also threatened by conversion to more intensive land uses and insufficient management of invasive plant species such as Japanese climbing fern.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered fire regime	High
B	Altered hydrologic regime	High
C	Habitat destruction or conversion	High
D	Altered community structure	High
E	Altered species composition/dominance	High
F	Fragmentation of habitats, communities, ecosystems	High
G	Insufficient size/extent of characteristic communities or ecosystems	High
H	Altered landscape mosaic or context	Medium
I	Keystone species missing or lacking in abundance	Low
J	Missing key communities, functional guilds, or seral stages	Low
K	Altered soil structure and/or chemistry	Low
L	Excessive depredation and/or parasitism	Low
M	Habitat degradation/disturbance	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Roads	**Very High**	A, B, C, D, E, F, G, H
2	Conversion to housing and urban development	**Very High**	A, B, C, F, G, H
3	Surface water withdrawal	**High**	A, B, C, D, E, F
4	Incompatible fire	**High**	A, B, C, D, E, H
5	Conversion to commercial and industrial development	**High**	A, B, C, F, G, H
6	Invasive plants	**High**	A, B, D, E
7	Incompatible recreational activities	**High**	A, B, C, D, E, F
8	Incompatible forestry practices	**High**	A, B, C, D, E, F
9	Groundwater withdrawal	**Medium**	A, B, D, E
10	Conversion to recreation areas	**Medium**	A, B, C, F, G
11	Utility corridors	**Medium**	A, B, C, D, E, F, G
12	Conversion to agriculture	**Low**	H
13	Incompatible grazing and ranching	**Low**	A
14	Invasive animals	**Low**	D, E
15	Incompatible resources extraction: mining/drilling	**Low**	C, F, H
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Natural Pinelands that were also identified as statewide threats (see list above in Conservation Threats section) are in Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Natural Pineland habitat are below. These actions were designed to reduce habitat loss and fragmentation from utility rights-of-way and conversion to more intensive silviculture on public lands. Control of Japanese climbing fern was also identified as necessary where pine straw is harvested.

Invasive Plants

Overall Rank	Education and Awareness	*Feasibility*	*Benefits*	Cost
L	Educate the forest management consulting community about the illegality of selling pine straw bales contaminated with Japanese climbing fern, and appropriate control methods.	H	L	L
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**

L	Create a system where landowners can voluntarily have their plantations certified as Lygodium-free. Provide incentive programs so that landowners increase profits by having certified pine straw.	M	L	L

Utility Corridors

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
M	Develop private-public partnerships that facilitate placement of utilities on existing FDOT rights-of-way and vice-versa to minimize their cumulative impacts on habitats.	M	M	L
M	Provide data on sensitive habitats to utilities and Florida Public Service Commission (FPSC) early in the utility siting and planning process to minimize conflicts between wildlife, important habitats, and utility corridors.	VH	L	L
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Encourage language (e.g., ETDM) in utility siting process for co-location that minimizes fragmentation of natural areas.	M	M	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
VH	Explore options to reduce fragmentation of public lands caused by incompatible utility placement and land use. Promote awareness of this issue and encourage compatible alternate routes and land uses.	M	VH	H

Conversion to Agriculture

Overall Rank	Land/Water Protection	*Feasibility*	*Benefits*	Cost
M	Explore opportunities to encourage avoidance of converting natural habitats on public conservation lands to other uses.	M	M	L

Pelagic

Status
Current condition: Unknown. Due to the lack of sufficient map data for this habitat category, no acreage estimates are currently available.

Habitat Description

FNAI type: None

The Pelagic environment includes the waters lying over the continental shelf (neritic zone) and waters beyond the continental shelf. The Pelagic community lives in the water column above the seafloor and below the surface. This community does not depend on the seabed, although its members may visit it occasionally. The community consists of free-swimming creatures known as nekton and less- or non-motile plankton.

In Florida, this environment extends three nautical miles off of the Florida east coast and nine nautical miles off of the Florida Gulf coast. Maximum depths vary from approximately 30 feet (9 m) in the Gulf of Mexico to more than 1,000 feet (304 m) off of the Florida Keys and southeast Florida.

Associated Species of Greatest Conservation Need

Mammals

- *Eubalaena glacialis* — North Atlantic Right Whale
- *Kogia simus* — Dwarf Sperm Whale
- *Kogia breviceps* — Pygmy Sperm Whale
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Aythya affinis* Lesser Scaup
- *Gavia immer* Common Loon
- *Podiceps auritus coronutus* Horned Grebe
- *Pelecanus occidentalis* Brown Pelican
- *Fregata magnificens* Magnificent Frigatebird
- *Sterna nilotica* Gull-billed Tern
- *Sterna caspia* Caspian Tern
- *Sterna maxima* Royal Tern
- *Sterna dougallii* Roseate Tern
- *Sterna anaethetus* Bridled Tern
- *Sterna fuscata* Sooty Tern
- *Anous stolidus* Brown Noddy

Reptiles

- *Chelonia mydas* Green Turtle
- *Eretmochelys imbricata* Hawksbill
- *Caretta caretta* Loggerhead
- *Lepidochelys kempii* Kemp's Ridley
- *Dermochelys coriacea* Leatherback

Fish

- *Rhincodon typus* Whale Shark
- *Carcharhinus acronotus* Blacknose Shark
- *Carcharhinus brevipinna* Spinner Shark
- *Carcharhinus falciformis* Silky Shark
- *Carcharhinus isodon* Finetooth Shark
- *Carcharhinus leucas* Bull Shark
- *Carcharhinus limbatus* Blacktip Shark
- *Carcharhinus obscurus* Dusky Shark
- *Carcharhinus perezii* Reef Shark
- *Galeocerdo cuvier* Tiger Shark
- *Negaprian brevirostris* Lemon Shark
- *Prionace glauca* Blue Shark
- *Rhizoprionodon terraenovae* Atlantic Sharpnose Shark
- *Sphyrna lewini* Scalloped Hammerhead
- *Sphyrna mokarran* Great Hammerhead
- *Sphyrna zygaena* Smooth Hammerhead
- *Carcharias taurus* Sand Tiger
- *Alopias superciliosus* Bigeye Thresher
- *Alopias vulpinus* Thresher Shark
- *Carcharodon carcharias* White Shark
- *Isurus oxyrinchus* Shortfin Mako
- *Isurus paucus* Longfin Mako
- *Aetobatus narinari* Spotted Eagle Ray
- *Manta birostris* Giant Manta
- *Acipenser oxyrinchus desotoi* Gulf Sturgeon
- *Megalops atlanticus* Tarpon
- *Anguilla rostrata* American Eel
- *Alosa aestivalis* Blueback Herring
- *Alosa alabamae* Alabama Shad
- *Alosa mediocris* Hickory Shad

- *Alosa sapidissima* American Shad
- *Menidia conchorum* Key Silverside
- *Hemiramphus balao* Balao
- *Hemiramphus brasiliensis* Ballyhoo
- *Hyporhamphus meeki* False Silverstripe Halfbeak
- *Bryx dunckeri* Pugnose Pipefish
- *Hippocampus reidi* Longsnout Seahorse
- *Syngnathus fuscus* Northern Pipefish
- *Syngnathus louisianae* Chain Pipefish
- *Syngnathus pelagicus* Sargassum Pipefish
- *Syngnathus springeri* Bull Pipefish
- *Epinephelus itajara* Goliath Grouper
- *Mycteroperca bonaci* Black Grouper
- *Mycteroperca microlepis* Gag
- *Pomatomus saltatrix* Bluefish
- *Rachycentron canadum* Cobia
- *Coryphaena hippurus* Dolphinfish
- *Alectis ciliaris* African Pompano
- *Caranx latus* Horse-eye Jack
- *Elagatis bipinnulata* Rainbow Runner
- *Selar crumenophthalmus* Bigeye Scad
- *Seriola dumerili* Greater Amberjack
- *Seriola rivoliana* Almaco Jack
- *Seriola zonata* Banded Rudderfish
- *Trachinotus carolinus* Florida Pompano
- *Trachinotus falcatus* Permit
- *Lutjanus analis* Mutton Snapper
- *Lutjanus cyanopterus* Cubera Snapper
- *Lutjanus griseus* Gray Snapper
- *Lutjanus synagris* Lane Snapper
- *Ocyurus chrysurus* Yellowtail Snapper
- *Rhomboplites aurorubens* Vermilion Snapper
- *Lobotes surinamensis* Atlantic Tripletail
- *Cynoscion regalis* Weakfish
- *Clepticus parrae* Creole Wrasse
- *Acanthocybium solandri* Wahoo
- *Scomberomorus cavalla* King Mackerel
- *Scomberomorus maculatus* Spanish Mackerel
- *Scomberomorus regalis* Cero
- *Thunnus albacares* Yellowfin Tuna
- *Thunnus atlanticus* Blackfin Tuna
- *Thunnus thynnus* Bluefin Tuna
- *Xiphias gladius* Swordfish
- *Istiophorus platypterus* Sailfish
- *Balistes capriscus* Gray Triggerfish
- *Canthidermis sufflamen* Ocean Triggerfish
- *Aluterus schoepfii* Orange Filefish
- *Aluterus scriptus* Scrawled Filefish
- *Chilomycterus schoepfii* Striped Burrfish

Invertebrates *

- *Physalia physalis* Portuguese Man-o-war

- *Aurelia aurita* Moon Jelly
- *Stomolophus meleagris* Cannonball Jelly
- *Mnemiopsis mccradyi* Comb Jelly

* Only Invertebrates that use the Pelagic environment as obligate adult habitat are listed.

Conservation Threats

Threats to the Pelagic habitats that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible wildlife and fisheries management strategies
- Invasive animals
- Key predator/herbivore Loss
- Nutrient loads (urban)

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered primary productivity	High
B	Altered species composition	High
C	Altered water quality–nutrients	High
D	Altered water quality–physical, chemistry	High
E	Missing key communities or functional guilds/trophic shift	High
F	Keystone species missing or lacking in abundance	High

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Harmful algal blooms	**High**	A, B, C, E
2	Inadequate stormwater management	**High**	A, B, C, D
3	Key predator/herbivore losses	**High**	B, E, F
4	Nutrient loads (all sources)	**Medium**	A, C, E
5	Incompatible fishing pressure	**Medium**	B, F
6	Invasive animals	**Medium**	B
7	Placement of artificial structures	**Low**	B
8	Incompatible aquaculture operations	**Low**	C
9	Channel modification/shipping lanes	**Low**	D
10	Incompatible industrial operations	**Low**	B

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
11	Incompatible wildlife and fisheries management strategies	**Low**	B, F
12	Vessel impacts	**Low**	
13	Acoustic impacts	**Low**	
14	Fishing gear impacts	**Low**	
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Pelagic habitats that were also identified as statewide threats (see list above) are in the Chapter Multiple Habitat Threats and Conservation Actions. Many of the threats to Pelagic habitats are the same as for several other marine and estuarine habitats. Consequently, actions to abate these threats will be the same or similar to the actions recommended for abating threats to several other marine and estuarine habitats (e.g., Coral Reef, Hard Bottom, Submerged Aquatic Vegetation).

Pine Rockland

Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 2,959 acres (1,197 ha) of Pine Rockland habitat exist, of which 77% (2,275 ac; 921 ha) are in existing conservation or managed areas. Another 13% (382 ac; 155 ha) are Florida Forever projects and 1% (25 ac; 10 ha) are SHCA-identified lands. The remaining 9% (277 ac; 112 ha) are other private lands.

Habitat Description

FNAI type: Pine Rocklands

Pine Rockland is a unique type of pine flatwoods that is found exclusively on limestone substrate in the Florida Keys, the Big Cypress Swamp, and the Miami Rock Ridge (the limestone outcropping that rises from the Everglades to heights of 23 feet (7 m) above sea level). The overstory of Pine Rockland habitat contains a single canopy species, South Florida slash pine. The dominant pines tower over a savanna-like understory of saw palmettos, locust berry, willow bustic, beauty berry, broom grasses, silver palms, and a rich herbaceous layer. This community is often associated with rockland hammock and other short-hydroperiod freshwater wetland communities. These sub-tropical pine trees and understory plants have adapted to seasonal wildfires and the lack of soil on the exposed limerock. Pine Rockland communities are globally imperiled and support

federal and state listed plant species, such as deltoid spurge and Small's milkwort which only occur in this habitat.

Associated Species of Greatest Conservation Need

Mammals

- *Sylvilagus palustris hefneri* — Lower Keys Marsh Rabbit
- *Sciurus niger avicennia* — Big Cypress Fox Squirrel
- *Oryzomys argentatus* — Silver Rice Rat
- *Sigmodon hispidus exsputus* — Lower Keys Cotton Rat
- *Ursus americanus floridanus* — Florida Black Bear
- *Provyon lotor auspicatus* — Key Vaca Raccoon
- *Proycon lotor incautus* — Key West Raccoon
- *Puma concolor* — Florida Panther
- *Odocoileus vurginianus clavium* — Key Deer

Birds

- *Colinus virginianus* — Northern Bobwhite
- *Elanoides forficatus* — Swallow-tailed Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Falco sparverius paulus* — Southeastern American Kestrel
- *Coccyzus minor* — Mangrove Cuckoo
- *Picoides villosus* — Hairy Woodpecker
- *Picoides borealis* — Red-cockaded Woodpecker
- *Tyrannus dominicensis* — Gray Kingbird
- *Lanius ludovicianus* — Loggerhead Shrike
- *Vireo altiloquus* — Black-Whiskered Vireo
- *Sitta pusilla* — Brown-headed Nuthatch
- *Dendroica petechia gundlachi* — Cuban Yellow Warbler
- *Sturnella magna* — Eastern Meadowlark

Reptiles

- *Kinosternon baurii* — Key Mud Turtle
- *Terrapene carolina bauri* — Florida Box Turtle
- *Gopherus polyphemus* — Gopher Tortoise
- *Eumeces egregius egregius* — Florida Keys Mole Skink
- *Storeria dekayi* — Lower Keys Brown Snake
- *Thamnophis sauritus* — Lower Keys Ribbon Snake
- *Diadophis punctatus acricus* — Key Ringneck Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Tantilla oolitica* — Rim Rock Crowned Snake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake

Invertebrates

- *Liguus fasciatus matecumbensis* — Florida (Matecumbe) Tree Snail
- *Anomala robinsoni* — Robinson's Anomala Scarab Beetle
- *Eumaeus atala* — Atala
- *Hemiargus thomasi bethunebakeri* — Miami Blue
- *Strymon acis bartrami* — Bartram's Hairstreak
- *Anaea troglodyta floridalis* — Florida Leafwing

Conservation Threats

Threats to Pine Rockland habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Chemicals and toxins
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Incompatible fire
- Invasive animals
- Invasive plants
- Roads

Threats specific to Pine Rockland were limited to incompatible residential activities that include movement of fertilizer, herbicide, and invasive species from landscape maintenance, activities of people, their pets, and nuisance species, and disposal of yard and household waste.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered fire regime	High
B	Altered landscape mosaic or context	High
C	Habitat destruction or conversion	High
D	Fragmentation of habitats, communities, ecosystems	Medium
E	Altered community structure	Medium
F	Altered species composition/dominance	Medium
G	Excessive depredation and/or parasitism	Medium
H	Insufficient size/extent of characteristic communities or ecosystems	Medium
I	Habitat degradation/disturbance	Medium
J	Altered hydrologic regime	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Roads	**High**	A, B, C
2	Conversion to housing and urban development	**High**	A, B, C
3	Conversion to commercial and industrial development	**High**	A, B, C
4	Incompatible fire	**Medium**	A, B, C
5	Invasive plants	**Low**	A, B, C
6	Invasive animals	**Low**	B
7	Chemicals and toxins	**Low**	B
8	Incompatible residential activities	**Low**	A, C

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
9	Incompatible agricultural practices	Low	B
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

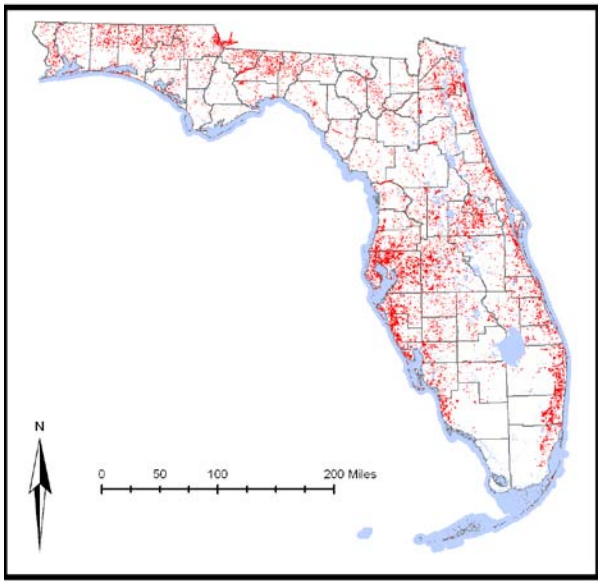
Actions to abate the threats to Pine Rockland that were also identified as statewide threats (Roads, Conversion to housing and urban development, Conversion to commercial and industrial development, Incompatible fire, Invasive plants, Invasive animals, Chemicals and toxins) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Pine Rockland habitat are below, although none were ranked of high priority for implementation. These actions were designed to reduce the impacts from activities of residents adjacent to this habitat.

Incompatible Residential Activities

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Expand the scale of the Florida Yards and Neighborhoods program from certifying individual landowners to whole neighborhoods; certification should be renewed biennially and any time property ownership changes.	M	M	L
L	Support incentives for residential property owners to resolve issues of incompatible use, including pesticide use, pet control, feeding of wildlife, household or yard waste disposal, landscape plants, irrigation use, prescribed fire tolerance, and lighting use in coastal areas.	M	L	L
L	Identify and promote effective reward models for homeowners, maintenance companies, and municipalities for reducing impacts on neighboring conservation areas.	M	L	L
L	Develop a voluntary program directed at developers to provide on-site site-specific educational materials and recommendations to homeowner associations about incompatible residential activities.	M	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Implement and fund continuing education courses for the landscape maintenance industry that includes appropriate use of chemicals, irrigation, plants, and disposal of yard waste.	H	M	M

Reservoir/Managed Lake



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 601,902 acres (243,581 ha) of Reservoir/Managed Lake habitat exist.

Habitat Description

FNAI type: None

This habitat category consists exclusively of man-made standing water bodies, each created by the damming of a flowing stream or excavation within a terrestrial habitat. These landscape features range from farm ponds and borrow pits of less than one acre (0.4 ha) to municipal reservoirs of more than 30,000 acres (12,141 ha). Reservoir/Managed Lake habitats are essentially permanent, although some of them dry completely during droughts.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat

- *Corynorhinus rafinesquii* Rafinesque's Big-eared Bat
- *Eptesicus fuscus* Big Brown Bat
- *Pipistrellus subflavus* Eastern Pipistrelle
- *Lutra canadensis lataxina* River Otter
- *Trichechus manatus latirostris* Florida Manatee

Birds

- *Anas fulvigula fulvigula* Florida Mottled Duck
- *Anas acuta* Northern Pintail
- *Aythya affinis* Lesser Scaup
- *Gavia immer* Common Loon
- *Pelecanus occidentalis* Brown Pelican
- *Botaurus lentiginosus* American Bittern
- *Ixobrychus exilis* Least Bittern
- *Egretta thula* Snowy Egret
- *Egretta caerulea* Little Blue Heron
- *Egretta tricolor* Tricolored Heron
- *Egretta rufescens* Reddish Egret
- *Nycticorax nycticorax* Black-crowned Night-Heron
- *Nyctanassa violacea* Yellow-crowned Night-Heron
- *Ajaja ajaja* Roseate Spoonbill
- *Eudocimus albus* White Ibis
- *Plegadis falcinellus* Glossy Ibis
- *Mycteria americana* Wood Stork
- *Rostrhamus sociabilis plumbeus* Snail Kite
- *Haliaeetus leucocephalus* Bald Eagle
- *Falco columbarius* Merlin
- *Falco peregrinus* Peregrine Falcon
- *Rallus elegans elegans* King Rail
- *Aramus guarauna* Limpkin
- *Grus canadensis pratensis* Florida Sandhill Crane
- *Grus americana* Whooping Crane
- *Recurvirostra americana* American Avocet
- *Sterna caspia* Caspian Tern
- *Sterna antillarum* Least Tern

Reptiles

- *Macrochelys temminckii* Alligator Snapping Turtle
- *Graptemys barbouri* Barbour's Map Turtle
- *Pseudemys concinna suwanniensis* Suwannee Cooter
- *Nerodia cyclopion* Mississippi Green Water Snake
- *Farancia erytrogramma* Rainbow Snake

Invertebrates

- *Anodonta heardi* Apalachicola Floater
- *Anodonta suborbiculata* Flat Floater
- *Utterbackia peggyae* Florida Floater
- *Utterbackia peninsularis* Peninsular Floater
- *Villosa amygdala* Florida Rainbow
- *Procambarus latipleurum* A Crayfish
- *Oxyethira elerobi* Elerob's (Cream and Brown Mottled) Microcaddisfly

- *Oxyethira kelleyi* Kelley's Cream and Brown Mottled Microcaddisfly
- *Oxyethira novasota* Novasota Oxyethiran Microcaddisfly

Conservation Threats

Threats to the Reservoir/Managed Lake habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Chemicals and toxins
- Incompatible forestry practices
- Incompatible recreational activities
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban

Threats specific to Reservoir/Managed Lake, as well as other habitats, include runoff from chemicals and toxins. Reservoirs are created for multiple purposes, some of which may be incompatible with their role as wildlife habitat. At the same time, reservoirs, especially instream impoundments, were themselves identified as important sources of fragmentation, altered hydrology, and other stresses to river and stream habitats.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered species composition/dominance	High
B	Altered water quality of surface water or aquifer: contaminants	High
C	Erosion/sedimentation	High
D	Altered water quality of surface water or aquifer: nutrients	High

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Nutrient loads–urban	**High**	A, D
2	Invasive animals	**High**	A
3	Incompatible recreational activities	**High**	A, B, C, D
4	Invasive plants	**High**	A
5	Incompatible construction practices	**Medium**	C, D
6	Nutrient loads–agriculture	**Medium**	A, D
7	Chemicals and toxins	**Medium**	B
8	Incompatible agricultural practices	**Medium**	B, C
9	Incompatible forestry practices	**Low**	C
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

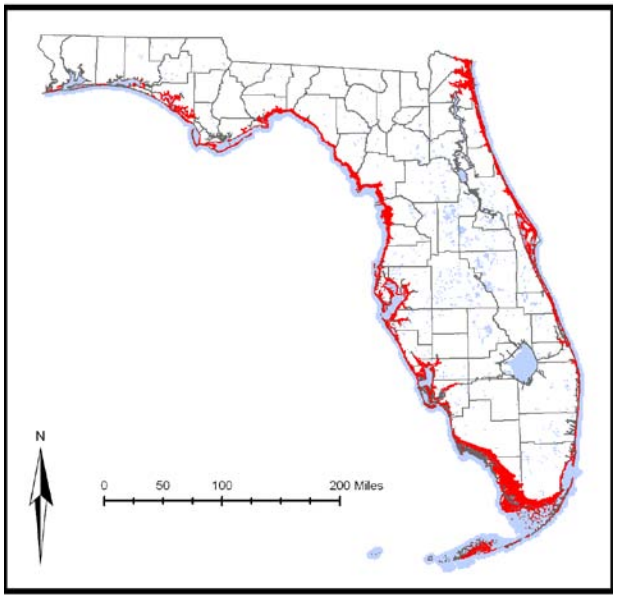
Actions to abate the threats to Reservoir/Managed Lake habitats that were also identified as statewide threats (Nutrient loads–urban, Invasive animals, Incompatible recreational activities, Invasive plants, Nutrient loads–agriculture, Chemicals and toxins, Incompatible forestry practices) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Reservoir/Managed Lake and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. Additional actions were developed to address threats specific to this habitat. These actions are intended to prevent degradation of water quality in reservoirs, prevent excessive withdrawal of water from reservoirs that would exacerbate the downstream hydrologic alteration caused by the dam, prevent reservoirs from becoming points of introduction or refugia for invasive species, operate dams such that the timing, frequency, duration, and magnitude of releases are compatible with the hydrologic needs of downstream aquatic habitat, operate and/or retrofit dams and other structures to facilitate movement of anadromous fishes through and upstream of reservoirs.

Chemicals and Toxins

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Develop and encourage use of recommendations for private landowners that minimize runoff of chemicals and toxins into wetlands and aquatic systems.	H	L	M
L	Develop management techniques and design protocols to minimize exposure of wading birds and other wetland wildlife to contaminants.	H	L	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
M	Evaluate cumulative impacts of small rural impoundments on fish and wildlife.	M	M	M
L	Conduct research defining appropriate sediment quality standards for the various aquatic and marine systems. Fund research defining the relationship between sediment contamination (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H
L	Conduct research defining standards for persistent organic contaminants for the various aquatic and marine systems. Fund research defining the relationship between contamination from organics (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H

Salt Marsh



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 442,577 acres (179,105 ha) of Salt Marsh habitat exist, of which 71% (316,033 ac; 127,894 ha) are in conservation or managed areas. Another 6% (26,740 ac; 10,821 ha) are in Florida Forever projects and 8% (33,222 ac; 13,444 ha) are in SHCA-designated lands. The remaining 15% (66,582 ac; 26,945 ha) are other private lands.

Habitat Description

FNAI type: Tidal Marsh

Salt Marsh is vegetated almost completely by herbaceous plants, primarily grasses, sedges, and rushes. This community type occurs within the intertidal zone of coastal areas and may be infrequently (high marsh) to frequently (low marsh) inundated by salt or brackish water. Salt Marsh develops where wave energies are low and where mangroves are absent. Mangroves may extirpate shade-intolerant marsh species. The size of a Salt Marsh depends on the extent of the intertidal zone in which it occurs. Salt Marshes of larger sizes are usually dissected by numerous tidal creeks. Areas that have low topographic relief and relatively high tidal ranges are likely to have larger Salt Marsh extents. Within Salt Marsh, plant species are often distributed unevenly, especially in transitional areas. Species distributions are affected by biotic and abiotic variables such as elevation, substrate type, degree of slope, wave energy, competing species, and salinity.

Smooth cordgrass typically occupies the lower elevations and is usually adjacent to tidal creeks and pools. Needlerush dominates the slightly less frequently inundated zone. Vegetation at the higher elevations forms transitional areas to uplands and may contain species such as marsh-hay, glassworts, saltwort, saltgrass, sea ox-eye daises, marsh-elder, and saltbush as well as many other species.

The Salt Marsh habitat is among the most productive communities in the world. Primary production is greatly affected by soil salinity and tidal frequency. Salt Marshes vary in extent and species composition throughout Florida and support diverse local faunas.

Associated Species of Greatest Conservation Need

Mammals

- *Microtus pennsylvanicus dukecampbelli* — Florida Salt Marsh Vole
- *Sylvilagus palustris hefneri* — Lower Keys Marsh Rabbit
- *Oryzomys palustris planirostris* — Pine Island Marsh Rice Rat
- *Oryzomys palustris sanibeli* — Sanibel Island Marsh Rice Rat
- *Oryzomys argentatus* — Silver Rice Rat
- *Sigmodon hispidus exsputus* — Lower Keys Cotton Rat
- *Sigmodon hispidus insulicola* — Insular Cotton Rat
- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Lutra canadensis lataxina* — River Otter
- *Odocoileus virginianus clavium* — Key Deer
- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Anas acuta* — Northern Pintail
- *Aythya affinis* — Lesser Scaup
- *Pelecanus occidentalis* — Brown Pelican
- *Ardea herodias occidentalis* — Great White Heron
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Egretta tricolor* — Tricolored Heron
- *Egretta rufescens* — Reddish Egret
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill
- *Eudocimus albus* — White Ibis
- *Mycteria americana* — Wood Stork
- *Haliaeetus leucocephalus* — Bald Eagle
- *Falco columbarius* — Merlin
- *Falco peregrinus* — Peregrine Falcon
- *Laterallus jamaicensis* — Black Rail
- *Rallus longirostris insularum* — Mangrove Clapper Rail
- *Rallus longirostris scottii* — Florida Clapper Rail
- *Haematopus palliatus* — American Oystercatcher

- *Recurvirostra americana* American Avocet
- *Numenius phaeopus hudsonicus* Whimbrel
- *Limosa fedoa* Marbled Godwit
- *Calidris canutus rufa* Red Knot
- *Calidris mauri* Western Sandpiper
- *Sterna nilotica* Gull-billed Tern
- *Sterna caspia* Caspian Tern
- *Sterna maxima* Royal Tern
- *Sterna antillarum* Least Tern
- *Rynchops niger* Black Skimmer
- *Cistothorus palustris griseus* Worthington's Marsh Wren
- *Cistothorus palustris marianae* Marian's Marsh Wren
- *Ammodramus maritimus fisheri* Louisiana Seaside Sparrow
- *Ammodramus maritimus junicolus* Wakulla Seaside Sparrow
- *Ammodramus maritimus macgillivraii* Macgillivray's Seaside Sparrow
- *Ammodramus maritimus peninsulae* Scott's Seaside Sparrow

Reptiles

- *Crocodylus acutus* American Crocodile
- *Terrapene carolina bauri* Florida Box Turtle
- *Malaclemys terrapin* Diamondback Terrapin
- *Chelonia mydas* Green Turtle
- *Caretta caretta* Loggerhead
- *Lepidochelys kempii* Kemp's Ridley
- *Nerodia clarkii clarkii* Gulf Salt Marsh Snake
- *Nerodia clarkii compressicauda* Mangrove Salt Marsh Snake
- *Nerodia clarkii taeniata* Atlantic Salt Marsh Snake
- *Lampropeltis getula* Common Kingsnake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Fish

- *Pristis pectinata* Smalltooth Sawfish
- *Acipenser oxyrinchus oxyrinchus* Atlantic Sturgeon
- *Acipenser oxyrinchus desotoi* Gulf Sturgeon
- *Atractosteus spatula* Alligator Gar
- *Megalops atlanticus* Tarpon
- *Mugil cephalus* Striped Mullet
- *Mugil curema* White Mullet
- *Rivulus marmoratus* Mangrove Rivulus
- *Fundulus jenkinsi* Saltmarsh Topminnow
- *Microphis brachyurus* Opossum Pipefish
- *Centropomus parallelus* Smallscale Fat Snook
- *Centropomus pectinatus* Tarpon Snook
- *Centropomus undecimalis* Common Snook
- *Epinephelus itajara* Goliath Grouper
- *Lutjanus griseus* Gray Snapper
- *Archosargus probatocephalus* Sheepshead
- *Cynoscion nebulosus* Spotted Seatrout
- *Pogonias cromis* Black Drum
- *Sciaenops ocellatus* Red Drum
- *Stathmonotus hemphilli* Blackbelly Blenny
- *Gobiomorus dormitor* Bigmouth Sleeper

- *Ctenogobius pseudofasciatus* Slashcheek Goby
- *Etropus crossotus* Fringed Flounder

Invertebrates

- *Geukensia demissa* Ribbed Mussel
- *Crassostrea virginica* Eastern Oyster
- *Uca minax* Red-jointed Fiddler, Brackish Water Fiddler
- *Uca pugilator* Sand Fiddler Crab
- *Uca pugnax* Mud Fiddler Crab
- *Callinectes sapidus* Blue Crab

Conservation Threats

Threats to Salt Marsh habitats that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Coastal development
- Dam operations/incompatible release of water (quality, quantity, timing)
- Disruption of longshore transport of sediments
- Incompatible industrial operations
- Incompatible wildlife and fisheries Management strategies
- Invasive plants
- Industrial spills
- Management of nature (beach nourishment and impoundments)
- Military activities
- Roads, bridges and causeways
- Shoreline hardening
- Surface water and groundwater withdrawal
- Vessel impacts

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Habitat destruction	Very High
B	Habitat fragmentation	Very High
C	Sedimentation	Very High
D	Altered structure	Medium
E	Altered water quality–contaminants	Medium
F	Altered water quality–physical, chemistry	Medium
G	Altered weather regime/sea level rise	Medium
H	Erosion	Medium
I	Altered hydrologic regime	Medium
J	Altered primary productivity	Medium
K	Altered species composition	Medium

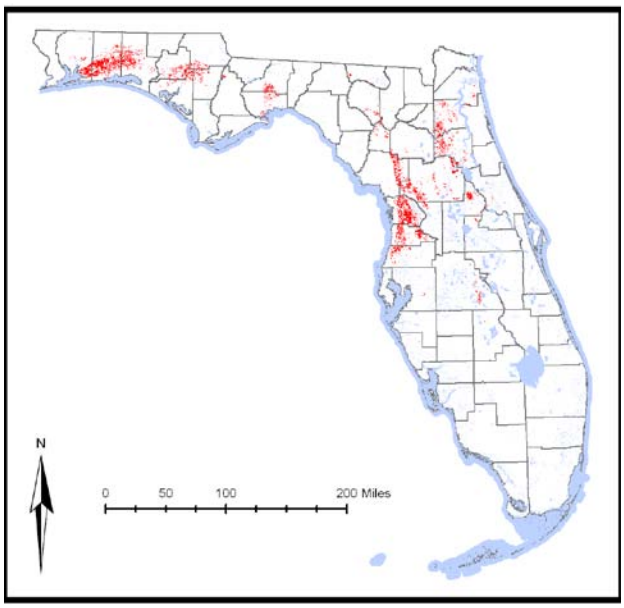
The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Coastal development	**Very High**	A, B, C, E, I, K
2	Roads, bridges and causeways	**High**	A, B, I, K
3	Incompatible industrial operations	**High**	A, B, E, I, K
4	Dam operations/incompatible release of water (quality, quantity, timing)	**High**	A, C, D, E, F, H, I, J, K
5	Climate variability	**High**	D, G, H, K
6	Inadequate stormwater management	**High**	A, B, C, D, E, F, I, J, K
7	Surface water withdrawal	**High**	D, F, I, K
8	Channel modification/shipping lanes	**High**	A, B, C, F, H
9	Incompatible wildlife and fisheries management strategies	**High**	A, B, I, K
10	Management of nature (beach nourishment, impoundments)	**High**	A, B, D, E, K
11	Disruption of longshore transport of sediments	**High**	C, H
12	Invasive plants	**Medium**	A, B, D, J, K
13	Shoreline hardening	**Medium**	A, B
14	Chemicals and toxins	**Medium**	E
15	Industrial spills	**Medium**	E
16	Utility corridors	**Medium**	A, B
17	Boating impacts	**Medium**	A, H
18	Military activities	**Low**	A
19	Vessel impacts	**Low**	A
20	Placement of artificial structures	**Low**	A
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Salt Marsh habitats that were also identified as statewide threats (see list above), are in Chapter Multiple Habitat Threats and Conservation Actions. Many of the threats to Salt Marsh are the same as for several other marine and estuarine habitats. Consequently, actions to abate these threats will be the same or similar to the actions recommended for abating threats to several other marine and estuarine habitats (e.g., Coastal Tidal River or Stream, Submerged Aquatic Vegetation, Mangrove Swamp, Coral Reef, Beach/Surf Zone).

Sandhill



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 753,547 acres (304,950 ha) of Sandhill habitat exist, of which 46% (348,512 ac; 141,038 ha) are in conservation or managed areas. Another 5% (35,052 ac; 14,185 ha) are in Florida Forever projects and 5% (34,517; 13,969 ha) are in SHCA-designated lands. The remaining 45% (335,466; 135,758 ha) are other private lands.

Habitat Description

FNAI type: Sandhill

Sandhill communities occur only in north and central Florida in areas of gently rolling terrain on deep, well-drained, mostly yellow, sterile sands. This xeric community is dominated by an overstory of widely spaced, scattered longleaf pine, along with an understory of turkey oak, sand post oak, and bluejack oak. The park-like ground cover consists of various grasses and herbs, including wiregrass, lopsided Indian grass, bluestems, blazing star, partridge pea, beggars tick, milk pea, queen's delight, and others. Due to the poor water retention properties of the soils and open canopy, temperature and humidity fluctuate rapidly and frequently in this habitat compared to high-moisture closed-canopy forests. However, many temporary wetlands are found throughout Sandhill landscapes and are an integral part of this habitat type, providing breeding and foraging habitat for many wildlife species. Sandhill is a community that is sustained by ground fires with short return intervals to reduce hardwood intrusion and to promote flowering of many grasses and herbs. In the

absence of fire, Sandhill will eventually succeed into a xeric hammock. Sand pine can quickly invade Sandhills where seed sources are available and fires are suppressed.

Associated Species of Greatest Conservation Need

Mammals

- *Sylvilagus floridanus* — Eastern Cottontail Rabbit
- *Sciurus niger shermani* — Sherman's Fox Squirrel
- *Geomys pinetis pinetis* — Southeastern Pocket Gopher
- *Podomys floridanus* — Florida Mouse
- *Ursus americanus floridanus* — Florida Black Bear
- *Spilogale putorius* — Spotted Skunk

Birds

- *Colinus virginianus* — Northern Bobwhite
- *Elanoides forficatus* — Swallow-tailed Kite
- *Ictinia mississippiensis* — Mississippi Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Falco sparverius paulus* — Southeastern American Kestrel
- *Columbina passerine* — Common Ground-Dove
- *Athene cunicularia floridana* — Florida Burrowing Owl
- *Melanerpes erythrocephalus* — Red-headed Woodpecker
- *Picoides villosus* — Hairy Woodpecker
- *Picoides borealis* — Red-cockaded Woodpecker
- *Colaptes auratus auratus* — Northern Flicker
- *Sitta pusilla* — Brown-headed Nuthatch
- *Aimophila aestivalis* — Bachman’s Sparrow
- *Ammodramus savannarum* — Grasshopper Sparrow (migrant)

Amphibians

- *Ambystoma tigrinum* — Tiger Salamander
- *Notophthalmus perstriatus* — Striped Newt
- *Pseudacris ornata* — Ornate Chorus Frog
- *Rana capito* — Gopher Frog

Reptiles

- *Terrapene carolina bauri* — Florida Box Turtle
- *Deirochelys reticularia* — Chicken Turtle
- *Gopherus polyphemus* — Gopher Tortoise
- *Sceloporus woodi* — Florida Scrub Lizard
- *Eumeces egregius lividus* — Bluetail Mole Skink
- *Neoseps reynoldsi* — Sand Skink
- *Heterodon platirhinos* — Eastern Hognose Snake
- *Heterodon simus* — Southern Hognose Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Pituophis melanoleucus mugitus* — Florida Pine Snake
- *Lampropeltis calligaster* — Mole Kingsnake
- *Stilosoma extenuatum* — Short-tailed Snake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake

Invertebrates

- *Cicindela highlandensis* — Highlands Tiger Beetle
- *Chelyoxenus xerobatis* — Gopher Tortoise Hister Beetle
- *Anomala exigua* — Exiguous (Pygmy) Anomala Scarab Beetle
- *Aphodius troglodytes* — Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* — Gopher Tortoise Copris Commensal Scarab Beetle
- *Mycotrupes pedester* — Scrub Island Burrowing Scarab Beetle (SW FL Mycotrupes)
- *Onthophagus polyphemi polyphemi* — Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Atrytone arogos arogos* — Arogos Skipper
- *Incisalia irus* — Frosted Elfin

Conservation Threats

Threats to Sandhill habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Conversion to recreation areas
- Incompatible fire
- Incompatible recreational activities
- Incompatible resource extraction: mining/drilling
- Invasive animals
- Invasive plants
- Roads

Threats specific to Sandhill were identified for the pathogen-causing Upper Respiratory Tract Disease in gopher tortoises, and movement of other parasites and pathogens from pets to native wildlife. Additionally, siting of utility corridors through this habitat, particularly on public lands, was identified as a cause of fragmentation and loss of habitat. Military base closure threatens potential conservation protection for Sandhill. Insufficient management of invasive plant species, such as Japanese climbing fern and cogongrass, also threatens this habitat and others.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered fire regime	Very High
B	Habitat destruction or conversion	Very High
C	Altered species composition/dominance	High
D	Keystone species missing or lacking in abundance	High
E	Altered hydrologic regime	High
F	Altered community structure	High
G	Fragmentation of habitats, communities, ecosystems	High
H	Insufficient size/extent of characteristic communities or ecosystems	High
I	Altered soil structure and/or chemistry	High
J	Missing key communities, functional guilds, or seral stages	Medium

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Incompatible recreational activities	**Very High**	B, C, D, E, F, G I
2	Conversion to housing and urban development	**Very High**	A, B, D, E, G, H, I
3	Roads	**Very High**	A, B, C, D, E, F, G, H, I
4	Incompatible fire	**High**	A, C, D, E, F
5	Utility corridors	**High**	B, C, E, G, H, I
6	Parasites/pathogens	**High**	C, D, F
7	Conversion to commercial and industrial development	**High**	A, B, D, E, G, H
8	Incompatible resource extraction: mining/drilling	**Medium**	B, E, G
9	Military activities	**Medium**	B, F, G
10	Invasive animals	**Medium**	C, D, F
11	Invasive plants	**Medium**	C, F
12	Conversion to recreation areas	**Medium**	B, C, D, E, G, H
13	Incompatible wild animal harvest	**Low**	C, D, F
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Sandhill that were also identified as statewide threats (Incompatible recreational activities, Roads, Conversion to housing and urban development, Incompatible fire, Conversion to commercial and industrial development, Incompatible resource extraction: mining/drilling, Invasive animals, Invasive plants (also see actions below), Conversion to recreation areas) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Sandhill are below. These actions were designed to reduce the potential for spread of parasites and pathogens, with specific reference to gopher tortoises, reduce habitat loss for utility rights-of-way, and assure that the management and closure of military bases be implemented to retain critical habitat for Florida's SGCN. Control of Japanese climbing fern was also identified as necessary where pine straw is harvested.

Utility Corridors

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
M	Develop private-public partnerships that facilitate placement of utilities on existing Florida FDOT rights-of-way and vice-versa to minimize their cumulative impacts on habitats.	M	M	L

M	Provide data on sensitive habitats to utilities and PSC early in the utility siting and planning process to minimize conflicts between wildlife, critical habitats, and utility corridors.	VH	L	L
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Encourage language (e.g., ETDM) in utility siting process for co-location and that minimizes fragmentation of natural areas.	M	M	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
VH	Explore options to reduce fragmentation of public lands caused by incompatible utility placement and land use. Promote awareness of this issue and encourage compatible alternate routes and land uses.	M	VH	H

Parasites/Pathogens

Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Develop an information clearinghouse for existing and emerging pathogens and parasites and their potential impacts on Florida's wildlife.	H	M	M
M	Develop educational materials for the public about gopher tortoises and the spread of URTD. (Work with the FWC, research community, and Gopher Tortoise Council).	VH	L	M

Military Activities

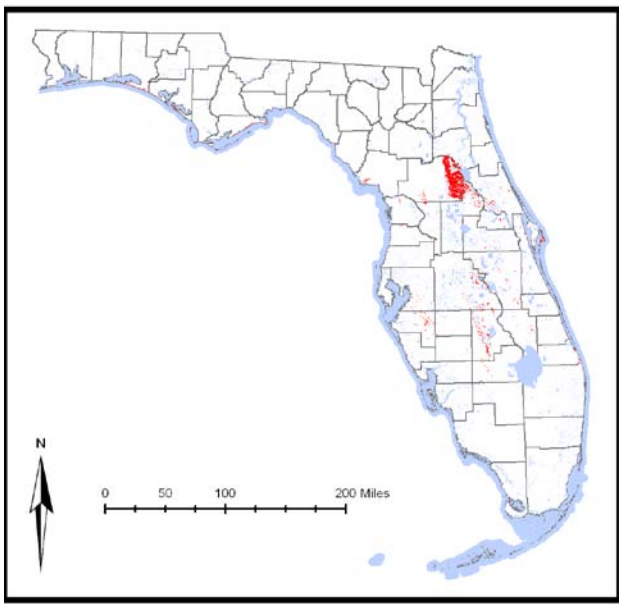
Overall Rank	**Capacity Building**	*Feasibility*	*Benefits*	**Cost**
H	Establish a permanent consultative group of multi-agency wildlife and habitat professionals that work with USDOD on development of any statewide plans for base expansion, increased usage, and growth or closure needs to enhance positive, or minimize any negative, impacts on wildlife and conservation lands.	M	H	M
Overall Rank	**Land/Water Protection**	*Feasibility*	*Benefits*	**Cost**
VH	Work to develop partnerships to encourage conservation of significant habitats on lands encompassed by federal/state base closures.	H	VH	VH
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
M	Create a cooperative program to ensure consistent implementation of management plans on USDOD/state lands with sufficient capacity for conservation management of wildlife and habitats on military lands in Florida (e.g., prescribed fire, invasive species control, monitoring).	M	M	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Work to develop partnerships to encourage implementation of comprehensive management and mitigation plans that protect high quality habitats and natural resources.	H	M	M

Invasive Plants

Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Educate the forest management consulting community about the illegality of selling pine straw bales contaminated with Japanese climbing fern, and appropriate control methods.	H	L	L

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Create a system where landowners can voluntarily have their plantations certified as *Lygodium*-free. Provide incentive programs so that landowners increase profits by having certified pine straw.	M	L	L

Scrub



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 337,458 acres (136,564 ha) of Scrub habitat exist, of which 76% (257,015 ac; 104,010 ha) are in existing protected or managed areas. Another 3% (11,311 ac; 4,577 ha) are in Florida Forever projects, while 4% (14,031 ac; 5,678 ha) are in SHCA-designated lands. The remaining 16% (55,101 ac; 22,299 ha) are other private lands.

Habitat Description

FNAI type: Scrub

This habitat occurs on areas of deep, well-drained, infertile sandy soils that are typically white or near white. Scrub has a patchy distribution and occurs in both inland and coastal areas, from the panhandle through subtropical regions of the peninsula. The largest and most important patches of Scrub occur along the central ridge of the peninsula near Ocala and in Polk and Highlands counties. This habitat is fire-dependent; it is maintained by fires that are usually very hot or intense, but occur infrequently at intervals of 10-20 years, or more. Generally, Scrub is dominated by evergreen, or nearly evergreen, oaks and/or Florida rosemary, with or without a pine overstory. A relatively large suite of plant species is endemic to Scrub (e.g., scrub holly and inopina oak); the rarest endemic plant species are restricted to the Lake Wales area of the central ridge (e.g., pygmy fringe tree and scrub plum). Some species of wildlife also are endemic or largely restricted to Scrub habitat (e.g., Florida scrub-jay and sand skink). Several types of Scrub

are recognized. Oak Scrub is a hardwood community typically consisting of clumped patches of low growing oaks interspersed with patches of bare, white sand. Pines are uncommon or absent. Oak Scrub is dominated by myrtle oak, Chapman's oak, sand-live oak, inopina oak, scrub holly, scrub plum, scrub hickory, rosemary, scrub palmetto, and saw palmetto. Sand Pine Scrub occurs on former shorelines and islands of ancient seas. This plant community is dominated by an overstory of sand pine and has an understory of myrtle oak, Chapman's oak, sand-live oak, rusty lyonia, wild olive, scrub bay, and scrub holly. Ground cover is usually sparse to absent, especially in mature stands, and rosemary and lichens occur in some open areas. Rosemary Scrub has few or no sand pines or scrub oaks but is dominated by rosemary with scattered lichen cover, scrub hypericum, and paper nailwort. Scrubby Flatwoods, differing from Scrub by having a sparse canopy of slash pine, is addressed in the Natural Pineland chapter. Additionally, many temporary wetlands are found throughout the Scrub landscape and are an integral part of this habitat type, providing breeding and foraging habitat for many wildlife species.

Associated Species of Greatest Conservation Need

Mammals

- *Sylvilagus floridanus* — Eastern Cottontail Rabbit
- *Sciurus niger shermani* — Sherman's Fox Squirrel
- *Geomys pinetis pinetis* — Southeastern Pocket Gopher
- *Peromyscus polionotus allophrys* — Choctawhatchee Beach Mouse
- *Peromyscus polionotus leucocephalus* — Santa Rosa Beach Mouse
- *Peromyscus polionotus niveiventris* — Southeastern Beach Mouse
- *Peromyscus polionotus peninsularis* — St. Andrews Beach Mouse
- *Peromyscus polionotus trissyllepsis* — Perdido Key Beach Mouse
- *Podomys floridanus* — Florida Mouse
- *Ursus americanus floridanus* — Florida Black Bear
- *Spilogale putorius* — Spotted Skunk
- *Puma concolor coryi* — Florida Panther

Birds

- *Colinus virginianus* — Northern Bobwhite
- *Elanoides forficatus* — Swallow-tailed Kite
- *Falco sparverius paulus* — Southeastern American Kestrel
- *Columbina passerine* — Common Ground-Dove
- *Athene cunicularia floridana* — Florida Burrowing Owl
- *Melanerpes erythrocephalus* — Red-headed Woodpecker
- *Picoides villosus* — Hairy Woodpecker
- *Colaptes auratus auratus* — Northern Flicker
- *Lanius ludovicianus* — Loggerhead Shrike
- *Aphelocoma coerulescens* — Florida Scrub-Jay

Amphibians

- *Notophthalmus perstriatus* — Striped Newt
- *Pseudacris ornata* — Ornate Chorus Frog
- *Rana capito* — Gopher Frog

Reptiles

- *Terrapene carolina bauri* — Florida Box Turtle
- *Gopherus polyphemus* — Gopher Tortoise
- *Sceloporus woodi* — Florida Scrub Lizard
- *Eumeces egregius insularis* — Cedar Key Mole Skink
- *Eumeces egregius lividus* — Bluetail Mole Skink
- *Neoseps reynoldsi* — Sand Skink
- *Virginia valeriae* — Smooth Earth Snake (Highlands Co population only)
- *Heterodon platirhinos* — Eastern Hognose Snake
- *Heterodon simus* — Southern Hognose Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Pituophis melanoleucus mugitus* — Florida Pine Snake
- *Stilosoma extenuatum* — Short-tailed Snake
- *Tantilla relicta pamlica* — Coastal Dunes Crowned Snake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake

Invertebrates

- *Coenobita clypeatus* — Land Hermit Crab
- *Aneflomorpha delongi* — Delong's Aneflomorpha
- *Romulus globosus* — Round-necked Romulus
- *Chelyoxenus xerobatis* — Gopher Tortoise Hister Beetle
- *Anomala eximia* — Archbold (Scrub) Anomala Scarab Beetle
- *Aphodius troglodytes* — Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* — Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* — Gopher Tortoise Onthophagus Commensal Scarab Beetle

Conservation Threats

Threats to Scrub habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to agriculture
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Conversion to recreation areas
- Incompatible fire
- Incompatible forestry practices
- Incompatible recreational activities
- Incompatible resource extraction: mining/drilling
- Invasive animals
- Invasive plants
- Roads

Threats specific to Scrub habitat include Incompatible forestry practices because this habitat supports Florida scrub-jays, which are not tolerant of dense pine stands adjacent to or within Scrub sites. Habitat-specific threats from mining includes habitat loss both when areas are mined and when dredge spoil is deposited on Scrub and mitigation activities that result in small, fragmented areas rather than more contiguous areas of this habitat. Military base closure threatens potential loss of protection of Scrub.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Fragmentation of habitats, communities, ecosystems	Very High
B	Insufficient size/extent of characteristic communities or ecosystems	Very High
C	Altered community structure	High
D	Altered fire regime	High
E	Habitat destruction or conversion	High
F	Altered soil structure and chemistry	High
G	Altered species composition/dominance	High
H	Altered landscape mosaic or context	High

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Incompatible fire	**Very High**	A, C, D, E, G, H
2	Conversion to housing and urban development	**Very High**	A, B, D, E, H
3	Roads	**Very High**	A, B, D, E, H
4	Incompatible forestry practices	**Very High**	A, C, D, E, F, G, H
5	Incompatible resource extraction: mining/drilling	**Very High**	A, B, E, F, H
6	Conversion to agriculture	**Very High**	A, B, E, H
7	Conversion to commercial and industrial development	**Very High**	A, B, D, E, H
8	Management of nature – stormwater facilities	**High**	A, E, F, H
9	Management of nature – dredge spoil deposition	**High**	A, E, F
10	Conversion to recreation areas	**Medium**	A, D, E
11	Invasive animals	**Medium**	C, D, E, G
12	Incompatible recreational activities	**Medium**	A, C, E
13	Military activities	**Medium**	A, B, D, E, H
14	Invasive plants	**Medium**	C, G
15	Incompatible agricultural practices	**Medium**	F
16	Incompatible grazing and ranching	**Low**	C
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Scrub that were also identified as statewide threats (Conversion to agriculture, Conversion to commercial and industrial development, Conversion to

housing and urban development, Conversion to recreation areas, Incompatible fire, Incompatible forestry practices (also see actions below), Incompatible recreational activities, Incompatible resource extraction: mining/drilling (also see actions below), Invasive animals, Invasive plants, Roads) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Scrub are below. These actions were designed to reduce the impacts of adjacent incompatible forest management, mining and mine mitigation, habitat loss from public facility siting, and potential management or loss on Avon Park Air Force Range.

Incompatible Forestry Practices

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Promote importance of bird viability in management decisions on public lands where silvicultural management is in conflict with maintaining viable populations of imperiled grassland and scrub birds.	M	L	L

Incompatible Resource Extraction: Mining/Drilling

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
H	Encourage preservation of large contiguous patches of scrub and other sensitive upland habitats in lieu of current practice of protecting habitat piecemeal.	H	H	H
M	Create voluntary incentives to avoid loss of, and impacts to, SHCAs and sensitive habitats from mining, particularly wet and dry prairie, scrub, and bat caves.	H	M	H
Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Develop a coalition of groups to identify local restoration projects where spoil material can be used.	M	L	L

Management of Nature – Stormwater/Wastewater Facilities

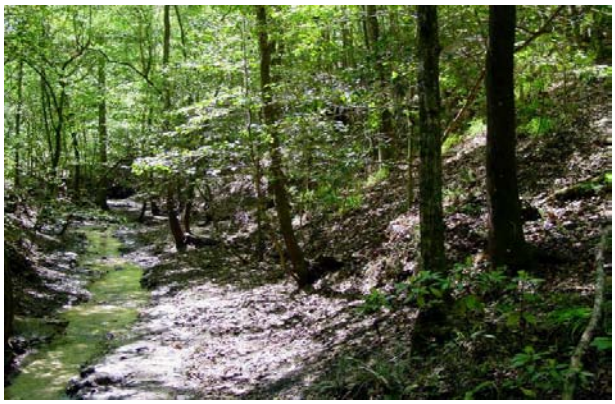
Overall Rank	Policy	*Feasibility*	*Benefits*	Cost
M	Promote the importance of scrub habitat and encourage placement of county or municipal water treatment facilities in other areas when imperiled species utilize proposed scrub sites.	M	M	L

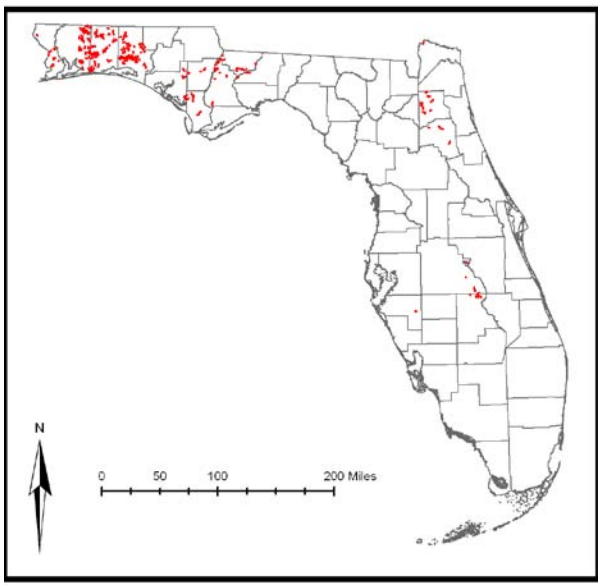
Military Activities

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Establish a permanent consultative group of multi-agency wildlife and habitat professionals that work with USDOD on development of any statewide plans for base expansion, increased usage, and growth or closure needs to enhance positive, or minimize any negative impacts on wildlife and conservation lands.	M	H	M
Overall Rank	Land/Water Protection	*Feasibility*	*Benefits*	Cost
VH	Work to develop partnerships to encourage conservation of significant habitats on lands encompassed by federal/state base closures.	H	VH	VH
Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost

H	Support a collaborative effort among the USFWS, Avon Park Air Force Range, Archbold Biological Station, and the FWC to develop and implement a mitigation and management plan to accommodate military needs and maintain habitat and species viability.	VH	M	VH
M	Create a cooperative program to ensure consistent implementation of management plans on USDOD lands with sufficient capacity for conservation management of wildlife and habitats on military lands in Florida (e.g., prescribed fire, invasive species control, monitoring).	M	M	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
M	Work to develop partnerships to encourage implementation of comprehensive management and mitigation plans that protect high quality habitats and natural resources.	H	M	M

Seepage/Steephead Stream





Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Good and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 515 miles (2,639 km) of Seepage/Steephead Stream habitat exist.

Habitat Description

FNAI type: Seepage Stream, Seepage Slope

This habitat includes seepage bogs and streams that typically have deep sand bottoms with slow, constant, percolated groundwater inflow of clear, cool, unpolluted water. Seepage/Steephead Streams are usually less than 40 feet (12 m) wide, shallow, often form the headwaters of many Alluvial and blackwater streams, and are biologically diverse. These streams are usually sheltered by a dense overstory and therefore have little to no aquatic vegetation. Green algae may occur intermittently within the stream, while mosses, ferns and liverworts can sometimes occur in clumps at the waters edge. Seepage/Steephead Streams are usually accompanied by seepage slopes. These slopes have acidic, low-nutrient soils which are constantly saturated with moisture flowing from upslope. Steephead streams are formed when drainage water begins to collect underground from a slope and flow outward to the surface. The resulting flow brings about an erosion of the slopes base, which forms a cut out in the underside of the hill. Seepage bogs exist in areas where the land gradually slopes to just above, or slightly intersects the water table. These bogs do not have regular standing water and are not as wet as swamps or marshes. Seepage bogs are dominated by low growing plant species, such as grasses and carnivorous plants, which occasionally must burn to remain healthy. Classic Florida examples are found in the Apalachicola drainage, but streams of this type also occur elsewhere in the state where there is topographic relief. This category includes

seepage streams in ravines, and the hillside pitcher plant bogs found at the head of or along seepage streams on Eglin Air Force Base and Blackwater River State Forest.

Associated Species of Greatest Conservation Need

Mammals

- *Myotis austroriparius* Southeastern Bat
- *Myotis grisescens* Gray Bat
- *Lasiurus borealis* Eastern Red Bat
- *Lasiurus seminolus* Seminole Bat
- *Lasiurus intermedius* Northern Yellow Bat
- *Lasiurus cinereus* Hoary Bat
- *Corynorhinus rafinesquii* Rafinesque's Big-eared Bat
- *Eptesicus fuscus* Big Brown Bat
- *Pipistrellus subflavus* Eastern Pipistrelle
- *Lutra canadensis lataxina* River Otter

Birds

- *Egretta caerulea* Little Blue Heron
- *Elanoides forficatus* Swallow-tailed Kite
- *Seiurus montacilla* Louisiana Waterthrush

Amphibians

- *Amphiuma pholeter* One-toed Amphiuma
- *Desmognathus auriculatus* Southern Dusky Salamander
- *Desmognathus monticola* Seal Salamander
- *Desmognathus cf. conanti* Eglin Ravine Dusky Salamander
- *Desmognathus apalachicolae* Apalachicola Dusky Salamander
- *Hemidactylium scutatum* Four-toed Salamander
- *Eurycea chamberlaini* Chamberlain's Dwarf Salamander
- *Eurycea cf. quadridigitata* Bog Dwarf Salamander
- *Hyla andersonii* Pine Barrens Treefrog
- *Rana okaloosae* Florida Bog Frog

Fish

- *Etheostoma parvipinne* Goldstripe Darter
- *Etheostoma okaloosae* Okaloosa Darter

Invertebrates

- *Cambarus pyronotus* Fire-back (Red-back) Crayfish
- *Procambarus rathbunae* A Crayfish
- *Procambarus rogersi expletus* A Crayfish
- *Cordulegaster sayi* Say's Spiketail
- *Lestes inaequalis* Elegant Spreadwing
- *Oecetis parva* Little Longhorned Caddisfly
- *Agarodes ziczac* Zigzag Blackwater River Caddisfly

Conservation Threats

Threats to the Seepage/Steephead Stream habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to commercial/industrial development
- Conversion to housing and urban development
- Incompatible fire
- Invasive animals
- Incompatible forestry practices
- Incompatible resource extraction–mining/drilling
- Roads

Threats to this habitat are those common to most unprotected low-order of headwater stream systems in Florida and these threats include outright conversion to other land uses, especially housing, roads and commercial forests. Herbaceous seepage systems suffer from inadequate fire, often leading to succession of associated herbaceous communities to hardwood swamp wetlands. Additional threats specific to this habitat include the operation of dams or control structures on small steephead and seepage streams, especially in north Florida, where these systems have historically been utilized for small-scale water supplies or fishing impoundments.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered hydrologic regime	High
B	Altered community structure	Medium
C	Altered successional dynamics	Medium
D	Erosion/sedimentation	Medium
E	Habitat destruction or conversion	Medium
F	Altered species composition/dominance	Medium
G	Fragmentation of habitats, communities, ecosystems	Low
H	Altered water quality of surface water or aquifer: nutrients	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Invasive animals	**Medium**	A, D
2	Conversion to housing and urban development	**Medium**	A, D
3	Conversion to commercial and industrial development	**Medium**	A, D
4	Management of nature - water control structures	**Medium**	A, B
5	Roads	**Medium**	A, B, D
6	Incompatible resource extraction: mining/drilling	**Medium**	D
7	Incompatible fire	**Medium**	A, B, C

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
8	Incompatible forestry practices	Low	A, D
Statewide Threat Rank of Habitat		**Medium**	

Conservation Actions

Actions to abate the threats to Seepage/Steephead Stream that were also identified as statewide threats (Invasive animals, Conversion to housing and urban development, Conversion to commercial/industrial development, Roads, Incompatible resource extraction – mining/drilling, Incompatible fire, Incompatible forestry practices) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Seepage/Steephead Stream and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Softwater Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. Additional actions were developed to address threats specific to this habitat. These actions are intended to ensure that road crossings for these streams are designed to prevent creation of impoundments and reduce introduction of sediments, maintain natural riparian buffers in developing areas, raise awareness of the need for fire in these systems and reduce impacts caused by dams and water control structures through targeted restoration projects.

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Encourage conservation of lake frontage, riparian habitats and their floodplains.	M	L	VH
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Support incentives program that encourages a buffer zone between new development and river, stream or floodplain edges, of a minimum distance (e.g., Farm Bill programs).	M	L	M

Management of Nature – Water Control Structures

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Review existing Farm Bill programs and explore options for enhancing economic benefits to landowners that improve or remove water control structures.	VH	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
H	Encourage the development of partnerships to enhance wetland restoration projects on private lands that involve removing small, local water control structures.	VH	M	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**

M	Support research to identify the habitat needs and movement requirements of native aquatic species, inventory water control structures, and identify the extent to which particular existing water control structures negatively affect species ecology.	VH	L	M
L	Support research to investigate the cumulative impacts of small farm ponds on low-order streams in north Florida.	M	L	M

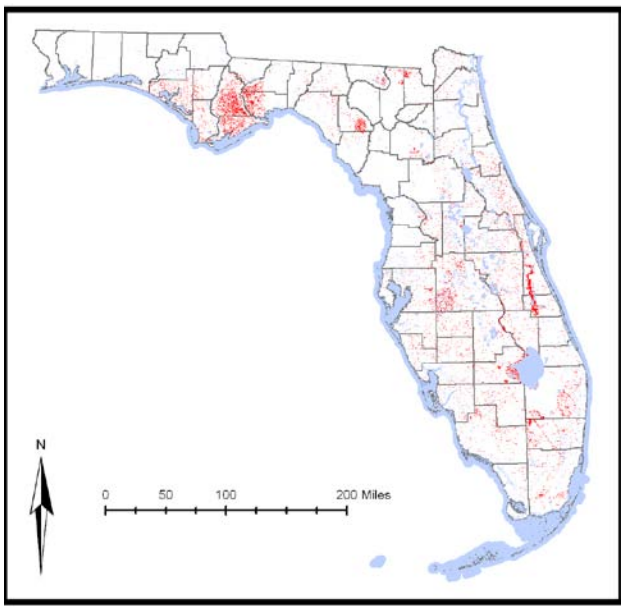
Roads

Overall Rank	**Capacity Building**	*Feasibility*	*Benefits*	**Cost**
M	Work with USFWS to improve coordination of the Technical Advisory Committee for the Stream Crossing Technical Center (SCTC).	VH	L	L
Overall Rank	**Economic and Other Incentives**	*Feasibility*	*Benefits*	**Cost**
L	Based on a stream crossing inventory and prioritization, develop funding opportunities for road stabilization projects in Florida counties.	H	L	H
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Provide training to road maintenance personnel on methods for minimizing sediment movement to water bodies.	M	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
L	Fund the start-up and operation of the Stream Crossing Technical Center (SCTC) to promote recovery and conservation of aquatic ecosystems from interactions between unpaved road-stream crossings that result in sediment movement into streams.	H	L	M

Incompatible Fire

Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Develop and disseminate a focused education program for ranchers and plantation owners on the value of growing season burns and burning in wetlands. Review and improve existing agency outreach materials to address these issues.	H	M	L

Shrub Swamp



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Unknown.
According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 1,069,770 acres (432,921 ha) of Shrub Swamp habitat exist, of which 49% (521,957 ac; 211,229ha) are in existing conservation or managed areas. Another 7% (74,135 ac; 30,001 ha) are Florida Forever projects and 8% (88,325 ac; 35,744 ha) are SHCA-identified lands. The remaining 36% (385,353 ac; 155,947ha) are other private lands.

Habitat Description

FNAI type: None

Shrub Swamps are wetland communities dominated by dense, low-growing, woody shrubs or small trees. Shrub Swamps are usually characteristic of wetland areas that are experiencing environmental change, and are early to mid-successional in species complement and structure. These changes are a result of natural or man-induced perturbations due to increased or decreased hydroperiod, fire, clear cutting or land clearing, and siltation.

Shrub Swamps statewide may be dominated by one species, such as willow, or an array of opportunistic plants may form a dense, low canopy. Common species include willow, wax myrtle, primrose willow, buttonbush, and saplings of red maple, sweetbay, black gum, and other hydric tree

species indicative of wooded wetlands. In northern Florida, some Shrub Swamps are a fire-maintained subclimax of Bay Swamps. These dense shrubby areas are dominated by black titi, swamp cyrilla, fetterbush, sweet pepperbush, doghobble, large gallberry, and myrtle-leaf holly.

Associated Species of Greatest Conservation Need

Mammals

- *Ursus americanus floridanus* — Florida Black Bear
- *Puma concolor coryi* — Florida Panther

Birds

- *Anas fulvigula fulvigula* — Florida Mottled Duck
- *Ixobrychus exilis* — Least Bittern
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Rostrhamus sociabilis plumbeus* — Snail Kite
- *Protonotaria citrea* — Prothonotary Warbler
- *Limnothlypis swainsonii* — Swainson's Warbler

Amphibians

- *Ambystoma cingulatum* — Flatwoods Salamander
- *Ambystoma tigrinum* — Tiger Salamander
- *Stereochilus marginatus* — Many-lined Salamander
- *Hyla andersonii* — Pine Barrens Treefrog
- *Rana virgatipes* — Carpenter Frog
- *Rana okaloosae* — Florida Bog Frog

Reptiles

- *Clemmys guttata* — Spotted Turtle
- *Eumeces anthracinus* — Coal Skink
- *Drymarchon couperi* — Eastern Indigo Snake
- *Lampropeltis getula* — Common Kingsnake

Fish

- *Umbra pygmaea* — Eastern Mudminnow
- *Acantharchus pomotis* — Mud Sunfish

Invertebrates

- *Procambarus apalachicolae* — A Crayfish
- *Procambarus capillatus* — A Crayfish
- *Procambarus econfinae* — Panama City Crayfish
- *Procambarus escambiensis* — A Crayfish
- *Procambarus latipleurum* — A Crayfish
- *Procambarus rathbunae* — A Crayfish
- *Procambarus rogersi rogersi* — A Crayfish

Conservation Threats

Because of serious problems interpreting this habitat in the workshops, threats could not be clearly identified and hence no specific conservation actions were developed by The Nature Conservancy's process (Chapter. Florida's Approach to Meeting the Eight Required Elements). Spatial extent of this habitat has increased significantly from its likely natural distribution through hydrologic alteration and fire exclusion in adjacent wetland habitats. When experts examined the distribution of this cover type, they suggested that some of the Shrub Swamp habitat, especially in north Florida, consists of heavily degraded wet flatwoods that have become dominated by willow and titi. Most of this Shrub Swamp habitat was once savanna, wet prairie, or pine flatwoods in north and central Florida. In south and central Florida a substantial amount of Shrub Swamp is associated with the freshwater marsh/wet prairie habitat where fire has been excluded. Nevertheless, Shrub Swamp is habitat for species like bears, tree frogs, migratory birds, and salamanders. If the habitat is maintained as shrub swamp, those animals that are using it, can continue using it.

This habitat is not stressed by fragmentation or development, since most is in public ownership. However, this habitat will spread if similar or adjacent areas are drained and fire suppressed. The experts agreed that the spatial extent of this habitat should not be allowed to increase as a result of these factors. Additionally, fire and management are needed so that this habitat will not succeed into Bay Swamp. As a result, the experts recommend active management to decrease the area of this habitat and restore the more natural habitats that have been overgrown by shrubs in many areas.

The recommendation of the experts was to subsume this habitat under the habitats from which it has succeeded due to fire and hydrological changes. For these reasons, threats and actions are presented as bulleted lists with no prioritization.

The following stresses threaten this habitat:

- Altered community structure
- Altered fire regime - timing, frequency, intensity, extent
- Altered hydrologic regime - timing, duration, frequency, extent
- Altered soil structure and chemistry
- Altered species composition/dominance
- Altered water quality of surface water or aquifer: contaminants
- Altered water quality of surface water or aquifer: nutrients

The sources of stress, or threats, were used to generate conservation actions.

- Ground water withdrawal
- Incompatible fire
- Invasive animals
- Invasive plants
- Surface water withdrawal

Conservation Actions

Actions to abate threats to Shrub Swamp were designed to reduce the impacts to this habitat and increase the suitability to wildlife. Most threats were statewide (Incompatible fire, Invasive animals, Invasive plants, and Surface and Groundwater Withdrawal).

The actions to abate threats that were identified for Shrub Swamp habitat are below, though none were prioritized for implementation.

Capacity Building

- Form and facilitate partnerships, alliances and networks of organizations willing to research, conserve and manage this habitat

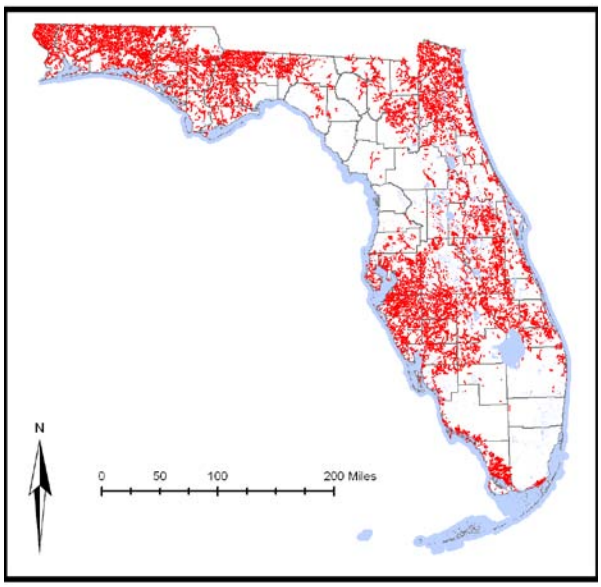
Land/Water/Species Management

- Convert invasive-dominated sites into early-successional habitat, and maintain

Research, Education and Awareness

- Target education for homeowners, developers, construction contractors, and policy makers to benefit wildlife in their day-to-day activities
- Research plans for restoration of this habitat and its hydrology
- Better define and map current condition, and develop management practices to achieve the future condition of this habitat

Softwater Stream



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Variable by size. Large Softwater Streams were considered good and declining, but small Softwater Streams were judged poor and declining. According to the best available GIS information at this time (See Appendix D. GIS Data Tables), 19,401 miles (31,223 km) Softwater Stream habitat exists.

Habitat Description

FNAI type: Blackwater Stream

Typical Softwater Streams originate from sandy flats containing broad wetlands which collect rainfall and slowly release water into the stream. This habitat category has water with low pH, low carbonate, that may be stained by tannins and humic acids filtered from the drainage of swamps and marshes. The flow rate is usually gentle in smaller streams to moderate in larger, but is altogether influenced by seasonal local rainfall. These streams typically have sand or silt bottoms with varying amounts of aquatic vegetation. Plants include golden club, smartweed, sedges, and grasses. Softwater Streams differ from Alluvial Streams by having high, steep banks, and by lacking extensive floodplains and natural levees. This habitat is well distributed throughout Florida, except in the regions of north and central Florida dominated by Calcareous Streams, and in the Everglades/Big Cypress region of south Florida, where wetlands and coastal streams dominate the aquatic landscape. Most of the streams in this category are small natural streams originating in pinelands or swamps or small natural segments of otherwise channelized streams in south central Florida. Smaller Softwater Streams examples include Big Coldwater Creek, Pine Barren Creek,

Big Escambia Creek, Big Sweetwater Creek. Large Softwater Stream examples include the Blackwater, Wacasassa, Yellow, Perdido, Econfina, Aucilla, Sopchoppy, St. Marys, or Ochlockonee rivers.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesqii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Lutra canadensis lataxina* — River Otter
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Egretta caerulea* — Little Blue Heron
- *Elanoides forficatus* — Swallow-tailed Kite
- *Haliaeetus leucocephalus* — Bald Eagle
- *Aramus guarauna* — Limpkin
- *Seiurus montacilla* — Louisiana Waterthrush

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Desmognathus auriculatus* — Southern Dusky Salamander
- *Stereochilus marginatus* — Many-lined Salamander

Reptiles

- *Macrochelys temminckii* — Alligator Snapping Turtle
- *Clemmys guttata* — Spotted Turtle
- *Graptemys barbouri* — Barbour's Map Turtle
- *Graptemys ernsti* — Escambia Map Turtle
- *Pseudemys concinna suwanniensis* — Suwannee Cooter
- *Apalone mutica calvata* — Gulf Coast Smooth Softshell
- *Nerodia cyclopion* — Mississippi Green Water Snake

Fish

- *Acipenser oxyrinchus oxyrinchus* — Atlantic Sturgeon
- *Atractosteus spatula* — Alligator Gar
- *Alosa alabamae* — Alabama Shad
- *Hybognathus hayi* — Cypress Minnow
- *Luxilus zonistius* — Bandfin Shiner
- *Macrhybopsis n. sp. cf aestivalis* — Florida Chub/Speckled Chub
- *Notropis melanostomus* — Blackmouth Shiner
- *Notropis chalybaeus* — Ironcolor Shiner

- *Pteronotropis welaka* Bluenose Shiner
- *Moxostoma n. sp. cf poecilurum* Grayfin Redhorse
- *Morone saxatilis* Striped Bass
- *Etheostoma proeliare* Cypress Darter
- *Etheostoma histrio* Harlequin Darter
- *Etheostoma okaloosae* Okaloosa Darter
- *Etheostoma stigmaeum* Speckled Darter
- *Etheostoma olmstedi* Tessellated Darter

Invertebrates

- *Elliptoideus sloatianus* Purple Bankclimber
- *Fusconaia escambia* Narrow Pigtoe
- *Glebula rotundata* Round Pearlshell
- *Lampsilis australis* Southern Sandshell
- *Lampsilis subangulata* Shiny-rayed Pocketbook
- *Lampsilis teres* Yellow Sandshell
- *Medionidus penicillatus* Gulf Moccasinshell
- *Pleurobema pyriforme* Oval Pigtoe
- *Pleurobema strodeanum* Fuzzy Pigtoe
- *Ptychobranchus jonesi* Southern Kidneyshell
- *Quadrula infucata* Sculptured Pigtoe
- *Quadrula kleiniana* Suwannee Pigtoe
- *Quincuncina burkei* Tapered Pigtoe
- *Utterbackia peninsularis* Peninsular Floater
- *Villosa choctawensis* Choctaw Bean
- *Villosa villosa* Downy Rainbow
- *Procambarus latipleurum* A Crayfish
- *Procambarus pictus* Black Creek Crayfish
- *Procambarus suttkusi* A Crayfish
- *Procambarus youngi* Florida Longbeak Crayfish
- *Baetisca becki* A Mayfly
- *Baetisca rogersi* A Mayfly
- *Dolania americana* American Sand-burrowing Mayfly
- *Brachycercus nasutus* A Mayfly
- *Attenella attenuata* A Mayfly
- *Dannella simplex* A Mayfly
- *Macdunnoa brunnea* A Mayfly
- *Pseudiron centralis* White Sand-river Mayfly
- *Stenacron floridense* A Mayfly
- *Asioplax dolani* A Mayfly
- *Siphloplecton brunneum* A Mayfly
- *Siphloplecton fuscum* A Mayfly
- *Siphloplecton simile* A Mayfly
- *Homoeoneuria dolani* Blue Sand-river Mayfly
- *Isonychia berneri* A Mayfly
- *Isonychia sicca* A Mayfly
- *Hetaerina americana* American Rubyspot
- *Dromogomphus armatus* Southeastern Spinyleg
- *Gomphus geminatus* Twin-striped Clubtail
- *Progomphus bellei* Belle's Sanddragon
- *Cheumatopsyche gordonae* Gordon's Little Sister Sedge
- *Cheumatopsyche petersi* Peters' Little Sister Sedge Caddisfly

- *Ochrotrichia okaloosa* — Okaloosa Somber Microcaddisfly
- *Oxyethira elerobi* — Elerob's (Cream and Brown Mottled) Microcaddisfly
- *Oxyethira janella* — Little-entrance Oxyethiran Microcaddisfly
- *Oxyethira kelleyi* — Kelley's Cream and Brown Mottled Microcaddisfly
- *Oxyethira novasota* — Novasota Oxyethiran Microcaddisfly
- *Lepidostoma morsei* — Morse's Little Plain Brown Sedge
- *Ceraclea floridana* — Florida (Scaly Wing Sedge) Ceraclean Caddisfly
- *Oecetis floridana* — Florida Long-horn Sedge
- *Triaenodes furcella* — Little-fork Triaenode Caddisfly
- *Chimarra florida* — Floridian Finger-net Caddisfly
- *Polycentropus floridensis* — Florida Brown Checkered Summer Sedge
- *Agarodes libalis* — Spring-loving Psiloneuran Caddisfly

Conservation Threats

Threats to the Softwater Stream habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Chemicals and toxins
- Conversion to agriculture
- Conversion to commercial/industrial development
- Conversion to housing and urban development
- Groundwater withdrawal
- Incompatible recreational activities
- Incompatible forestry practices
- Incompatible resource extraction–mining/drilling
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban
- Roads
- Surface water withdrawal and diversion

Softwater Streams, commonly known as “blackwater streams,” are among the most ubiquitous stream habitats in Florida and the Southeast. As such, they are subject to a wide variety of threats, many of them serious and statewide in scope. The majority of Softwater Streams are creeks and small rivers and are particularly vulnerable to conversion of riparian and floodplain areas to various forms of development. Softwater Streams are naturally low nutrient systems and are likewise vulnerable to even modest increases in nutrient loading. Fragmentation of this habitat occurs as a result of riparian conversion, channelization and loss of connection with floodplain wetlands. Additional threats specific to this habitat include the effects of stream channelization, operation of dams or control structures on small to medium sized Softwater Streams statewide and the impacts of sedimentation caused by road crossings and boat wakes.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Fragmentation of habitats, communities, ecosystems	High
B	Altered hydrologic regime	High
C	Altered landscape mosaic or context	High

D	Erosion/sedimentation	High
E	Altered water quality of surface water or aquifer: nutrients	High
F	Altered community structure	Medium
G	Altered species composition/dominance	Medium
H	Altered water quality of surface water or aquifer: contaminants	Medium
I	Habitat destruction or conversion	Medium
J	Altered water salinity, pH, conductivity or other physical water quality characteristics	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Surface water withdrawal	**High**	A, B, C, F
2	Conversion to agriculture	**High**	A, C, F
3	Nutrient loads - agriculture	**High**	E
4	Roads	**High**	A, D, E, I
5	Conversion to housing and urban development	**High**	A, C, D, I
6	Dam operations	**Medium**	A, B
7	Nutrient loads – urban	**Medium**	E
8	Incompatible resource extraction: mining/drilling	**Medium**	D, I
9	Chemicals and toxins	**Medium**	H
10	Conversion to commercial and industrial development	**Medium**	D, I
11	Invasive animals	**Medium**	G
12	Invasive plants	**Medium**	G
13	Incompatible recreational activities	**Low**	D, I
14	Incompatible forestry practices	**Low**	B, D, I
15	Groundwater withdrawal	**Low**	B
16	Incompatible agricultural practices	**Low**	B, D
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Softwater Stream that were also identified as statewide threats (Surface water withdrawal and diversion, Conversion to agriculture, Nutrient loads – agriculture, Roads, Conversion to housing and urban development, Nutrient loads – urban, Incompatible resource extraction – mining/drilling, Chemicals and toxins, Conversion to commercial/industrial development, Invasive animals, Invasive plants, Incompatible recreational activities, Incompatible

forestry practices, Groundwater withdrawal) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Softwater Stream and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Spring and Spring Run, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. Additional actions were developed to address threats specific to this habitat. These actions are intended to prevent harm to aquatic ecosystems by setting limits on the magnitude, duration and frequency of downstream water releases required to support aquatic habitat and remediating the damage to Softwater Streams caused by channelization, dams and phosphate mining through targeted restoration projects.

Surface Water Withdrawal

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
VH	Support funding of the Kissimmee River Restoration Headwaters Revitalization Projects, and assess the value of expansion to apply to SGCN.	VH	H	VH

Conversion to Agriculture

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Encourage incentives for maintenance and conversion of lands to agricultural uses that use less water and result in lower nutrient outputs into Florida's waters and wetlands and encourage market-based incentives to compensate private landowners for the environmental services they provide to the State through management that increases water storage and nutrient reduction.	M	M	H

Roads

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
M	Work with USFWS to improve coordination of the Technical Advisory Committee for the Stream Crossing Technical Center (SCTC).	VH	L	L
Overall Rank	**Economic and Other Incentives**	*Feasibility*	*Benefits*	**Cost**
L	Based on a stream crossing inventory and prioritization, develop funding opportunities for road stabilization projects in Florida counties.	H	L	H
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
L	Provide training to road maintenance personnel on methods for minimizing sediment movement to water bodies.	M	L	L
Overall Rank	**Land/Water/Species Management**	*Feasibility*	*Benefits*	**Cost**
L	Support the start-up and operation of the Stream Crossing Technical Center (SCTC) to promote recovery and conservation of aquatic ecosystems from interactions between unpaved road-stream crossings that result in sediment movement into streams.	H	L	M

Conversion to Housing and Urban Development

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
L	Encourage conservation of lake frontage, riparian habitats and their floodplains.	M	L	VH
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Support incentives program that encourages development of and use of a buffer zone between new development and river or floodplain edges, of a minimum distance (e.g., Farm Bill programs).	M	L	M

Dam Operations

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
H	Coordinate interstate Strategy actions to ensure that all fish and wildlife resources in all states are protected when changing dams operations in shared basins. (USFWS)	M	H	L
L	Coordinate multiagency review of USACE activities, including biological aspects (fish spawn guidelines, protection of fish and wildlife resources) of water control plans for interstate water projects, fish spawn guidelines, re-establishing natural seasonal fluctuation of flows.	H	L	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
M	Fund research to investigate the cumulative impacts of small rural impoundments on fish and wildlife	M	M	M

Incompatible Resource Extraction: Mining/Drilling

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Fund and create incentives for completing the reclamation of impaired stream systems identified in the Non-mandatory Land Reclamation Report for phosphate mining region.	H	M	H

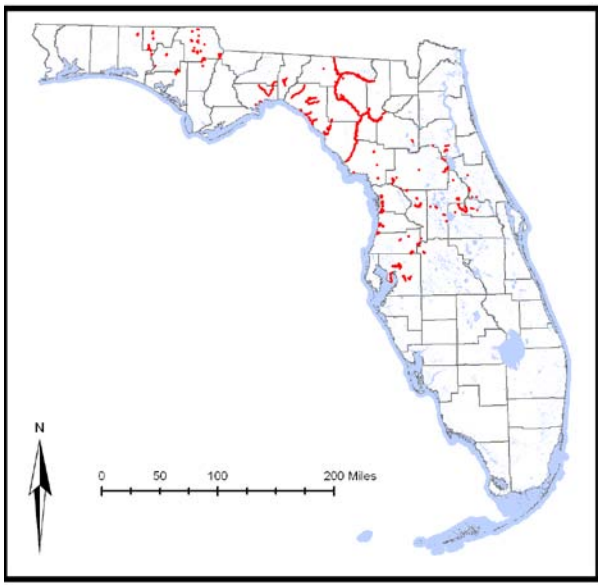
Chemicals and Toxins

Overall Rank	Planning and Standards	*Feasibility*	*Benefits*	Cost
L	Develop management techniques and recommendations for private landowners that minimize runoff of chemicals and toxins into wetlands and aquatic systems.	H	L	M
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
L	Conduct research defining appropriate sediment quality standards for the various aquatic and marine systems. Fund research defining the relationship between sediment contamination (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine systems.	M	L	H
L	Conduct research defining standards for persistent organic contaminants for the various aquatic and marine systems. Fund research defining the relationship between contamination from organics (individually and in chemical interactions) and key biological indicators of degradation in different aquatic and marine.	M	L	H

Invasive Plants

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
M	Research methods for control of aquatic invasive species in flowing waters where current control methods for those species are only effective in non-flowing waters.	VH	L	M

Spring and Spring Run



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (Appendix D. GIS Data Tables), there are approximately 570 springs arising from the Floridian Aquifer, constituting a total spring- run length of about 572 miles (921 km).

Habitat Description

FNAI type: Spring-run Stream

This habitat is present in the north and central regions of Florida, in most of the same areas occupied by Calcareous Stream habitat, where underlying limestone is close to the surface. Spring and Spring Run often represent headwaters or low-order tributaries of, and thus share many characteristics with Calcareous Streams. The Spring and Spring Run originate from and have direct outflow as artesian openings in the underground, limestone, Floridan aquifer. Because of the calcareous nature of the limestone aquifer, the outflow from most springs carries dissolved mineral ions such as calcium, magnesium, bicarbonate, sulfate, and sodium. Springs typically have high water clarity, low sedimentation, stable channels, and openings that are less than 40 feet (12.2 m) wide. Individual springs are stable systems, with very little change in water temperature, water flow, or chemical composition, but those characteristics can vary from one spring to the next. The bottoms of spring runs are generally sand or exposed limestone along a central, stable channel. Vegetation in Spring and Spring Run consists of submerged aquatic vegetation, aquatic algae covering limestone outcroppings, and species such as tape grass, wild rice, and giant cutgrass located in the spring runs. The constant temperatures of springs provide essential habitat for

manatees and some species of fish. Examples of Spring and Spring Run include Silver Springs, Manatee Springs, Spring Creek, Blue Spring, and Rainbow Springs.

Associated Species of Greatest Conservation Need

Mammals

- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Lasiurus cinereus* — Hoary Bat
- *Corynorhinus rafinesquii* — Rafinesque's Big-eared Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Lutra canadensis lataxina* — River Otter
- *Mustela vison evergladensis* — Everglades Mink
- *Mustela vison halilimnetes* — Gulf Salt Marsh Mink
- *Mustela vison lutensis* — Atlantic Salt Marsh Mink
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Ixobrychus exilis* — Least Bittern
- *Egretta thula* — Snowy Egret
- *Egretta caerulea* — Little Blue Heron
- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Elanoides forficatus* — Swallow-tailed Kite
- *Ictinia mississippiensis* — Mississippi Kite
- *Aramus guarauna* — Limpkin
- *Protonotaria citrea* — Prothonotary Warbler

Amphibians

- *Amphiuma pholeter* — One-toed Amphiuma
- *Desmognathus auriculatus* — Southern Dusky Salamander
- *Haideotriton wallacei* — Georgia Blind Salamander

Reptiles

- *Macrochelys temminckii* — Alligator Snapping Turtle
- *Graptemys barbouri* — Barbour's Map Turtle
- *Pseudemys concinna suwanniensis* — Suwannee Cooter
- *Farancia erytrogramma* — Rainbow Snake

Fish

- *Acipenser oxyrinchus oxyrinchus* — Atlantic Sturgeon
- *Acipenser oxyrinchus desotoi* — Gulf Sturgeon
- *Alosa alabamae* — Alabama Shad
- *Morone saxatilis* — Striped Bass
- *Pteronotropis welaka* — Bluenose Shiner

- *Moxostoma n. sp. cf poecilurum* Grayfin Redhorse
- *Micropterus notius* Suwannee Bass

Invertebrates

- *Elliptio chipolaensis* Chipola Slabshell
- *Medionidus acutissimus* Alabama Moccasinshell
- *Medionidus walkeri* Suwannee Moccasinshell
- *Quadrula infucata* Sculptured Pigtoe
- *Quadrula kleiniana* Suwannee Pigtoe
- *Villosa amygdala* Florida Rainbow
- *Villosa villosa* Downy Rainbow
- *Aphaostracon asthenes* Blue Spring Hydrobe
- *Aphaostracon chalarogyrus* Freemouth Hydrobe
- *Aphaostracon monas* Wekiwa Hydrobe
- *Aphaostracon pycnum* Dense Hydrobe
- *Aphaostracon theiocrenetum* Clifton Springs Hydrobe
- *Aphaostracon xynoelictum* Fenney Springs Hydrobe
- *Cincinnatia helicogyra* Helicoid Spring Siltsnail
- *Cincinnatia mica* Ichetucknee Siltsnail
- *Cincinnatia monroensis* Enterprise Siltsnail
- *Cincinnatia parva* Blue Spring Siltsnail
- *Cincinnatia ponderosa* Sanlando Spring Siltsnail
- *Cincinnatia vanhyningi* Seminole Spring Siltsnail
- *Cincinnatia wekiwae* Wekiwa Siltsnail
- *Cambarus cryptodytes* Dougherty Plain (Apalachicola) Cave Crayfish
- *Procambarus acherontis* Orlando (Palm Springs) Cave Crayfish
- *Procambarus attiguus* Silver Glen Springs (Cave) Crayfish
- *Procambarus delicatus* Big-cheeked Cave Crayfish
- *Procambarus horsti* Big Blue Spring Cave Crayfish
- *Procambarus orcinus* Woodville (Karst) Cave Crayfish
- *Procambarus pallidus* Pallid Cave Crayfish
- *Caecidotea sp. 1* Rock Springs Cave Isopod
- *Caecidotea sp. 8* Econfina Springs Cave Isopod
- *Hexagenia limbata* A Burrowing Mayfly
- *Hetaerina americana* American Rubyspot
- *Tachopteryx thoreyi* Gray Petaltail
- *Hydroptila wakulla* Wakulla Springs Vari-colored Microcaddisfly

Conservation Threats

Threats to Spring and Spring Run habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Conversion to commercial/industrial development
- Conversion to recreation areas
- Groundwater withdrawal
- Incompatible forestry practices
- Incompatible recreational activities
- Invasive animals
- Invasive plants
- Nutrient loads–agriculture
- Nutrient loads–urban

- Surface water diversion and withdrawal

Nutrient loading of groundwater, perhaps in conjunction with other threats, has led to profound changes in the ecological functioning and composition of Spring and Spring Run similar to those resulting from eutrophication in lake and wetland systems. This eutrophication alters species composition and community structure, contributing to the productivity and population growth of algae and invasive plant and animal species. Increased withdrawal of groundwater in urbanizing areas of central and north Florida threatens to significantly alter the hydrology of these systems over the next five to ten years. Additional habitat-specific threats were identified, including decreased water input from recharge areas as both the impervious surface within springsheds and groundwater withdrawals increase and the presence of numerous invasive animals in the systems, especially fishes and freshwater snails, the effects of which are likely to be profound, but which are relatively less well studied than are those of invasive plants.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered species composition/dominance	Very High
B	Altered water quality of surface water or aquifer: nutrients	Very High
C	Altered community structure	High
D	Habitat destruction or conversion	High
E	Altered hydrologic regime	High
F	Erosion/sedimentation	Medium
G	Altered water quality of surface water or aquifer: contaminants	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Nutrient loads – urban	**Very High**	A, B, C, D
2	Invasive plants	**Very High**	A, C, D
3	Nutrient loads – agriculture	**High**	A, B, C, D
4	Invasive animals	**High**	A, C
5	Incompatible recreational activities	**Medium**	A, B, C, D, F
6	Surface water withdrawal	**Medium**	E
7	Groundwater withdrawal	**Medium**	C, D, E
8	Conversion to recreation areas	**Low**	A, C, D
9	Incompatible forestry practices	**Low**	C, D
10	Conversion to commercial and industrial development	**Low**	D
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Springs and Spring Run that were also identified as statewide threats (Nutrient loads – urban, Invasive plants, Nutrient loads – agriculture, Invasive animals, Incompatible recreational activities, Surface water diversion and withdrawal, Groundwater withdrawal, Conversion to recreation areas, Incompatible forestry practices, Conversion to commercial/industrial development) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat were only applicable to Spring and Spring Run and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Terrestrial Cave, and Coastal Tidal River or Stream) and are listed below. These actions were designed to prevent harm to stream ecosystems influenced by groundwater inflows by placing limits on the total permissible nutrient loads, to substantially increase the acreage of spring recharge lands protected from development, to ensure that development in unprotected springsheds is designed to maintain recharge functions, minimize groundwater withdrawals, reduce nutrient loading to groundwater and reduce recreational pressure on springs by limiting use to scientifically-based estimates of carrying capacity.

Nutrient Loads – Urban

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
H	Monitor effects on groundwater ecosystems as well as biota where groundwater discharges to springs and other surface waters.	M	H	H

Invasive Plants

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
M	Research methods for control of aquatic invasive species in flowing waters where current control methods for those species are only effective in non-flowing waters.	VH	L	M

Incompatible Recreational Activities

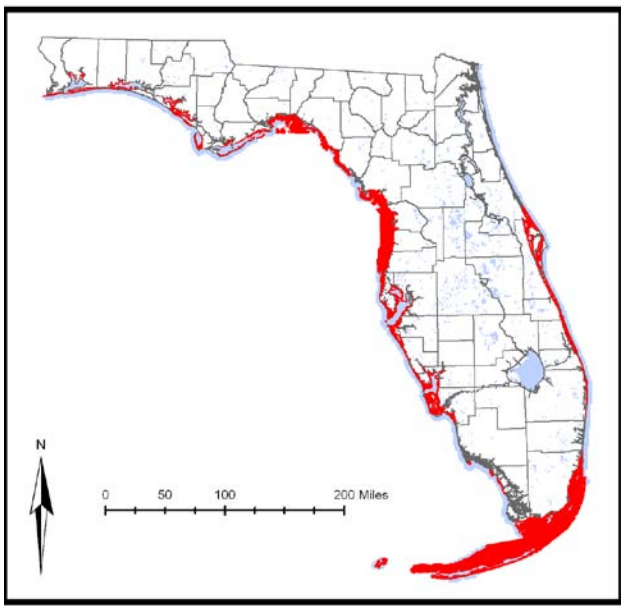
Overall Rank	Research	*Feasibility*	*Benefits*	Cost
H	Determine how variation in recreational carrying capacities affect wildlife and wildlife habitat in Spring and Spring Runs.	H	H	L

Groundwater Withdrawal

Overall Rank	Land/Water Protection	*Feasibility*	*Benefits*	Cost
VH	Support programs to conserve important natural habitats significant to watershed recharge and springs.	H	VH	VH

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
H	Support implementation of recommendations of the Florida Springs Task Force in its report Florida's Springs: Strategies for Protection and Restoration, November 2000.	H	H	H
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
H	Explore options and alternative methods to protect submarine springs.	H	H	L

Submerged Aquatic Vegetation



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 2,419,458 acres (979,120 ha) of seagrass beds (a subtype of Submerged Aquatic Vegetation habitat) exist.

Habitat Description

FNAI type: Algal Bed, Seagrass Bed, Composite Substrate

Submerged Aquatic Vegetation is defined as any combination of seagrasses, oligohaline grasses, attached macroalgae and drift algae that covers 10 to 100 percent of a substrate. In this chapter only seagrasses will be addressed. Seagrasses are marine flowering plants adapted to grow and reproduce in the underwater environment. Florida estuaries and nearshore coastal waters contain the nation's largest seagrass resources (more than two-million acres), as well as its two most extensive, contiguous seagrass beds (i.e., Florida Bay and the Big Bend region). Factors that affect the establishment and growth of seagrass include light availability, water temperature, salinity, sediment composition, nutrient levels, wave energy, and tidal range. Seagrass most often occurs in areas of low to moderate current velocities where the water is clear; thereby allowing sunlight to penetrate to the leaf blades. Seagrass communities are highly productive, faunally rich, and ecologically important systems. Hundreds to thousands of species of flora and fauna may inhabit seagrass habitats utilizing food, substrate, and shelter provided by the plants. Seagrasses also stabilize sediments and help maintain water clarity.

Associated Species of Greatest Conservation Need

Mammals

- *Tursiops truncatus* — Atlantic Bottlenose Dolphin
- *Trichechus manatus latirostris* — Florida Manatee

Birds

- *Anas acuta* — Northern Pintail
- *Aythya affinis* — Lesser Scaup
- *Gavia immer* — Common Loon
- *Podiceps auritus coronutus* — Horned Grebe
- *Pelecanus occidentalis* — Brown Pelican
- *Ardea herodias occidentalis* — Great White Heron
- *Egretta tricolor* — Tricolored Heron
- *Egretta rufescens* — Reddish Egret
- *Ajaja ajaja* — Roseate Spoonbill
- *Mycteria americana* — Wood Stork
- *Haliaeetus leucocephalus* — Bald Eagle
- *Numenius phaeopus hudsonicus* — Whimbrel
- *Sterna nilotica* — Gull-billed Tern
- *Sterna caspia* — Caspian Tern
- *Sterna maxima* — Royal Tern
- *Sterna sandvicensis* — Sandwich Tern
- *Sterna dougallii* — Roseate Tern
- *Sterna antillarum* — Least Tern
- *Sterna fuscata* — Sooty Tern
- *Rynchops niger* — Black Skimmer

Reptiles

- *Crocodylus acutus* — American Crocodile
- *Malaclemys terrapin* — Diamondback Terrapin
- *Chelonia mydas* — Green Turtle
- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley
- *Nerodia clarkii compressicauda* — Mangrove Salt Marsh Snake

Fish

- *Ginglymostoma cirratum* — Nurse Shark
- *Carcharhinus acronotus* — Blacknose Shark
- *Carcharhinus leucas* — Bull Shark
- *Carcharhinus limbatus* — Blacktip Shark
- *Negaprion brevirostris* — Lemon Shark
- *Rhizoprionodon terraenovae* — Atlantic Sharpnose Shark
- *Sphyrna tiburo* — Bonnethead
- *Pristis pectinata* — Smalltooth Sawfish
- *Aetobatus narinari* — Spotted Eagle Ray
- *Megalops atlanticus* — Tarpon
- *Albula vulpes* — Bonefish
- *Anguilla rostrata* — American Eel
- *Gymnothorax moringa* — Spotted Moray

- *Gymnothorax vicinus* Purplemouth Moray
- *Myrichthys breviceps* Sharptail Eel
- *Opsanus beta* Gulf Toadfish
- *Opsanus tau* Oyster Toadfish
- *Ogcocephalus nasutus* Shortnose Batfish
- *Mugil cephalus* Striped Mullet
- *Mugil curema* White Mullet
- *Mugil gyrans* Whirligig Mullet
- *Hemiramphus balao* Balao
- *Hemiramphus brasiliensis* Ballyhoo
- *Hyporhamphus meeki* False Silverstripe Halfbeak
- *Hyporhamphus unifasciatus* Atlantic Silverstripe Halfbeak
- *Anarchopterus criniger* Fringed Pipefish
- *Bryx dunckeri* Pugnose Pipefish
- *Cosmocampus albirostris* Whitenose Pipefish
- *Cosmocampus brachycephalus* Crested Pipefish
- *Cosmocampus elucens* Shortfin Pipefish
- *Halicampus crinitus* Banded Pipefish
- *Hippocampus erectus* Lined Seahorse
- *Hippocampus reidi* Longsnout Seahorse
- *Hippocampus zosterae* Dwarf Seahorse
- *Syngnathus floridae* Dusky Pipefish
- *Syngnathus fuscus* Northern Pipefish
- *Syngnathus louisianae* Chain Pipefish
- *Syngnathus scovelli* Gulf Pipefish
- *Syngnathus springeri* Bull Pipefish
- *Aulostomus maculatus* Atlantic Trumpetfish
- *Fistularia tabacaria* Bluespotted Cornetfish
- *Centropomus undecimalis* Common Snook
- *Centropristis striata* Black Sea Bass
- *Epinephelus morio* Red Grouper
- *Hypoplectrus aberrans* Yellowbelly Hamlet
- *Hypoplectrus gemme* Blue Hamlet
- *Hypoplectrus guttavarius* Shy Hamlet
- *Hypoplectrus indigo* Indigo Hamlet
- *Hypoplectrus nigricans* Black Hamlet
- *Hypoplectrus puella* Barred Hamlet
- *Hypoplectrus unicolor* Butter Hamlet
- *Mycteroperca bonaci* Black Grouper
- *Mycteroperca microlepis* Gag
- *Serranus baldwini* Lantern Bass
- *Serranus tigrinus* Harlequin Bass
- *Opistognathus whitehursti* Dusky Jawfish
- *Astrapogon alutus* Bronze Cardinalfish
- *Astrapogon puncticulatus* Blackfin Cardinalfish
- *Astrapogon stellatus* Conchfish
- *Phaeoptyx conklini* Freckled Cardinalfish
- *Phaeoptyx pigmentaria* Dusky Cardinalfish
- *Phaeoptyx xenus* Sponge Cardinalfish
- *Caranx latus* Horse-eye Jack
- *Lutjanus analis* Mutton Snapper
- *Lutjanus apodus* Schoolmaster
- *Lutjanus griseus* Gray Snapper

- *Lutjanus synagris* Lane Snapper
- *Ocyurus chrysurus* Yellowtail Snapper
- *Haemulon album* Margate
- *Haemulon aurolineatum* Tomtate
- *Haemulon flavolineatum* French Grunt
- *Haemulon plumierii* White Grunt
- *Haemulon sciurus* Bluestriped Grunt
- *Orthopristis chrysoptera* Pigfish
- *Archosargus probatocep* Sheepshead
- *Cynoscion nebulosus* Spotted Seatrout
- *Cynoscion regalis* Weakfish
- *Pareques acuminatus* High-hat
- *Sciaenops ocellatus* Red Drum
- *Chaetodon capistratus* Foureye Butterflyfish
- *Pomacanthus arcuatus* Gray Angelfish
- *Stegastes leucostictus* Beaugregory
- *Doratonotus megalepis* Dwarf Wrasse
- *Halichoeres poeyi* Blackear Wrasse
- *Lachnolaimus maximus* Hogfish
- *Xyrichtys martinicensis* Rosy Razorfish
- *Xyrichtys novacula* Pearly Razorfish
- *Xyrichtys splendens* Green Razorfish
- *Cryptotomus roseus* Bluelip Parrotfish
- *Sparisoma chrysopterum* Redtail Parrotfish
- *Sparisoma radians* Bucktooth Parrotfish
- *Sparisoma rubripinne* Yellowtail Parrotfish
- *Labrisomus bucciferus* Puffcheek Blenny
- *Labrisomus guppyi* Mimic Blenny
- *Labrisomus haitiensis* Longfin Blenny
- *Labrisomus nuchipinnis* Hairy Blenny
- *Malacoctenus aurolineatus* Goldline Blenny
- *Malacoctenus macropus* Rosy Blenny
- *Paraclinus nigripinnis* Blackfin Blenny
- *Stathmonotus hemphilli* Blackbelly Blenny
- *Acyrtops beryllinus* Emerald Clingfish
- *Gobiesox strumosus* Skilletfish
- *Eleotris amblyopsis* Largescaled Spinycheek Sleeper
- *Coryphopterus glaucofraenum* Bridled Goby
- *Ctenogobius saepepallens* Dash Goby
- *Ctenogobius stigmaturus* Spottail Goby
- *Gobiosoma grosvenori* Rockcut Goby
- *Acanthurus bahianus* Ocean Surgeon
- *Acanthurus coeruleus* Blue Tang
- *Etropus crossotus* Fringed Flounder
- *Paralichthys albigutta* Gulf Flounder
- Paralichthys dentatus Summer Flounder
- *Balistes vetula* Queen Triggerfish
- *Aluterus schoepfii* Orange Filefish
- *Acanthostracion quadricornis* Crawled Cowfish
- *Lactophrys trigonus* Trunkfish
- *Lactophrys triqueter* Smooth Trunkfish
- *Canthigaster rostrata* Sharpnose Puffer

- *Chilomycterus schoepfii* Striped Burrfish
- *Diodon holocanthus* Balloonfish

Invertebrates

- *Spongia barbara* Yellow Sponge
- *Spheciospongia vesparia* Loggerhead Sponge
- *Argopecten irradians* Bay Scallop
- *Mercenaria campechiensis* Hard Clam
- *Mercenaria mercenaria* Hard Clam
- *Octopus vulgaris* Octopus
- *Aplysia dactylomela* Spotted Seahare
- *Calliostoma adelae* Keys Topsnail
- *Astralium phoebium* Longspine Starsnail
- *Fasciolaria lilium* Banded Tulip
- *Pleuroploca gigantea* Horse Conch
- *Busycon sinistrum* Lightning Whelk
- *Cassis tuberosa* Helmet Shell
- *Charonia tritonis variegata* Atlantic Trumpet Triton
- *Strombus gigas* Queen Conch
- *Elysia crispata* Lettuce Slug
- *Oreaster reticulatis* Cushion Star, Bahama Star
- *Meoma ventricosa* West Indian Sea Biscuit
- *Clypeaster rosaceus* West Indian Sea Biscuit
- *Clypeaster subdepressus* Sea Biscuit
- *Diadema antillarum* Long-spined Urchin
- *Lytechinus variegatus* Variegated Urchin
- *Tripneustes ventricosus* Sea Egg Urchin
- *Holothuria floridana* Florida Sea Cucumber
- *Ophiophragmus filograneus* Brittle Star
- *Astrophyton muricatum* Basket Star
- *Hermodice carunculata* Fire (Bristle) Worm
- *Limulus polyphemus* Horseshoe Crab
- *Lysmata wurdemanni.* Peppermint Shrimp
- *Stenorynchus seticornis* Yellowline Arrow Crab
- *Panulirus argus* Spiny Lobster
- *Farfantepenaeus duorarum* Pink Shrimp
- *Callinectes sapidus* Blue Crab
- *Upogebia islagrande* Ghost Shrimp
- *Menippe nodifrons* Cuban Stone Crab
- *Neogonodactylus oerstedii* Mantis Shrimp
- *Lysiosquilla scabricauda* Thumbsplitter Mantis Shrimp

Conservation Threats

The most serious threat to Florida's seagrass habitats is reduced water quality from anthropogenic nutrient loading and sometimes sediments. Non-point source pollution (e.g., stormwater run-off) is the most significant source. Other important human related threats are:

- Boat groundings and propeller scarring
- Boat wakes

- Coastal construction (including dock construction and seagrass shading from docks)
- Dredging and filling activities
- Hydrological modifications to estuarine systems that disrupt natural salinity patterns

Natural sources of seagrass loss (e.g., pathogens and large storms) are much smaller threats than human activities. Threats to Submerged Aquatic Vegetation habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Boating impacts
- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Coastal development
- Dam operations/incompatible release of water (quality, quantity, timing)
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Harmful algal blooms
- Incompatible fishing pressure
- Incompatible industrial operations
- Incompatible recreational activities
- Industrial spills
- Invasive animals
- Invasive plants
- Key predator/herbivore loss
- Management of nature (beach nourishment and impoundments)
- Nutrient loads (urban)
- Roads, bridges and causeways
- Shoreline hardening
- Surface water and groundwater withdrawal
- Vessel impacts

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered water quality - physical, chemistry	Very High
B	Habitat destruction	Very High
C	Altered species composition	Very High
D	Sedimentation	Very High
E	Altered water quality - contaminants	High
F	Altered water quality - nutrients	High
G	Altered structure	High
H	Erosion	High
I	Altered hydrologic regime	High
J	Altered primary productivity	High
K	Habitat fragmentation	Medium
L	Habitat disturbance	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Coastal development	**Very High**	A, B, C, D, E, F, G, H, I, K

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
2	Harmful algal blooms	**Very High**	A, B, C, F, J
3	Inadequate stormwater management	**Very High**	A, B, C, D, E, F, H, J
4	Channel modification/shipping lanes	**Very High**	A, B, D, G, H, I, J, K
5	Nutrient loads (all sources)	**High**	A, B, C, D, F, G, J, K
6	Incompatible industrial operations	**High**	A, B, C, D, E, G, H, J, K
7	Dam operations/incompatible release of water (quality, quantity, timing)	**High**	A, B, C, D, E, F, H, I, J
8	Climate variability	**High**	B, C, G, H, I, J
9	Surface water withdrawal	**High**	A, B, C, I, J
10	Invasive plants	**High**	B, C, F, G, J
11	Groundwater withdrawal	**High**	A, B, C, I, J
12	Roads, bridges and causeways	**High**	A, B, C, D, E, F, G, H, I, J, K
13	Shoreline hardening	**High**	A, B, C, E, F, H, J
14	Invasive animals	**High**	B, C
15	Incompatible fishing pressure	**High**	C, E, G
16	Destruction of longshore transport of sediments	**High**	A, C, D, F, H, J
17	Management of nature (beach nourishment, impoundments)	**Medium**	A, B, C, D, H, I, J, K
18	Boating impacts	**Medium**	A, B, C, D, E, F, G, H, J, K
19	Chemicals and toxins	**Medium**	A, B, C, J
20	Incompatible recreational activities	**Medium**	A, B, C, D, E, F, G, H
21	Key predator/herbivore losses	**Medium**	B, C, J
22	Incompatible aquarium trade	**Medium**	C
23	Utility corridors	**Medium**	B, G, K
24	Fishing gear impacts	**Medium**	B, C, G
25	Industrial spills	**Medium**	A, B, C, E, J
26	Incompatible aquaculture operations	**Medium**	A, B, C, D, F, G, H, J, K
27	Vessel impacts	**Medium**	B, E, G
28	Parasites/pathogens	**Medium**	C
29	Placement of artificial structure	**Medium**	B, C, D, G, J

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
30	Thermal pollution	Medium	B, K
31	Solid Waste	Low	B, G, J
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Submerged Aquatic Vegetation that were also identified as statewide threats, are in the Chapter Multiple Habitat Threats and Conservation Actions. Outcomes identified for this habitat address increasing the understanding of recreational boaters to reduce the likelihood of impacts to sensitive habitats, especially damage to seagrass from propellers. Assessment of the effects of pathogens on seagrasses is also necessary to increase our understanding of the scope and severity of this threat.

Highest ranked actions identified for abating this source of stress focus on:

- Improving environmental and boating safety around Submerged Aquatic Vegetation
- Reducing land-based nutrient input to coastal habitats
- Improving education on ecological importance and the impacts of damage to Submerged Aquatic Vegetation habitats

Additional actions included:

- Developing and implementing access plans and Submerged Aquatic Vegetation management and restoration plans

The following actions, organized by action type were identified to abate this threat:

Incompatible Recreation including Boating

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
VH	Promote understanding of environmental and boating regulations.	VH	H	VH
H	Improve understanding of and use of boating techniques that reduce the likelihood of propeller scars.	VH	M	VH
H	Assist in a multi-agency process in the identification and designation of no-motor zones in ecologically sensitive areas.	VH	M	H
M	Improve understanding of and compliance with existing regulations in sensitive fish and wildlife resource areas. Assist in the multi-agency development of management plans for those areas.	H	M	H
M	Investigate and analyze the potential of watercraft restricted areas based on environmental sensitivity and safety.	M	M	M

M	Develop and implement management/remediation activities based on synthesis of existing information on effects of use of and potential remediation of marine and estuarine habitats (see research).	M	M	M
L	Place mooring buoys at intensively used natural areas.	H	L	M
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
L	Encourage multi-agency cooperation/collaboration to review and revise seagrass protection measures.	H	L	L
L	Promote knowledge of basic boat operation and navigation as a component of boat registration.	L	L	H
L	Raise awareness and understanding of impacts from propeller scarring.	L	M	M

Parasites/Pathogens

Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
H	Synthesize and consolidate understanding, and identification of gaps in understanding, of marine flora/fauna diseases, pathogens, biotoxins, including slime mold on seagrasses and oyster disease.	VH	M	L

Subtidal Unconsolidated Marine/Estuary Sediment

Status
Current condition: Unknown.
Due to the lack of sufficient map data for this habitat category, no acreage estimates are currently available.

Habitat Description

FNAI type: Unconsolidated Substrate

This habitat consists of mineral based natural communities generally characterized as expansive, relatively open areas within subtidal, intertidal, and supratidal zones that are zero to less than 10 percent colonized by Submerged Aquatic Vegetation or corals. Substrates include coralgae, marl, mud, mud/sand, sand or shell. Types and distribution of unconsolidated sediments vary greatly throughout Florida and originate from parent sources, such as decaying plant tissues (e.g., mud) or from calcium carbonate depositions of plants or animals (e.g., coralgae, marl and shell substrates). While marl and coralgae substrates are primarily restricted to the southern portion of the state, unconsolidated sediments composed of mud, mud/sand, sand, and shell, are found throughout the coastal areas of Florida. This habitat category may support large populations of infaunal, transient planktonic and pelagic organisms (e.g., tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs). The intertidal and supratidal zones are important feeding areas for many shorebird and invertebrate species. Furthermore, infaunal organisms in subtidal zones can reach densities of the tens of thousands per meter square, making these areas important feeding grounds for many bottom feeding fish.

Associated Species of Greatest Conservation Need

Mammals

- *Trichechus manatus latirostris* — Florida Manatee
- *Tursiops truncatus* — Atlantic Bottlenose Dolphin

Birds

- *Nycticorax nycticorax* — Black-crowned Night-Heron
- *Nyctanassa violacea* — Yellow-crowned Night-Heron
- *Ajaja ajaja* — Roseate Spoonbill

Reptiles

- *Crocodylus acutus* — American Crocodile
- *Eretmochelys imbricata* — Hawksbill
- *Caretta caretta* — Loggerhead
- *Lepidochelys kempii* — Kemp's Ridley

Fish

- *Negaprion brevirostris* — Lemon Shark
- *Pristis pectinata* — Smalltooth Sawfish
- *Pristis pristis* — Largetooth Sawfish
- *Aetobatus narinari* — Spotted Eagle Ray
- *Acipenser oxyrinchus oxyrinchus* — Atlantic Sturgeon
- *Acipenser oxyrinchus desotoi* — Gulf Sturgeon
- *Megalops atlanticus* — Tarpon
- *Myrichthys breviceps* — Sharptail Eel
- *Opsanus beta* — Gulf Toadfish
- *Halieutichthys aculeatus* — Pancake Batfish
- *Ogcocephalus corniger* — Longnose Batfish
- *Ogcocephalus cubifrons* — Polka-dot Batfish
- *Ogcocephalus nasutus* — Shortnose Batfish
- *Ogcocephalus parvus* — Roughback Batfish
- *Agonostomus monticola* — Mountain Mullet
- *Mugil cephalus* — Striped Mullet
- *Mugil curema* — White Mullet
- *Mugil sp.* — Redeye Mullet
- *Menidia conchorum* — Key Silverside
- *Hyporhamphus meeki* — False Silverstripe Halfbeak
- *Rivulus marmoratus* — Mangrove Rivulus
- *Fundulus jenkinsi* — Saltmarsh Topminnow
- *Gambusia rhizophorae* — Mangrove Gambusia
- *Halicampus crinitus* — Banded Pipefish
- *Microphis brachyurus* — Opossum Pipefish
- *Syngnathus springeri* — Bull Pipefish
- *Fistularia petimba* — Red Cornetfish
- *Centropomus parallelus* — Smallscale Fat snook
- *Centropomus pectinatus* — Tarpon Snook
- *Centropomus undecimalis* — Common Snook
- *Morone saxatilis* — Striped Bass
- *Centropristis ocyurus* — Bank Sea Bass
- *Epinephelus flavolimbatus* — Yellowedge Grouper

- *Hypoplectrus unicolor* Butter Hamlet
- *Rypticus bistrispinus* Freckled Soapfish
- *Rypticus saponaceus* Greater Soapfish
- *Lonchopisthus micrognathus* Swordtail Jawfish
- *Opistognathus aurifrons* Yellowhead Jawfish
- *Opistognathus lonchurus* Moustache Jawfish
- *Opistognathus macrognathus* Banded Jawfish
- *Opistognathus maxillosus* Mottled Jawfish
- *Opistognathus robinsi* Spotfin Jawfish
- *Opistognathus whitehursti* Dusky Jawfish
- *Apogon quadrisquamatus* Sawcheek Cardinalfish
- *Astrapogon stellatus* Conchfish
- *Phaeoptyx pigmentaria* Dusky Cardinalfish
- *Caulolatilus cyanops* Blackline Tilefish
- *Caulolatilus microps* Blueline Tilefish
- *Rachycentron canadum* Cobia
- *Selar crumenophthalmus* Bigeye Scad
- *Lutjanus buccanella* Blackfin Snapper
- *Lutjanus campechanus* Red Snapper
- *Eugerres plumieri* Striped Mojarra
- *Haemulon album* Margate
- *Archosargus probatocephalus* Sheepshead
- *Calamus leucosteus* Whitebone porgy
- *Bairdiella batabana* Blue Croaker
- *Pareques umbrosus* Cubbyu
- *Pogonias cromis* Black Drum
- *Sciaenops ocellatus* Red Drum
- *Centropyge argi* Cherubfish
- *Stegastes leucostictus* Beaugregory
- *Xyrichtys martinicensis* Rosy Razorfish
- *Xyrichtys novacula* Pearly Razorfish
- *Xyrichtys splendens* Green Razorfish
- *Cryptotomus roseus* Bluelip Parrotfish
- *Scarus coeruleus* Blue Parrotfish
- *Labrisomus bucciferus* Puffcheek Blenny
- *Labrisomus nuchipinnis* Hairy Blenny
- *Paraclinus nigripinnis* Blackfin Blenny
- *Chaenopsis limbaughi* Yellowface Pikeblenny
- *Emblemaria atlantica* Banner Blenny
- *Emblemariopsis bahamensis* Blackhead Blenny
- *Stathmonotus stahli* Eelgrass Blenny
- *Hypleurochilus bermudensis* Barred Blenny
- *Dormitator maculatus* Fat Sleeper
- *Erotelis smaragdus* Emerald Sleeper
- *Gobiomorus dormitor* Bigmouth Sleeper
- *Awaous banana* River Goby
- *Coryphopterus glaucofraenum* Bridled Goby
- *Coryphopterus tortugae* Sand Goby
- *Ctenogobius pseudofasciatus* Slashcheek Goby
- *Ctenogobius saepepallens* Dash Goby
- *Ctenogobius stigmaturus* Spottail Goby
- *Gnatholepis thompsoni* Goldspot Goby
- *Microgobius carri* Seminole Goby

- *Nes longus* Orangespotted Goby
- *Etropus crossotus* Fringed Flounder
- *Paralichthys albigutta* Gulf Flounder
- *Paralichthys dentatus* Summer Flounder
- *Paralichthys lethostigma* Southern Flounder
- *Aluterus schoepfii* Orange Filefish
- *Monacanthus tuckeri* Slender Filefish
- *Diodon holocanthus* Balloonfish

Invertebrates

- *Zoanthus sp.* Green Sea Mat
- *Panopea bitruncata* Atlantic Geoduck
- *Nodipecten nodosus* Lion's Paw
- *Donax variabilis* Variable Coquina
- *Mercenaria campechiensis* Hard Clam
- *Mercenaria mercenaria* Hard Clam
- *Aplysia dactylomela* Spotted Seahare
- *Fasciolaria lilium* Banded Tulip
- *Pleuroploca gigantea* Horse Conch
- *Busycon sinistrum* Lightning Whelk
- *Cassis flammea* Helmet Shell
- *Cassis madagascariensis* Helmet Shell
- *Cassis tuberosa* Helmet Shell
- *Strombus gigas* Queen Conch
- *Oreaster reticulatis* Cushion Star, Bahama Star
- *Meoma ventricosa* West Indian Sea Biscuit
- *Clypeaster rosaceus* West Indian Sea Biscuit
- *Clypeaster subdepressus* Sea Biscuit
- *Encope michelini* Sand Dollar
- *Leodia sexiesperforata* Sand Dollar
- *Mellita isometra* Sand Dollar
- *Mellita quinquiesperforata* Five-holed Keyhole Sand Dollar
- *Mellita tenuis* Sand Dollar
- *Moira atropus* Burrowing Heart Urchin
- *Lytechinus variegatus* Variegated Urchin
- *Tripneustes ventricosus* Sea Egg Urchin
- *Ophiophragmus filograneus* Brittle Star
- *Arenicola cristata* Lugworm
- *Limulus polyphemus* Horseshoe Crab
- *Calappa flammea.* Shame-faced Crabs
- *Hepatus epheliticus.* Calico Crab
- *Phimochirus operculatus* Polkadotted Hermit Crab
- *Panulirus islagrande* Spiny Lobster
- *Upogebia spp.* Ghost Shrimp
- *Menippe nodifrons* Cuban Stone Crab
- *Neogonodactylus oerstedii* Mantis Shrimp
- *Lysiosquilla scabricauda* Thumbsplitter Mantis Shrimp
- *Farfantepenaeus duorarum* Pink Shrimp
- *Callinectes sapidus* Blue Crab

Conservation Threats

Threats to Subtidal Unconsolidated Marine/Estuary Sediment habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Coastal development
- Dam operations/incompatible release of water (quality, quantity, timing)
- Incompatible industrial operations
- Incompatible recreational activities
- Invasive animals
- Management of nature (beach nourishment and impoundments)
- Nutrient loads (urban)
- Roads, bridges and causeways
- Surface water and groundwater withdrawal

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered water quality - contaminants	High
B	Habitat disturbance	High
C	Altered species composition	Medium
D	Altered water quality – nutrients	Medium
E	Altered water quality - physical, chemistry	Medium
F	Habitat destruction	Medium
G	Altered hydrologic regime	Medium

The sources of stress, or threats, were used to generate conservation actions.

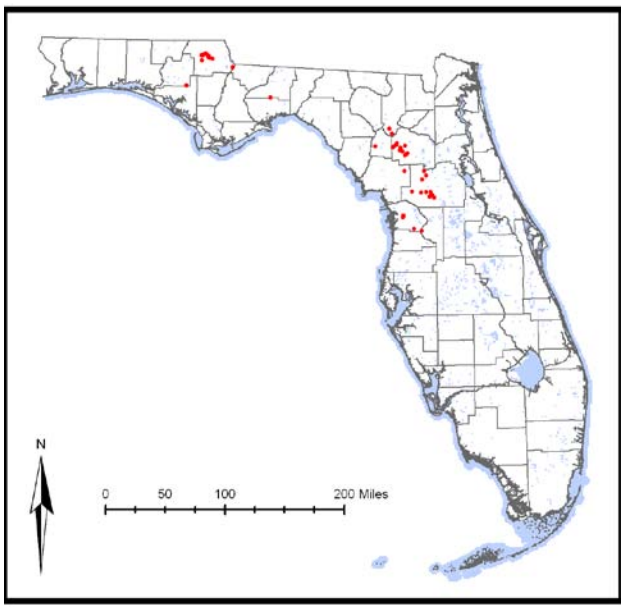
Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Dam operations/incompatible release of water (quality, quantity, timing)	**High**	A, B, D, E, G
2	Inadequate stormwater management	**High**	A, B, C, D, E, G
3	Coastal development	**High**	A, B, F, G
4	Chemicals and toxins	**High**	A, B, C
6	Incompatible industrial operations	**High**	A, F, G
7	Channel modification/shipping lanes	**Medium**	B, F, G
8	Fishing gear impacts	**Medium**	B, F
9	Incompatible recreational activities	**Medium**	B
10	Roads, bridges and causeways	**Medium**	B
11	Management of nature (beach nourishment, impoundments)	**Medium**	E
12	Boating impacts	**Low**	B
13	Nutrient loads	**Low**	C

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
14	Invasive animals	Low	B
15	Thermal pollution	Low	B, E
16	Solid Waste	Low	B
17	Surface water withdrawal	Low	E
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Most threats to Subtidal Unconsolidated Marine/Estuary Sediment habitat were also identified as statewide threats (see list above). Actions to abate them are in the Chapter Multiple Habitat Threats and Conservation Actions. Habitat-specific threats to Subtidal Unconsolidated Marine/Estuary Sediment are Boating Impacts, Solid Waste, and Thermal Pollution, which also affect several other marine and estuarine habitats. Consequently, actions to abate these threats will be the same or similar to the actions recommended for abating threats to several other marine and estuarine habitats (e.g., Coastal Tidal River or Stream, Mangrove Swamp, Submerged Aquatic Vegetation, Subtidal Unconsolidated Marine/Estuary Sediment, Tidal Flat) and are not repeated here.

Terrestrial Cave



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status

Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), several hundred Terrestrial Caves are likely to exist in Florida, although most have not been mapped. Of the Terrestrial Caves currently mapped, 19% (7) are in existing conservation or managed areas, 22% (8) are in private lands encompassed by Florida Forever project areas, and 11% (4) are in SCHA- identified lands, and the remaining 47% (17) occur in other private lands.

Habitat Description

FNAI type: Terrestrial Cave

Terrestrial Caves are cavities below the surface of the ground that do not contain permanent standing water. However, some cave systems can contain both aquatic and terrestrial cave conditions with Terrestrial Cave conditions existing in fissures over standing water. Due to the rise and fall of water levels many terrestrial caves have alternately been aquatic caves. Terrestrial Caves are known to occur in at least 26 Florida counties and are limited to north and central Florida. Caves develop in areas of karst topography; water moves through underlying limestone and dissolves it and creates fissures and caverns. Caves have stable internal environments with temperature and humidity levels remaining fairly constant. In the twilight zones of caves, where some light is present, some plants may exist, although these are limited to mosses, liverworts, ferns,

and algae. Beyond the twilight zone, no plants are found and the food chain is dependent on detritus and fecal matter entering the cave.

Associated Species of Greatest Conservation Need

Mammals

- *Myotis austroriparius* — Southeastern Bat
- *Myotis grisescens* — Gray Bat
- *Eptesicus fuscus* — Big Brown Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle

Amphibians

- *Haideotriton wallacei* — Georgia Blind Salamander

Conservation Threats

Threats to the Terrestrial Caves habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Incompatible recreational activities
- Incompatible resource extraction – mining/drilling

Threats specific to Terrestrial Cave also included mining activities causing destruction of habitat. Mining has been known to open up new cave habitat that was previously inaccessible to bats, but can also close off or destroy existing habitat. Habitat-specific incompatible recreation includes gating cave entrances and filling in cave openings to prevent trespass from unauthorized recreation. Caves support unique/irreplaceable species and those with very unique adaptations that may be sensitive to small increases in levels of contaminants, shifts in air temperature or food webs.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Habitat degradation/disturbance	High
B	Keystone species missing or lacking in abundance	High
C	Habitat destruction or conversion	Medium
D	Altered species composition/dominance	Low
E	Altered water and/or soil temperature	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Incompatible recreational activities	**High**	A, B, C
2	Solid waste	**Medium**	A, B, C
3	Incompatible resource extraction: mining/drilling	**Medium**	B, C
Statewide Threat Rank of Habitat		**Medium**	

Conservation Actions

Actions to abate the threats to Terrestrial Caves that were also identified as statewide threats (Incompatible recreational activities, Incompatible resource extraction – mining/drilling) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Several of the actions developed for a statewide threat that were only applicable to Terrestrial Caves and a few other habitats (i.e., Aquatic Cave, Calcareous Stream, Cypress Swamp, Freshwater Marsh and Wet Prairie, Natural Lake, Reservoir/Managed Lake, Seepage/Steephead Stream, Softwater Stream, Spring and Spring Run, and Coastal Tidal River or Stream) and are listed below. These actions are intended to prevent harm to cave and other ecosystems influenced by groundwater by developing numeric nutrient criteria specific to cave systems and to prevent physical destruction or degradation of cave habitat from recreational activities and facilitate movement of bats and other species through upgrading or retrofitting cave entrances and infrastructure for access.

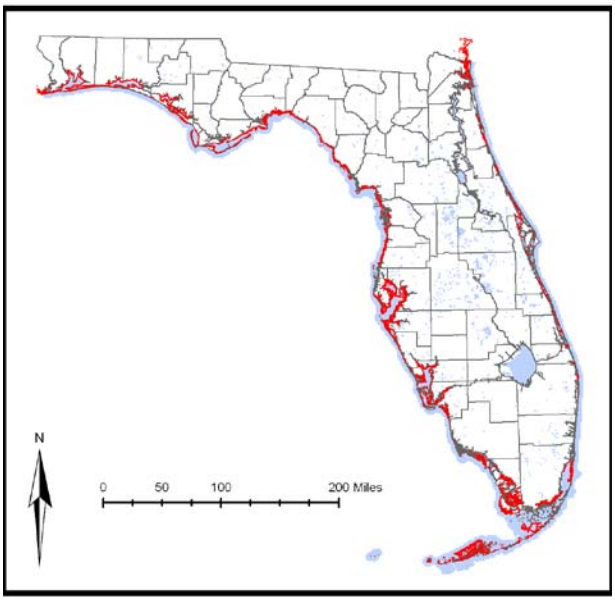
Incompatible Recreational Activities

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
M	Provide incentives (e.g., liability limitations where appropriate management procedures have been taken), cost-sharing, or design advice to secure cave entrances with bat-friendly gates.	H	M	M

Incompatible Resource Extraction: Mining/Drilling

Overall Rank	Economic and Other Incentives	*Feasibility*	*Benefits*	Cost
M	Create incentives to avoid loss of, and impacts to, SHCAs and sensitive habitats from mining, particularly wet and dry prairie, scrub, and bat caves.	H	M	H

Tidal Flat



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status

Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 442,500 acres (179,073 ha) of Tidal Flat habitat exist, of which 71% (316,000 ac; 127,881 ha) are protected in reserves and easements. Another 14% (60,000 ac; 24,281 ha) are proposed for acquisition. The remaining 15% (66,500 ac; 26,912 ha) are other private lands.

Habitat Description

FNAI type: None

Tidal flats are non-vegetated areas of sand or mud protected from wave action and composed primarily of mud transported by tidal channels. An important characteristic of the tidal flat environment is its alternating tidal cycle of submergence and exposure to the atmosphere.

Associated Species of Greatest Conservation Need

Mammals

- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Lutra canadensis lataxina* — River Otter

- *Trichechus manatus latirostris* Florida Manatee
- *Tursiops truncatus* Atlantic Bottlenose Dolphin

Birds

- *Anas fulvigula fulvigula* Florida Mottled Duck
- *Pelecanus occidentalis* Brown Pelican
- *Ardea herodias occidentalis* Great White Heron
- *Egretta thula* Snowy Egret
- *Egretta tricolor* Tricolored Heron
- *Egretta rufescens* Reddish Egret
- *Nycticorax nycticorax* Black-crowned Night-Heron
- *Nyctanassa violacea* Yellow-crowned Night-Heron
- *Ajaja ajaja* Roseate Spoonbill
- *Haliaeetus leucocephalus* Bald Eagle
- *Falco columbarius* Merlin
- *Falco peregrinus* Peregrine Falcon
- *Charadrius alexandrinus tenuirostris* Cuban Snowy Plover
- *Charadrius wilsonia* Wilson's Plover
- *Charadrius melodus* Piping Plover
- *Haematopus palliatus* American Oystercatcher
- *Numenius phaeopus hudsonicus* Whimbrel
- *Limosa fedoa* Marbled Godwit
- *Calidris canutus rufa* Red Knot
- *Calidris pusilla* Semipalmated Sandpiper
- *Calidris mauri* Western Sandpiper
- *Calidris fuscicollis* White-rumped Sandpiper

Reptiles

- *Crocodylus acutus* American Crocodile
- *Malaclemys terrapin* Diamondback Terrapin
- *Caretta caretta* Loggerhead
- *Lepidochelys kempii* Kemp's Ridley
- *Nerodia clarkii clarkii* Gulf Salt Marsh Snake
- *Nerodia clarkii compressicauda* Mangrove Salt Marsh Snake
- *Nerodia clarkii taeniata* Atlantic Salt Marsh Snake

Fish

- *Ginglymostoma cirratum* Nurse Shark
- *Carcharhinus acronotus* Blacknose Shark
- *Carcharhinus leucas* Bull Shark
- *Carcharhinus limbatus* Blacktip Shark
- *Negaprion brevirostris* Lemon Shark
- *Sphyrna lewini* Scalloped Hammerhead
- *Sphyrna tiburo* Bonnethead
- *Pristis pristis* Largetooth Sawfish
- *Acipenser oxyrinchus desotoi* Gulf Sturgeon
- *Megalops atlanticus* Tarpon
- *Albula vulpes* Bonefish
- *Uropterygias macularius* Marbled Moray
- *Opsanus beta* Gulf Toadfish
- *Opsanus pardus* Leopard Toadfish
- *Mugil cephalus* Striped Mullet
- *Mugil curema* White Mullet

- *Rivulus marmoratus* Mangrove Rivulus
- *Fundulus jenkinsi* Saltmarsh Topminnow
- *Gambusia rhizophorae* Mangrove Gambusia
- *Aulostomus maculatus* Atlantic Trumpetfish
- *Centropomus parallelus* Smallscale Fat Snook
- *Centropomus pectinatus* Tarpon Snook
- *Centropomus undecimalis* Common Snook
- *Cephalopholis fulva* Coney
- *Trachinotus carolinus* Florida Pompano
- *Trachinotus falcatus* Permit
- *Lutjanus analis* Mutton Snapper
- *Lutjanus apodus* Schoolmaster
- *Lutjanus griseus* Gray Snapper
- *Ocyurus chrysurus* Yellowtail Snapper
- *Lobotes surinamensis* Atlantic Tripletail
- *Archosargus probatocephalus* Sheepshead
- *Cynoscion nebulosus* Spotted Seatrout
- *Cynoscion regalis* Weakfish
- *Pogonias cromis* Black Drum
- *Sciaenops ocellatus* Red Drum
- *Stegastes partitus* Bicolor Damselfish
- *Halichoeres poeyi* Blackear Wrasse
- *Lachnolaimus maximus* Hogfish
- *Stathmonotus hemphilli* Blackbelly Blenny
- *Acanthurus bahianus* Ocean Surgeon
- *Etropus crossotus* Fringed Flounder
- *Paralichthys lethostigma* Southern Flounder
- *Canthigaster rostrata* Sharpnose Puffer

Invertebrates

- *Mercenaria campechiensis* Hard Clam
- *Mercenaria mercenaria* Hard Clam
- *Panopea bitruncata* Atlantic Geoduck
- *Fasciolaria lilium* Banded Tulip
- *Busycon sinistrum* Lightning Whelk
- *Strombus gigas* Queen Conch
- *Holothuria floridana* Florida Sea Cucumber
- *Arenicola cristata* Lugworm
- *Limulus polyphemus* Horseshoe Crab
- *Callichirus spp*. Ghost Shrimp
- *Clibanarius vittatus* Thinstripe Hermit Crab
- *Uca minax* Red-jointed Fiddler, Brackish Water Fiddler
- *Uca pugilator* Sand Fiddler
- *Uca pugnax* Mud Fiddler
- *Callinectes sapidus* Blue Crab
- *Clypeaster rosaceus* West Indian Sea Biscuit
- *Clypeaster subdepressus* Sea Biscuit
- *Meoma ventricosa* West Indian Sea Biscuit

Conservation Threats

Threats to Tidal Flat habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Coastal development
- Dam operations/incompatible release of water (quality, quantity, timing)
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Harmful algal blooms
- Incompatible industrial operations
- Incompatible recreational activities
- Industrial spills
- Invasive animals
- Management of nature (beach nourishment and impoundments)
- Roads, bridges and causeways
- Shoreline hardening
- Surface water and groundwater withdrawal
- Vessel impacts

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered water quality – physical, chemistry	Very High
B	Altered species composition	Very High
C	Altered water quality - contaminants	Very High
D	Habitat destruction	Very High
E	Habitat disturbance	Very High
F	Altered hydrological regime	Medium
G	Altered weather regime/sea level rise	Medium

The sources of stress, or threats, were used to generate conservation actions.

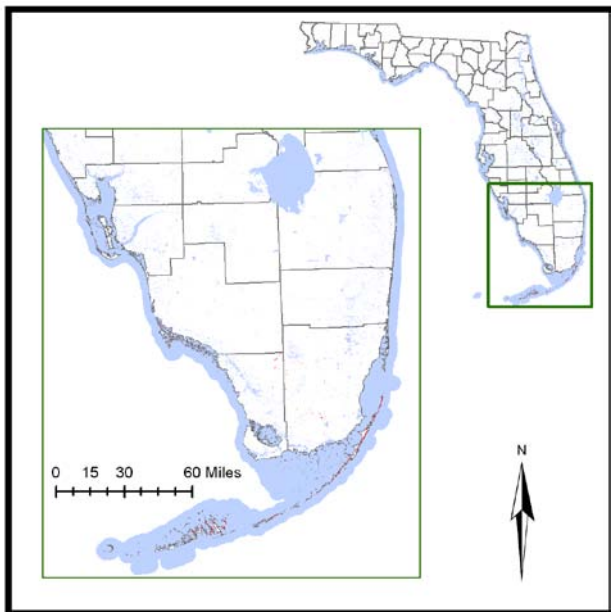
Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Coastal development	**Very High**	B, C, D, E, F
2	Incompatible industrial operations	**Very High**	B, C, D, E, F
3	Incompatible recreational activities	**High**	B, E
4	Roads, bridges and causeways	**High**	D, E, F
5	Inadequate stormwater management	**High**	A, B, C, E, F
6	Management of nature (beach nourishment, impoundments)	**High**	B, E, F
7	Invasive animals	**High**	B, E
8	Chemicals and toxins	**High**	C
9	Industrial spills	**High**	B, C
10	Dam operations/incompatible release of water	**High**	A, C, F

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
	(quality, quantity, timing)		
11	Solid waste	**Medium**	E
12	Disruption of longshore transport of sediments	**Medium**	A, B, D, F
13	Climate variability	**Medium**	G
14	Shoreline hardening	**Medium**	D, F
15	Boating impacts	**Medium**	E
16	Channel modification/shipping lanes	**Medium**	D, E, F
17	Surface water withdrawal	**Medium**	A
18	Groundwater withdrawal	**Medium**	A
19	Vessel impacts	**Medium**	D, E
20	Harmful algal blooms	**Medium**	B
21	Fishing gear impacts	**Low**	E
Statewide Threat Rank of Habitat		**Very High**	

Conservation Actions

Actions to abate the threats to Tidal Flat habitats that were also identified as statewide threats (see list above), are in the Chapter Multiple Habitat Threats and Conservation Actions. Many of the threats to Tidal Flats are the same as for several other marine and estuarine habitats. Consequently, actions to abate these threats will be the same or similar to the actions recommended for abating threats to several other marine and estuarine habitats (e.g., Beach/Surf Zone, Mangrove Swamp, Submerged Aquatic Vegetation, Coastal Tidal River or Stream).

Tropical Hardwood Hammock



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Poor and declining. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), 15,232 acres (6,164 ha) of Tropical Hardwood Hammock habitat exist, of which 71% (10,867 ac; 4,398 ha) are in existing conservation or managed areas. Another 10% (1,470 ac; 595 ha) are Florida Forever projects and 5% (783 ac; 317 ha) are SHCA-identified lands. The remaining 14% (2,112 ac; 855 ha) are other private lands.

Habitat Description

FNAI type: Rockland Hammock

These upland hardwood forests occur only in south Florida and are characterized by tree and shrub species on the northern edge of a range that extends southward into the Caribbean. These communities are sparsely distributed along coastal uplands south of a line from about Vero Beach on the Atlantic coast to Sarasota on the Gulf coast. They occur on many tree islands in the Everglades and on uplands throughout the Florida Keys. This cold-intolerant tropical community has very high plant species diversity, sometimes containing over 35 species of trees and about 65 species of shrubs. Characteristic tropical plants include strangler fig, gumbo-limbo, mastic, bustic, lancewood, ironwoods, poisonwood, pigeon plum, Jamaica dogwood, and Bahama lysiloma. Live oak and cabbage palm are also sometimes found within this community. Tropical Hardwood

Hammocks in the Florida Keys may also contain several plants, including lignum vitae, mahogany, thatch palms, and manchineel, which are extremely rare within the United States.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Molossus molossus* — Pallas' Mastiff Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Pipistrellus subflavus* — Eastern Pipistrelle
- *Sylvilagus palustris hefneri* — Lower Keys Marsh Rabbit
- *Neotoma floridana smalli* — Key Largo Woodrat
- *Peromyscus gossypinus allapaticola* — Key Largo Cotton Mouse
- *Ursus americanus floridanus* — Florida Black Bear
- *Procyon lotor auspicatus* — Key Vaca Raccoon
- *Procyon lotor incautus* — Key West Raccoon
- *Puma concolor coryi* — Florida Panther
- *Odocoileus virginianus clavium* — Key Deer

Birds

- *Colinus virginianus* — Northern Bobwhite
- *Buteo brachyurus* — Short-tailed Hawk
- *Falco columbarius* — Merlin
- *Falco peregrinus* — Peregrine Falcon
- *Columba leucocephala* — White-crowned Pigeon
- *Coccyzus minor* — Mangrove Cuckoo
- *Chordeiles gundlachii* — Antillean Nighthawk
- *Vireo altiloquus* — Black-whiskered Vireo
- *Dendroica petechia gundlachi* — Cuban Yellow Warbler
- *Dendroica discolor paludicola* — Florida Prairie Warbler
- *Dendroica cerulea* — Cerulean Warbler
- *Protonotaria citrea* — Prothonotary Warbler
- *Helmitheros vermivorum* — Worm-eating Warbler
- *Limnothlypis swainsonii* — Swainson's Warbler
- *Seiurus montacilla* — Louisiana Waterthrush
- *Wilsonia citrina* — Hooded Warbler

Reptiles

- *Eumeces egregius egregius* — Florida Keys Mole Skink
- *Diadophis punctatus acricus* — Key Ringneck Snake
- *Drymarchon couperi* — Eastern Indigo Snake
- *Storeria dekayi* — Lower Keys Brown Snake
- *Tantilla oolitica* — Rim Rock Crowned Snake
- *Crotalus adamanteus* — Eastern Diamondback Rattlesnake
- *Kinosternon baurii* — Key Mud Turtle
- *Terrapene carolina bauri* — Florida Box Turtle

Invertebrates

- *Liguus fasciatus matecumbensis* — Florida (Matecumbe) Tree Snail
- *Orthalicus reses nesodryas* — Florida Keys Tree Snail
- *Orthalicus reses reses* — Stock Island Tree Snail
- *Eburia stroheckeri* — Strohecker's Eburia
- *Linsleyonides albomaculatus* — White-spotted Longhorn
- *Romulus globosus* — Round-necked Romulus
- *Stenodontes chevrolati* — Chevrolat's Stenodontes
- *Chelyoxenus xerobatis* — Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* — Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* — Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* — Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Epargyreus zestos* — Zestos Skipper
- *Chlorostrymon maesites* — Amethyst Hairstreak
- *Eumaeus atala* — Atala
- *Hemiargus thomasi bethunebakeri* — Miami Blue
- *Anthanassa frisia* — Cuban Crescent
- *Eunica monima* — Dingy Purplewing
- *Eunica tatila tatilista* — Florida Purplewing
- *Heraclides aristodemus ponceanus* — Schaus' Swallowtail
- *Papilio andraemon bonhotei* — Bahama Swallowtail
- *Appias drusilla neumoegeni* — Florida White
- *Eurema dina helios* — Dina Yellow
- *Eurema nise* — Mimosa Yellow

Conservation Threats

Threats to Tropical Hardwood Hammock habitat that were also identified for multiple other habitats are addressed in the Chapter Multiple Habitat Threats and Conservation Actions. These threats include:

- Chemicals and toxins
- Conversion to housing and urban development
- Groundwater withdrawal
- Incompatible fire
- Invasive animals
- Invasive plants
- Roads
- Surface water withdrawal

Threats specific to Tropical Hardwood Hammock were limited to incompatible residential activities that include movement of fertilizer, herbicide, and invasive species from landscape maintenance, activities of people, their pets, and nuisance species, and disposal of yard and household waste. Feral or pet cats and roof rats were specifically identified as threatening SGCN in this habitat.

The following stresses and sources of stress threaten this habitat:

Stresses		Habitat Stress Rank
A	Altered landscape mosaic or context (S and E of canal L-31)	High

Stresses		Habitat Stress Rank
B	Excessive depredation and/or parasitism	High
C	Altered species composition/dominance	High
D	Altered hydrologic regime	High
E	Altered community structure	High
F	Fragmentation of habitats, communities, ecosystems (in urban)	Medium
G	Habitat destruction or conversion (on private lands)	Medium
H	Altered fire regime	Medium
I	Altered soil structure and chemistry (on Rock Ridge)	Medium
J	Insufficient size/extent of characteristic communities or ecosystems	Medium
K	Habitat degradation/disturbance	Medium
L	Missing key communities, functional guilds, or seral stages	Low

The sources of stress, or threats, were used to generate conservation actions.

Sources of Stress		Habitat Source Rank	Related Stresses (see above)
1	Invasive animals	**High**	A, B, C
2	Invasive plants	**High**	A, C, E
3	Incompatible fire	**Medium**	C, E
4	Groundwater withdrawal	**Medium**	D, C
5	Conversion to housing and urban development	**Medium**	A, D
6	Surface water withdrawal	**Medium**	C, D
7	Incompatible vegetation harvest	**Low**	B, C
8	Nuisance animals	**Low**	A, B, C
9	Chemicals and toxins	**Low**	A, C
10	Incompatible wild animal harvest	**Low**	B, C
11	Roads	**Low**	A, D
12	Incompatible residential activities	**Low**	A
13	Incompatible agricultural practices	**Low**	A
Statewide Threat Rank of Habitat		**High**	

Conservation Actions

Actions to abate the threats to Tropical Hardwood Hammock that were also identified as statewide threats (see list above in Conservation Threats section) are in the Chapter Multiple Habitat Threats and Conservation Actions.

Actions to abate specific threats that were identified for Tropical Hardwood Hammock are below, though none were ranked of high priority for implementation. These actions were designed to reduce the impacts from activities of residents adjacent to this habitat and the animals that accompany residential development.

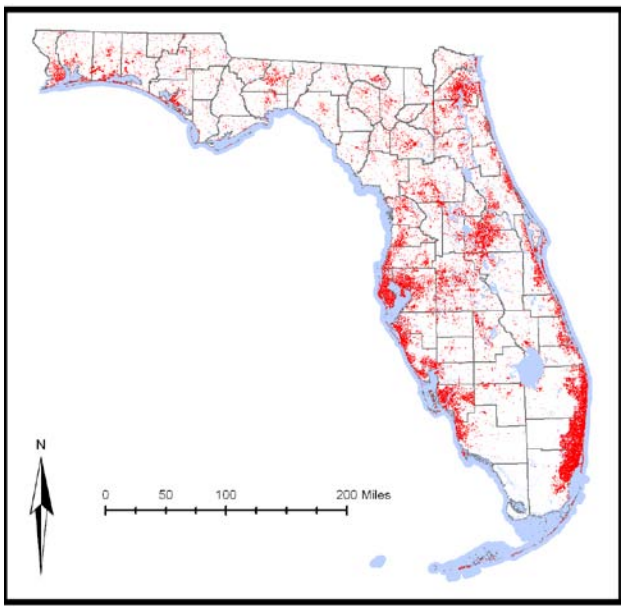
Nuisance Animals

Overall Rank	Land/Water/Species Management	*Feasibility*	*Benefits*	Cost
M	Work with the USDA Animal and Plant Health Inspection Service to establish and implement a trapping program for controlling feral cats in specific tropical hardwood hammocks to protect native species from excessive depredation.	M	M	M
Overall Rank	**Planning and Standards**	*Feasibility*	*Benefits*	**Cost**
L	Develop management techniques for waste management in areas where SGCN or habitats are subject to high depredation or disturbance rates by exotic and nuisance animals with populations elevated by garbage (providing a supplemental food source).	M	L	L
Overall Rank	**Policy**	*Feasibility*	*Benefits*	**Cost**
M	Assist counties, municipalities, and homeowners associations to develop and implement curbside pick-up of yard and household waste.	H	M	M
L	Promote increased awareness and understanding of potential impacts of outdoor pet feeding on wildlife, and encourage homeowners to feed pets indoors.	L	M	M
L	Support local governments to ensure that home and business owners have wildlife-proof garbage containers.	H	L	H
Overall Rank	**Research**	*Feasibility*	*Benefits*	**Cost**
M	Fund research on the impacts of roof rats on native tropical hardwood hammock SGCN populations to identify whether control programs are necessary and/or feasible.	VH	L	L

Incompatible Residential Activities

Overall Rank	Economic And Other Incentives	*Feasibility*	*Benefits*	Cost
M	Expand the scale of the Florida Yards and Neighborhoods program from certifying individual landowners to whole neighborhoods; certification should be renewed biennially and any time property ownership changes.	M	M	L
L	Support incentives for residential property owners to resolve issues of incompatible use of and including pesticide use, pet control, feeding of wildlife, household or yard waste disposal, landscape plants, irrigation use, prescribed fire tolerance, and light-use in coastal areas.	M	L	L
L	Identify and promote effective reward models for homeowners, maintenance companies, and municipalities for reducing impacts on neighboring conservation areas.	M	L	L
L	Develop a voluntary program directed at developers to provide on-site site specific educational materials and recommendations to home-owner associations about incompatible residential activities.	M	L	L
Overall Rank	**Education and Awareness**	*Feasibility*	*Benefits*	**Cost**
M	Encourage and support continuing education opportunities for landscape maintenance industry that includes appropriate use of chemicals, irrigation, plants, and disposal of yard waste.	H	M	M

Urban/Developed



Some habitat distributions or locations may be misrepresented on this map due to size, resolution and insufficient data sources.

Status
Current condition: Not applicable. According to the best available GIS information at this time (see Appendix D. GIS Data Tables), approximately 4,222,166 acres (1,708,650 ha) of Urban/Developed areas are present in Florida.

Habitat Description

FNAI type: None

This habitat includes a mixture of built structure (e.g., roads, residential and commercial buildings, and parking lots) and vegetation including lawns, golf courses, road shoulders, airports, park facilities, and natural remnants surrounded by or located near residential/commercial development. Many secondary roads are included in this category.

Associated Species of Greatest Conservation Need

Mammals

- *Eumops floridanus* — Florida Bonneted Bat
- *Molossus molossus* — Pallas' Mastiff Bat
- *Lasiurus borealis* — Eastern Red Bat
- *Lasiurus seminolus* — Seminole Bat
- *Lasiurus intermedius* — Northern Yellow Bat
- *Eptesicus fuscus* — Big Brown Bat

- *Tamias striatus* Eastern Chipmunk
- *Geomys pinetis pinetis* Southeastern Pocket Gopher
- *Ursus americanus floridanus* Florida Black Bear
- *Procyon lotor auspicatus* Key Vaca Raccoon
- *Procyon lotor incautus* Key West Raccoon
- *Odocoileus virginianus clavium* Key Deer

Birds

- *Anas fulvigula fulvigula* Florida Mottled Duck
- *Ardea herodias occidentalis* Great White Heron
- *Egretta thula* Snowy Egret
- *Egretta caerulea* Little Blue Heron
- *Egretta tricolor* Tricolored Heron
- *Egretta rufescens* Reddish Egret
- *Nycticorax nycticorax* Black-crowned Night-Heron
- *Nyctanassa violacea* Yellow-crowned Night Heron
- *Mycteria americana* Wood Stork
- *Haliaeetus leucocephalus* Bald Eagle
- *Falco sparverius paulus* Southeastern American Kestrel
- *Falco peregrinus* Peregrine Falcon
- *Grus canadensis pratensis* Florida Sandhill Crane
- *Haematopus palliatus* American Oystercatcher
- *Sterna dougallii* Roseate Tern
- *Sterna antillarum* Least Tern
- *Rynchops niger* Black Skimmer
- *Columbina passerine* Common Ground Dove
- *Athene cunicularia floridana* Florida Burrowing Owl
- *Colaptes auratus auratus* Northern Flicker
- *Tyrannus dominicensis* Gray Kingbird
- *Lanius ludovicianus* Loggerhead Shrike
- *Aphelocoma coerulescens* Florida Scrub-Jay

Reptiles

- *Terrapene carolina bauri* Florida Box Turtle
- *Gopherus polyphemus* Gopher Tortoise
- *Heterodon simus* Southern Hognose Snake
- *Drymarchon couperi* Eastern Indigo Snake
- *Tantilla oolitica* Rim Rock Crowned Snake
- *Crotalus adamanteus* Eastern Diamondback Rattlesnake

Invertebrates

- *Chelyoxenus xerobatis* Gopher Tortoise Hister Beetle
- *Aphodius troglodytes* Gopher Tortoise Aphodius Commensal Scarab Beetle
- *Copris gopheri* Gopher Tortoise Copris Commensal Scarab Beetle
- *Onthophagus polyphemi polyphemi* Gopher Tortoise Onthophagus Commensal Scarab Beetle
- *Eumaeus atala* Atala
- *Junonia genoveva* Tropical Buckeye

Conservation Threats

While threats to its conservation as well as remedial actions were identified during earlier workshops, the Urban/Developed habitat category was not addressed in the Threat and Action Workshops (Chapter. Florida's Approach to Meeting the Eight Required Elements) that generated tables of ranked threats and actions, as seen in most other habitat categories. The decision to not rank threats and actions for this habitat was made to maximize discussion time for higher-priority habitats and because of some disagreement over recognition of this habitat type as important to wildlife conservation. Therefore, threats and actions are presented as bulleted lists with no prioritization.

The following stresses threaten this habitat:

- Absent or insufficient biological legacies
- Altered community structure
- Altered fire regime - timing, frequency, intensity, extent
- Altered hydrologic regime - timing, duration, frequency, extent
- Altered landscape pattern or mosaic
- Altered soil structure and chemistry
- Altered species composition/dominance
- Altered successional dynamics
- Altered water and/or soil temperature
- Altered water quality of surface water or aquifer: contaminants
- Altered water quality of surface water or aquifer: nutrients
- Erosion/sedimentation
- Excessive depredation and/or parasitism
- Fragmentation of habitats, communities, ecosystems
- Habitat degradation/disturbance
- Insufficient size/extent of characteristic communities/ecosystems
- Keystone species missing or lacking in abundance
- Missing key communities, functional guilds, or seral stages

The sources of stress, or threats, were used to generate conservation actions.

- Chemicals and toxins
- Conversion to commercial and industrial development
- Conversion to housing and urban development
- Incompatible fire
- Incompatible recreational activities
- Incompatible wildlife and fisheries management strategies
- Invasive animals
- Invasive plants
- Light pollution
- Management of nature–impoundments
- Nuisance animals
- Nutrient loads–urban
- Parasites/pathogens
- Roads
- Solid waste
- Sonic pollution

Conservation Actions

Actions to abate threats to Urban/Developed were designed to reduce the impacts of urban activities and increase the habitat's suitability to wildlife. Many threats were statewide (Chemicals and toxins, Conversion to commercial and industrial development, Conversion to housing and urban development, Incompatible fire, Incompatible recreational activities, Invasive animals, Invasive plants, Nutrient loads- urban, roads, and Incompatible wildlife and fisheries management strategies).

The actions to abate threats that were identified for Urban/Developed habitat are below, though none were prioritized for implementation.

Land/Water Protection

- Develop low intensity recreation parks with native vegetation.
- Acquire open space with an emphasis on greenways and wildlife corridors

Land/Water/Species Management

- Restore hydrology by removing ditches, levees, and dams

Law and Policy

- Develop effective comprehensive land management for wildlife habitat enhancement
- Protect coast preserves with lighting ordinances
- Minimize connectivity impacts to wildlife through land use planning (e.g., avoid constructing new roads near wildlife crossings or water sources)
- Support incentives for residential property owners to resolve issues of incompatible use to enhance wildlife habitat or reduce development effects on wildlife and wildlife habitat
- Include green infrastructure (Chapter. Glossary of Terms) costs in cost-benefit analyses of development
- Support policies that increase ease of recycling and reduce waste (e.g., curb-side pick-up of recyclable material)

Research, Education and Awareness

- Target education for homeowners, developers, construction contractors, and policy makers to benefit wildlife in their day-to-day activities
- Encourage wildlife-friendly landscaping (e.g., retaining dead leaves on palms for nesting and roosting animals, dead trees for cavity-nesting birds, etc.)
- Educate nuisance wildlife trappers and pest control operators on the proper methods for animal exclusion devices, especially ensuring breeding seasons are considered
- Educate architects about benefits of native plants for landscaping
- Educate homeowners about energy and water conservation
- Educate citizens about the dangers of feeding wildlife
- Support research on effective urban design to benefit wildlife
- Train policy makers on true smart growth and make wildlife issues a consideration

- Involve community volunteers in wildlife conservation efforts and increase their opportunities for involvement
- Educate homeowners about proper pesticide and fertilizer use and disposal

Economic and Other Incentives

- Provide incentives to improve land for wildlife
- Provide incentives to enhance the creation of developments that conserve wildlife habitat (e.g., permits are expedited)
- Support economic incentives for "green development" practices that enhance and benefit wildlife
- Provide awards to organizations and individuals that implement wildlife-friendly design and management practices
- Provide funds and materials for landowners to remove invasive exotics
- Support spay or neuter programs for cats and dogs and reduce number of free-ranging pets

Capacity Building

- Develop wildlife-friendly storm water runoff ponds
- Develop mass transit, pedestrian-friendly communities, and bike paths to reduce transport footprint

Multiple Habitat Threats and Conservation Actions

Multiple habitat threats were identified because they applied to five or more of the 45 habitat categories. This chapter details 32 threats that address multiple habitats and their associated actions. Methods for The Nature Conservancy (TNC) conservation planning workshops identifying threats and actions are described in the Chapter Florida's Approach to Meeting the Eight Required Elements. Additional input was included from experts, stakeholders, and the public. The detailed actions that appear in these multiple habitat threats are not repeated in the Chapter Habitats. This chapter, combined with the Chapter Habitats, present the broad array of conservation threats and actions for Florida's habitats. The actions presented have been edited by the Florida Fish and Wildlife Conservation Commission (FWC) to reflect the incentive-based, non-regulatory intent of Florida's Comprehensive Wildlife Conservation Strategy (Strategy).

It is important to note that hunting and access to public conservation lands were not identified by those contributing to the Strategy development process as threats to wildlife and habitat conservation. The intent of the Strategy is to identify threats and challenges facing Florida's wildlife and to develop actions to address these challenges. Hunting was viewed as a positive factor relative to wildlife conservation and was not viewed as a threat or challenge that needed to be addressed. Implementation of the action plan will likely result in many direct benefits to game species and hunting; therefore, hunting was not a focus of the Strategy, identified threats, and or actions, and not directly addressed.

The 32 threats identified for multiple habitats include (*in alphabetic order*):

- Channel modification/shipping lanes
- Chemicals and toxins
- Climate variability
- Conversion to agriculture
- Conversion to housing and urban development
- Coastal development
- Conversion to recreation areas
- Dam operations
- Disruption of longshore transport of sediments
- Fishing gear impacts
- Groundwater withdrawal
- Harmful algal blooms
- Inadequate stormwater management
- Incompatible fire
- Incompatible fishing pressure
- Incompatible forestry practices
- Incompatible industrial operations
- Incompatible recreational activities
- Incompatible resource extraction: mining/drilling
- Incompatible wildlife and fisheries management strategies
- Industrial spills
- Invasive animals
- Invasive plants
- Key predator/herbivore loss
- Management of nature: beach Nourishment/impoundments
- Nutrient loads - agriculture

- Nutrient loads - urban
- Roads, bridges and causeways
- Shoreline hardening
- Surface water withdrawal/diversion
- Surface and groundwater withdrawal
- Vessel Impacts

Actions were identified to abate threats to multiple habitats since they are likely similar across the state. For each of the 32 priority threats, tables are divided into seven action categories: Capacity Building, Economic and Other Incentives, Education and Awareness, Land/Water Protection, Land/Water/Species Management, Planning and Standards, Policy, and Research. Actions are ranked within these action categories according to TNC's process (See Chapter Florida's Approach to Meeting the Eight Required Elements). Tables present actions with an Overall Rank, ordered from highest to lowest priority as follows: Very High (VH), High (H), Medium (M), or Low (L). Feasibility and benefit rankings, along with an estimated cost are presented. Feasibility and benefit rankings generate the Overall Rank as described below:

Feasibility–Simply defined as the ease of implementation. Actions that are less complex and have been successfully implemented previously, fit within the core competencies of the lead institution, and those that appeal to key constituencies have a higher likelihood of success than other actions.

Benefit–Simply defined as the threat abatement benefit. The degree to which the proposed action, if successfully implemented is likely to achieve the desired outcome(s).

Cost–Simply defined as the order of magnitude in dollars. Total cost of implementing the action estimated for the time horizon of the action, but no longer than 10 years.

Overall Rank–This is the average weighted rank combining Feasibility and Benefits.

While these rankings have been developed to help identify the most effective conservation actions, they do not identify the optimal sequence for implementation. Further, some types of action (e.g., research) often receive lower prioritization than actions that more immediately and directly address the threat (e.g., active management). As a result, the rankings presented provide a useful initial analysis of their management actions for implementation, but any individual, organization, federal, state, or local agency may modify management actions based on additional knowledge and criteria.

Although effort has been made to fact-check the conservation actions developed for each threat, errors of fact or omission may still exist and the authors welcome any feedback regarding such errors. Comments received in this regard will be incorporated into a later version of the Strategy as appropriate. The accuracy and scope of the actions and ranks are limited by the participants and their knowledge. In some cases actions identify potential lead organizations with the intent of initiating discussions that may lead to partnership development in order to implement an action. The Strategy and its components are intended to be a working document to be revised with partners, stakeholders, and public input (See Chapter Florida's Approach to Meeting the Eight Required Elements).

The following are detailed descriptions of the multiple threats and conservation actions presented in alphabetic order (not in order of priority). Each threat description lists the habitat categories to which it applies, summarizes the highest priority conservation actions addressing that threat, and then presents tables of specific recommended and ranked actions.

Channel Modification/Shipping Lanes

Conservation Threats

Channel modification and shipping lanes were identified as sources of habitat loss and habitat disturbance. Channel modification and shipping lanes are frequently necessary to provide services necessary for maintaining navigation and controlling water flow for human safety. These management actions can be incompatible with wildlife conservation due to altered water quality and hydrologic regime and overall degradation or destruction of habitats. While modification of one channel or any one shipping lane may not be significant, it is the cumulative impacts of these sources of stress across Florida's marine and estuarine habitats that are most important. This threat also applies to some freshwater habitats.

This source of stress was identified as a threat to the following individual habitats. Additional, habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coastal Strand
- Coral Reef
- Freshwater Marsh and Wet Prairie
- Hard Bottom
- Inlet
- Large Alluvial Stream
- Mangrove Swamp
- Pelagic
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Actions to abate channel modification and shipping lanes were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize fully understanding the cumulative impacts to marine and estuarine habitats that would result from channel modification (e.g., dredging) and maintenance of shipping lanes, and balancing marine and estuarine natural system needs with navigation needs when channel modification is under consideration, and restoring habitats at a comparable or greater level than the losses resulting from the maintenance or creation of a new channels and shipping lanes.

Highest ranked actions identified for abating this source of stress focus on:

- Identifying local restoration projects where dredged materials can be used
- Improve coordination of goals between statewide dredged material plans and the state's port expansion plans

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Statewide, develop coalitions of local groups to identify basin-wide restoration projects where dredge material can be used.	M	M	H
L	Select options that minimize the potential effects to marine species when designating or expanding shipping channels.	M	L	M
L	Ensure that dredged material is disposed of in the most ecologically beneficial way possible (e.g., create habitat with the dredge material and prevent harm to existing natural habitat).	M	L	H

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Work to improve coordination of goals between statewide dredged material plans and the state's port expansion plans.	M	M	M
L	Develop statewide system-specific dredge material disposal plans (USACE in cooperation with local resource management groups and government) for long-term identification of disposal sites.	M	L	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Encourage public disclosure of rules regarding nearshore channel depths.	M	L	L

Chemicals and Toxins
(Terrestrial and Freshwater)

Conservation Threats

Chemicals and toxins, as a group, was identified as a potential source of altered water quality and other stresses to aquatic habitats statewide, albeit a source of stress about which comparatively little is known regarding its severity and extent. Chemicals and toxins in aquatic habitats may originate from pesticide and herbicide applications; for example, mosquito control, industrial discharge to water bodies, atmospheric deposition and runoff of toxic substances in stormwater. Chemicals and toxins was also identified as a potential source of wildlife mortality and habitat degradation in several upland habitats, particularly those in south Florida harboring vulnerable invertebrate species.

This source of stress was identified as a threat to the following terrestrial and freshwater habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Calcareous Stream
- Coastal Strand
- Coastal Tidal River or Stream
- Large Alluvial Stream
- Natural Lake
- Pine Rockland
- Reservoir/Impoundment
- Softwater Stream
- Tropical Hardwood Hammock

Conservation Actions

Conservation actions to abate the threat posed by chemicals and toxins were based on outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). As would be expected for a source of stress with many uncertainties, many of the resulting actions focus on research and education. The actions emphasize preventing harm to vulnerable aquatic and terrestrial invertebrates from pesticide applications and mosquito control activities in and adjacent to natural areas, reducing the potential for pesticide drift and runoff, and increasing the level of knowledge of the severity and extent of this source of stress.

Highest ranked actions identified for abating this source of stress focus on:

- Developing incentives that encourage the limitation of airborne chemical releases
- Encouraging voluntary efforts to expand or create 'no-spray' (mosquito spray) buffer zones in habitats adjacent to conservation areas with vulnerable species

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Develop incentives that encourage the limitation of airborne chemical releases.	VH	H	VH

L	Create a new program “Ecologically Friendly Farming” in Florida--led by IFAS in cooperation with Florida Department of Agriculture and Florida Department of Environmental Protection with a goal of minimizing nutrient loads in runoff as well as pesticide/herbicide use and improving the position of agriculture in Florida's economy.	H	L	M
L	Create a high level of coordination on natural resource issues among various state and regional agencies (e.g., assure the FWC coordinates with other agencies on mosquito control issues.)	M	L	M
L	Identify and prioritize which hazardous waste/contamination sites still need cleanup and remediation. Encourage incentive-based mechanisms for "orphan share" of superfund sites and other non-superfund hazardous waste sites.	M	L	VH

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Convene conference of Lepidoptera (butterfly) experts to prepare a white paper with recommendations on standards, protocols, and research needs that will protect rare or imperiled populations from damage from pesticide exposure.	VH	L	L
M	Convene annual meeting (or add a session to existing meetings) of mosquito control and wildlife management agencies focused on identifying state-of-the-art techniques and approaches for minimizing the harmful effects of mosquito spray application.	VH	L	L
M	Strengthen existing educational programs/materials for professional and homeowner herbicide and pesticide applicators on detrimental effects of toxins/chemicals on wildlife and water quality.	VH	L	M
M	Promote ecological awareness among all users concerning the appropriate use, application, and disposal of chemicals, including pesticides and herbicides.	H	M	L
L	Encourage golf courses to implement standards (i.e., Audubon's New York chapter golf course Best Management Practice program) and integrated pest management. Promote this program to the public.	H	L	L
L	Promote the use of non-toxic alternatives by small quantity chemical generators.	M	L	M

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Encourage voluntary efforts with the counties to expand or create ‘no-spray’ (mosquito spray) buffer zones in habitats adjacent to conservation areas with vulnerable species.	VH	M	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Examine whether the detection and response models used in air quality management or abatement provide guidance for developing a similar system for water quality.	VH	L	L
L	Redesign and/or manage retention facilities for wildlife habitat especially to minimize toxic effects to wading birds.	M	L	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Encourage local development planning for suburban and urban developments to work with groups such as IFAS to develop landscaping that results in water conservation and minimized application of fertilizers, pesticides and herbicides.	L	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Review the current protocols and ecological effects of local mosquito control programs.	VH	L	L
M	Conduct a literature review of the effects of chemical releases on ecological health. Where data gaps exist, conduct applied research on the effects to Florida habitats or species.	VH	L	L
L	Conduct a coordinated state/federal review of effects from municipal water treatment methods, such as chlorination, on marine and estuarine species and habitats.	L	M	H
L	Fund research on the potential effects of chemicals/toxins on natural systems and wildlife, especially invertebrates. Develop ecological risk assessment models for sensitive species, including aquatic and terrestrial invertebrates.	H	L	H
L	Fund research to determine the prevalence of drift of aerial spraying when next to sensitive habitat areas.	H	L	M
L	Conduct research on potential adverse long-term effects of toxins on wading birds and other wildlife feeding and roosting in stormwater retention facilities, wetland mitigation sites, and agricultural runoff management facilities.	H	L	M
L	Investigate alternative aquatic weed control methods that help reduce the use of toxic chemicals.	H	L	M
L	Research alternatives to non-selective adult-specific spray for mosquitoes.	M	L	H
L	Fund research on ecologically-friendly, readily-broken-down fertilizer products and ensure that the results of this research are made available to companies producing and distributing fertilizers.	M	L	M
L	Fund research on genetic engineering techniques for agricultural products, turf grass, ornamental landscaping that would reduce the need for pesticides and herbicides.	M	L	M
L	Fund research on native turf grass for golf courses and other large turf applications that reduces reliance on potentially toxic chemicals.	M	L	M
L	Research the potential ecological effects of chemical pollutants (i.e., endocrine disrupters, pharmaceuticals, etc.), and airborne pollutants (heavy metals).	L	L	M

Chemicals and Toxins
(Marine)

Conservation Threats

The sources and effects of chemicals and toxins that enter Florida's marine and estuarine systems are not well defined. However, pesticide spraying to control nuisance and invasive species, including mosquitoes and invasive aquatic plants, is a source of stress identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). Overall, this threat was considered to have effects on species composition, water quality, and community structure, though much additional information and research is needed on the effects of this source of stress in the marine environment.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Conservation actions to abate chemicals and toxins were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions focused on attaining a better understanding of the origin of chemical and toxin releases entering coastal waters, the level of chemicals and toxins present in these waters and in the substrate, and the cumulative impacts of chemicals and toxins on marine wildlife and their habitats.

Highest ranked actions identified for abating this source of stress focus on:

- Finding alternate chemicals for use in mosquito spraying that do not harm other species
- Conducting research to better understand the effects from chemicals and toxins to our coastal habitats and species

The following actions, organized by action type, were identified to abate this threat:

Education and Awareness

Overall Rank	**Action**	*Feasibility*	*Benefits*	**Cost**
M	Promote ecological awareness among all users encouraging the appropriate use, application, and disposal of pesticides and other chemicals.	H	M	L
L	Encourage golf courses to implement standards BMPs (i.e., Audubon's New York chapter golf course Best Management Practice program) and integrated pest management. Promote this program to the public.	H	L	L

L	Promote the use of non-toxic alternatives instead of chemicals used by small quantity chemical generators that are exempt from the state's regulated program.	M	L	M

Land/Water/Species Management

Overall Rank	**Action**	*Feasibility*	*Benefits*	***Cost***
VH	Develop incentives that encourage the limitation of airborne chemical releases.	VH	H	VH
L	Support the reduction of airborne chemical releases from power plants, paper mills, and refineries. Develop cooperative interstate agreements to reduce emissions.	L	M	VH

Research

Overall Rank	**Action**	*Feasibility*	*Benefits*	***Cost***
M	Review the current protocols and ecological effects of local mosquito control programs.	VH	L	L
M	Conduct a literature review of the effects of chemical releases on ecological health. Where data gaps exist, conduct applied research on the effects to Florida habitats or species.	VH	L	L
M	Research and explore options for using mosquito control techniques other than toxic chemicals.	M	M	M
L	Investigate alternative aquatic weed control methods that help reduce the use of toxic chemicals.	H	L	M
L	Conduct a coordinated state/federal review of effects from municipal water treatment methods, such as chlorination, on marine and estuarine species and habitats.	L	M	H
L	Investigate the extent of small quantity chemical generators and producers' discharges into sewer systems.	M	L	M
L	Research the potential ecological effects of chemical pollutants (i.e., pharmaceuticals, endocrine disrupters, etc), and airborne pollutants (heavy metals).	L	L	M

Climate Variability

Conservation Threats

Climate variability was identified as a source of stress that could lead to ecological stresses in marine and estuarine habitats including habitat loss, habitat disturbance, altered water temperature, altered weather regime, altered structure, and altered species composition (see Chapter Florida's Approach to Meeting the Eight Required Elements). Climate variability is a threat operating at a different timescale and a different spatial scale than the other threats addressed in this analysis. Given this, it must be acknowledged that some of the actions taken at the state level will be unlikely to resolve a problem of this scope. On the other hand, potential benefits to be derived from actions that can be taken within the state to minimize or avoid contributing further to the problem or to react to changing conditions should be evaluated as information is gained about this threat. Potential effects may involve all habitats and species in the state. Certain coastal habitats in some areas could be significantly reduced or lost if changing climate and related sea level rise alter ecological conditions sufficiently. For example, rising sea levels could increase beach erosion or lead to the inundation of coastal habitats. In areas where coastal development does not allow for migration of this habitat into higher elevations, it will be lost. Similarly, changing climate may cause a shift in species ranges creating a need for migration corridors and mechanisms that allow organisms to respond to the changing climate. Existing development or natural barriers such as rivers could prevent populations from shifting along with the climate.

This source of stress was identified as a threat to the following marine/estuarine habitats and several others. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Coastal Strand
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Hydric Hammock
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Tidal Flat

Conservation Actions

Actions to abate climate variability were based on actions identified in the threats workshops and through expert input following the workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize protecting the likely migration footprint of coastal habitats in the face of sea level rise, protecting north-south native habitat corridors to accommodate changes in species range and the habitats they rely on in the face of warming climate, educating Floridians about the critically important issue of global climate change, and encouraging Floridians to take an active role in efforts to address global climate change.

Highest ranked actions identified for abating this source of stress focus on:

- Identifying and conserving likely migration corridors for habitats and species in the face of climate variability and sea level rise

The following actions, organized by action type, were identified to abate this threat:

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Provide incentives to expand use of solar energy and encourage ecologically friendly development.	M	M	M

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Educate the public about climate variability and the potential effects to Florida (i.e., sea level rise, spread of invasive plants and animals, and effects on wildlife). Use Regional Planning Council maps on sea level rise as a means and source for information dissemination (i.e., http://www.sfrpc.com/gis/slr.htm). Link individual activity with effects (e.g., How is my outboard motor affecting wildlife?) Educate citizens and visitors about how their energy usage is impacting Florida's plant and animal species.	H	M	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Use inundation maps and average temperature range maps as a guide for conservation and acquisition measures to ensure conservation of nesting habitat and expected migration pathways.	M	VH	H
M	Evaluate the feasibility of moving or relocating species that are threatened with extinction because of habitat loss due to sea level rise.	H	M	L
M	Provide technical expertise on fish and wildlife resources and related marine physical processes in coastal development management planning.	L	H	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Use South West Florida Regional Planning Council (SWFRPC) map on sea level rise as a template for planning purposes (http://www.swfrpc.org/maps.htm#Sea%20Level%20Rise). Develop a similar map for the entire state	M	M	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Support multi-agency review and revision of beach nourishment and shoreline hardening projects and their costs and benefits to fish and wildlife resources.	VH	VH	L
L	Continue and support research to better understand how coral reefs and other marine/estuarine habitats react to climate variability.	H	L	M
L	Continue research to understand the effects of climate variability to the Florida Keys.	M	L	M
L	Research new technologies for increasing carbon sequestration rates in Florida's natural habitats.	L	L	M

Conversion to Agriculture

The agricultural, natural resource, and commodity values of rural ranch and forest lands are vital to the state's economy, rural heritage, and quality of life. A thriving rural economy with a strong agricultural base and viable rural communities is essential to Florida's future. Landowners of ranch and forest lands generally have a healthy respect for Florida's natural resources, which is evident from their ability to maintain some of the best remaining examples of intact ecosystems, natural communities, and wildlife habitats in Florida. Also, agricultural and rural lands demand less service so they are a net benefit to the tax base.

It is important to recognize the benefits of agricultural and rural landscapes, including water pollution prevention, wetlands protection, improvement of air quality, prevention of soil erosion, and providing habitat for certain wildlife. Agricultural lands and natural habitat buffers are important habitat and movement corridors for many species of wildlife. However, when a natural area is converted to agricultural use, much of the native vegetation is removed, its habitat potential is significantly altered, and the variety of animals that live within the area usually decreases. Many previously associated species are no longer able to survive in the altered environment. Wildlife conservation can be compatible with agriculture if areas to be converted to agriculture are carefully planned and efforts are made to harmonize agricultural land uses with wildlife habitat values.

Conservation Threats

Although the rate of agricultural conversion in Florida has declined in recent years, many existing low-intensity agricultural lands are being converted to more intensive uses and the historical legacy of past conversion represents a continuing threat to many of Florida's terrestrial, wetland, and freshwater habitats. Accordingly, this source of stress includes both new conversion of natural habitat to agricultural uses and conversion of existing low-intensity agricultural lands with embedded natural habitat to more intensive agricultural operations. Related sources of stress include incompatible agricultural practices, incompatible grazing and ranching, incompatible forestry practices, nutrient loads (agriculture, surface water diversion and withdrawal, and management of nature), and water control structures.

This source of stress was identified as a threat to the following habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Bay Swamp
- Cypress Swamp
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Grassland/Improved Pasture
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Natural Lake
- Natural Pineland
- Scrub
- Softwater Stream

Conservation Actions

Conservation actions to abate conversion to agriculture were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize preventing the conversion of natural lands in agricultural settings, as well as conversion of existing agricultural lands to more intensive agriculture or urban development, ensuring that new agricultural development occurs on already impacted lands rather than functional wildlife habitat, and restoring former agricultural lands to improve wildlife habitat.

Highest ranked actions identified for abating this source of stress focus on:

- Identifying important natural habitats that are to be converted to agricultural uses and working with landowners on a voluntary basis to conserve the habitat via acquisition or easement agreements
- Providing tax incentives to landowners to maintain property in agriculture for five or more years
- Providing incentives (for example, a tax exemption for private lands managed for conservation purposes equivalent to the agricultural tax exemption) to encourage landowners to maintain and manage existing natural areas in the agricultural landscape

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Support development of a cooperative group that includes conservation organizations, agencies, the agricultural industry, and farmland protection organizations to develop strategies designed to reduce conflicts between land protection strategies and agricultural pursuits. This group should explicitly consider international trade pressures on agriculture in Florida and cost and benefits of fee acquisition strategies with the goal of best integrating natural landscapes with active, working agricultural lands in Florida for the long-term.	M	M	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Support the Rural and Family Lands Act (http://www.fl-dof.com/forest_management/fm_pdfs/RandF_landprotection_act.pdf.)	M	M	VH
M	Increase the relevance and allocation of Farm Bill funds for Florida.	M	M	M
M	Identify which federal programs might reinforce low-intensity agricultural activities (IFAS, FDOACS, FDEP, WMD, NRCS, the FWC, USFWS) to obtain more funding for this purpose in Florida. Develop partnerships among the appropriate agencies to develop the flexibility to adapt these programs with the goal of increasing attractiveness to private landowners.	VH	L	M
L	Encourage and develop incentives for the revegetation of improved pasture with native plant species. Encourage the development of cost-effective native plant species seed sources.	M	L	VH

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage and educate county property appraisers to consider natural forest management as eligible for agricultural exemption under clear standards for this type of exemption. (Potential partner of this work IFAS)	H	M	M
L	Provide education and incentives for low-impact sod practices which require reduced amounts of pesticides, nutrients, irrigation and mowing.	H	L	L
L	Reduce the demand for sod through education of consumers and incentives to use xeriscaping and other landscape options.	M	L	M

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Identify important natural habitats that are to be converted to agricultural uses and work with landowners on a voluntary basis to conserve the habitat via acquisition or easement agreements.	H	VH	VH
M	Establish and fund a sustained program for establishing agricultural reserves (e.g., publicly owned or with conservation easements, TDRs, zoning, etc.), particularly in the Everglades Agricultural Area. Encourage conversion to more water friendly crops in these reserves through the easement process.	H	M	VH
L	Develop strategies for promoting equestrian and agricultural buffer zones adjacent to natural areas.	M	L	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Enable funding for experts to coordinate restoration of private or public lands and fund the implementation of appropriate restoration methods once lands are in public ownership.	H	M	H
L	Develop improved restoration techniques for converting agricultural areas back to natural habitats and for providing native alternatives for the developed landscape (e.g., mixed native sod).	M	L	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Allow present use valuation for natural lands managed for conservation for a designated time period, and explore the development of a tax exemption schedule for natural habitats that would be equivalent to the agricultural tax exemption.	L	VH	H

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Fund research to examine whether county bond initiatives provide a feasible approach for protecting agricultural land uses (potential partner for this work: American Farmland Trust).	H	M	L
M	Fund research that identifies any incompatible agricultural activities on public lands and the appropriate management programs for those activities.	VH	L	M
L	Fund research on the types of habitat being converted and rate of conversion to dairy and other confined animal-feeding operations (CAFO).	H	L	L
L	Fund research on perennial lawn grasses that can be propagated by seed.	H	L	M

Conversion to Housing and Urban Development

Urbanization is the process by which wildlife habitat is transformed to better meet the needs of humans. When an area is developed for human use, much of the native vegetation is removed and its habitat potential is significantly altered. The variety of native animals that live within a particular area decreases when an area becomes urbanized. The terms "urban" and "wildlife" seem almost contradictory. The terms are often used in reference to exotic species such as English sparrows, European starlings, feral pigeons (rock doves), or nuisance animals like opossums and raccoons. Some native animals adapt very well to the urban environment, and those values should be recognized and encouraged; however, the majority of native wildlife species decrease in number and variety.

Florida's population growth and urban expansion will undoubtedly result in the continued conversion of natural, agricultural, and rural lands into other more intense land uses. Conversion of rural lands to higher density and more intense uses is having a profound effect on Florida's ability to maintain a balance between population growth and the natural resources necessary to support that growth. The development of isolated, rural landscapes is fragmenting and degrading the quality and character of Florida's natural and agricultural lands. Not only does the prevailing development pattern threaten the state's ability to meet the needs of its citizens through adequate delivery of services and the maintenance of an agricultural economy, it also interrupts the natural hydrological and biological functions that support both agriculture and healthy ecosystems. The fragmentation of plant and animal habitat occurring through rural land conversion poses a material threat to the survival of a number of species important to Florida's natural environment and the propagation of agricultural products.

Conservation Threats

Conversion to housing and urban development, including conversion to commercial development, is perhaps the most pervasive threat to Florida's native wildlife and habitats addressed by this Strategy. Urbanization's effects cut across terrestrial, freshwater, and marine realms statewide. This source of stress is strictly defined as outright conversion of wildlife habitat to residential and other forms of urban or suburban development, but in some cases also includes conversion of adjacent habitat where such conversion results in substantial loss of function of adjoining natural habitat. Conversion to housing and urban development is implicated as the source of many ecological stresses, including natural habitat destruction, habitat fragmentation, altered hydrologic regime, altered fire regime, altered habitat mosaic, and others. Related sources of stress include incompatible residential activities, roads and utilities, nutrient loads–urban, surface water diversion, and withdrawal, conversion to recreation areas, and conversion to commercial and industrial development.

This source of stress was identified as a threat to the following freshwater and terrestrial habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Bay Swamp
- Calcareous Stream
- Coastal Strand
- Coastal Tidal River or Stream
- Cypress Swamp
- Dry Prairie

- Freshwater Marsh and Wet Prairie
- Grassland/Improved Pasture
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Industrial/Commercial Pineland
- Natural Lake
- Natural Pineland
- Pine Rockland
- Sandhill
- Scrub
- Seepage/Steephead Stream
- Softwater Stream
- Tropical Hardwood Hammock

Conservation Actions

Conservation actions to abate conversion to housing and urban development were based on actions identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions identified emphasize strengthening the linkage between natural resource management and land-use decision-making and protecting Florida's best quality natural lands, including intact habitat, wildlife corridors and connectors, critical habitat for wildlife and low-intensity agricultural lands through acquisition, easements, partnerships and incentives tools, local land-use planning, and wildlife-friendly development.

Actions for conversion to commercial and industrial development are combined here with conversion to housing and urban development due to the similarity of these kinds of activities and of the conservation actions needed for abating these threats.

Highest ranked actions identified for abating this source of stress focus on:

- Collaboration among agencies, non-governmental organizations, and the public to collectively create, identify, and adopt a statewide "Cooperative Conservation Blueprint" (see Chapter Florida's Strategic Vision) to help guide state and local land-use decisions and land-protection priorities
- Continuing and expanding funding for the state's land-acquisition program, Florida Forever, identified in the "Cooperative Conservation Blueprint" process
- Establishing a high level of coordination between agencies, non-governmental entities, and the public to recommend methods and funding sources for more ecologically friendly development within the "Cooperative Conservation Blueprint" process and to acquire and manage natural areas within the areas identified
- Establishing a statewide upland protection program and developing the tools to mitigate for the loss of upland habitat within the "Cooperative Conservation Blueprint"

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Create public/private collaboration to create a "Cooperative Conservation Blueprint" process.	VH	M	L
M	Explore the establishment of a biologist/ecologist staff position within each local government whose job duties include reviewing land conversion applications and making recommendations for minimizing effects to wildlife habitat.	M	M	H

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Support the Rural and Family Lands Protection Act (http://www.fl-dof.com/forest_management/fm_pdfs/RandF_landprotection_act.pdf.) .	M	M	VH
L	Create incentives and recognition for ecologically-friendly developments through agency and non-governmental organizations. Establish criteria and develop an associated media campaign (e.g., templates could be created cooperatively with developers that guide development design to maximize native wildlife and habitat protection, as well as a set of well-publicized awards for ecologically-friendly developments.)	H	L	H
L	Increase funding of and awareness about existing incentive programs for protection and management of private property, such as the Landowner Incentive Program, Farm Bill programs that benefit wildlife and habitat (EQIP, WHIP, WRP, FRPP), Partners for Fish and Wildlife Programs, etc.	M	L	H

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Develop an education program for county staff on the utility and application of the Habitat Conservation Plan process for reducing conflicts between development and conservation of wildlife and habitat (e.g., use Sonoran Desert Conservation Plan as a model: http://www.co.pima.az.us/cmo/sdcp/).	H	L	L
L	Develop a curriculum for those designing developments that provides design features that maximize natural habitat values. Incorporate this curriculum into relevant continuing education programs.	H	L	M
L	Incorporate into or expand upon existing public conservation education for adults. Enhance and emphasize the information about the benefits of natural habitats to wildlife and property values, and the potential negative effects of increased development.	H	L	M
L	Convene a series of workshops to develop strategies for shaping the ecological character of the built/developed environment such that wildlife compatible development is encouraged.	M	L	L

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Promote, encourage, and advocate ways to extend the state's land acquisition program, Florida Forever, for an additional 10 years at $400 million/year with corresponding increases in land management funding. (Note: This action is clearly regulatory in nature because it advocates a change in statute. Even though this action is regulatory in nature, it promotes extension of an existing regulatory program that is absolutely critical to achievement of the Strategy.)	H	VH	VH
M	Develop incentives programs (for example tax incentives, transfer of development right programs, conservation easements, and land acquisition) to minimize development within lands identified for conservation or agriculture.	M	M	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Develop voluntary incentives to include those lands most important for the maintenance in agriculture as buffers to conservation areas when developing the "Cooperative Conservation Blueprint."	VH	M	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Explore ways to protect natural lands and commercial forests from conversion that are outside an Urban Service Boundary. Develop incentives to take into consideration wildlife, habitat, and available water resources.	L	VH	M
H	Convene a coalition of appropriate stakeholders (for example, conservationists, state natural resource agencies, agricultural interests, and major development and economic interests in Florida) to develop voluntary and incentive-based opportunities and methods for more ecologically friendly development and to develop additional resources to protect, acquire, and manage natural lands identified in the "Cooperative Conservation Blueprint" process.	M	H	M
M	Support retention of the designations of Areas of Critical State Concern (http://ccgov.carr.org/plan-d/manchester/chapter8.pdf) for the City of Apalachicola, City of Key West, Green Swamp, Florida Keys (Monroe County), Big Cypress Swamp (Miami-Dade, Monroe, and Collier counties).	H	M	L
M	Encourage public/private partnerships to cooperatively help guide development design and implementation with the goal of maximizing protection and proper management of natural habitat identified in the "Cooperative Conservation Blueprint."	M	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Develop incentives programs to preserve natural upland and wetland habitats.	L	VH	VH
H	Develop incentives for counties and municipalities to protect habitat within the boundary of the "Cooperative Conservation Blueprint." (See Chapter IV. Florida's Strategic Vision).	M	H	M
M	Develop incentives or other mechanisms that establish permanent smoke sheds or smoke dispersion corridors. Coordinate with farmland preservation organizations and other efforts.	M	M	L
L	Establish incentives for natural habitat preservation areas and management associated with any development. Provide incentives for developers to work with local agencies to set aside quality native habitat for wildlife use.	M	L	H

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Identify model initiatives developed elsewhere for maintaining land in agriculture, livestock and forestry enterprises (e.g., Blackfoot Initiative in Montana, see http://www.blackfootchallenge.org/am/publish/article_200.php, Sandhill Coalition in Nebraska) and examine their utility in Florida. In Florida, a model program is the Quail Initiative: Restoration of Native Rangelands to Benefit Wildlife and Range Resources www.fl.nrcs.usda.gov/programs/eqip/additionalcostshare.html	H	L	L

Coastal Development

Conservation Threats

Coastal development was identified as a source of stress leading to many ecological stresses to multiple marine and estuarine habitats, with effects including altered water quality, fragmentation of habitats, habitat disturbance, and altered species composition. Continued expansion of coastal development will increase the total acreage of impacted area as well as the overall impact to coastal habitats. Many sources of stress are related to this source including conversion to housing and urban development, inadequate stormwater management, nutrient loads (from urban sources), dams and incompatible releases of water, beach nourishment, impoundments, roads/bridges/causeways, utility corridors, incompatible recreational activities, and docks.

This source of stress was identified as a threat to the following marine/estuarine habitats. Additional, habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coral Reef
- Inlet
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Conservation actions to abate coastal development were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize abating loss of additional marine and estuarine habitat, protecting and restoring marine/estuarine habitats impacted by coastal development, minimizing harm caused by new and existing coastal development, discouraging growth in high-hazard coastal areas, and effectively managing existing coastal resources to minimize harm to wildlife (e.g., shorebirds nesting on beaches accessible to people).

Highest ranked actions identified for abating this source of stress focus on:

- Establishing a comprehensive mitigation/restoration incentive-based program to achieve a no-net-loss of coastal habitat
- Acquiring coastal properties and buffer properties in fee title and through conservation easements
- Developing incentives to create buffers around coastal areas
- Promoting conservation easements in buffer areas

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Create state and federal collaborative incentive-based programs to more effectively protect coastal resources across individual state or federal jurisdictions.	VH	H	L

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Develop incentives for maintaining buffer areas around riparian or coastal areas.	VH	H	H

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Promote conservation easements in buffer areas.	VH	VH	L
H	Develop hands-on field training programs within educational institutions throughout the state for implementing successful restoration projects. Develop cooperative education programs using university and coastal land management practitioner knowledge. Develop survey to determine desired course content. Offer training to regulatory and land management staff.	VH	M	M
H	Expand public outreach for management plan updating process.	VH	M	L
H	Assist in the development of educational tools to promote the values and importance of coastal resources.	VH	M	H
M	Create public education campaign in counties, akin to that in St. Lucie County that emphasizes the theme of "What do we want our county to look like?" Apply this especially in coastal communities.	VH	L	L

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Accelerate acquisition of coastal lands and buffers to critical coastal habitats through development of public/private partnerships and incentive programs.	VH	VH	VH
VH	Identify and acquire or otherwise conserve buffer areas to important coastal habitats through continued or expanded funding of Florida Forever or other programs.	VH	VH	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Encourage multi-agency mitigation program review that includes long-term monitoring of coastal habitats.	M	VH	VH
H	Identify priority sovereign submerged lands that maximize benefits to wildlife and habitat protection.	VH	M	M
H	Develop organized and cooperative program to utilize funds for restoration projects. Increase Florida's competitiveness to attract federal dollars for restoration. Form a "Florida Restoration Office" (formerly in the Florida Department of Environmental Protection). Identify restoration needs and create criteria to select priority projects. Establish monitoring program to determine effects of restoration projects.	VH	M	L
H	Explore methods for funding coastal restoration.	L	VH	VH
L	Support state and county programs that use long-term monitoring of marine and estuarine systems.	M	L	H

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Seek public support during up-dating process of management plans for aquatic preserve, marine national parks and sanctuaries, and refuges.	VH	H	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Provide fish and wildlife technical expertise in the development of coastal growth management plans.	L	H	L
M	Support the modification and implementation of the Total Maximum Daily Load (TMDL) program in marine and estuarine waters.	M	M	VH

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Conduct and fund research (environmental or economic impact studies) to determine true value of natural coastal resources to economy and state, and assess cost of cumulative impacts. Include findings in outreach message for public and community leaders.	M	H	H

Conversion to Recreation Areas

Florida's natural areas provide a multitude of quality recreational activities. Florida's recreational areas contribute to the economy by attracting tourists and contribute to the overall quality of life of Floridians. Florida's state park system is one of the largest in the country with 158 parks covering more than 700,000 acres. Florida's 158 state parks attracted more than 18.2 million visitors last year and contributed more than $500 million to local economies (FDEP 2004). Despite the benefits that recreational areas provide, the conversion of lands to recreational areas can conflict with management needs of some wildlife species. When an area is developed for recreational use, much of the native vegetation is removed, fire management becomes more problematic, and habitat potential is significantly altered. As a result, the variety of native animals that live within a particular area often decreases.

Conservation Threats

Conversion to recreation areas (e.g., the replacement of natural lands purchased for conservation with parking lots, cabins and associated support structures, on-site housing, etc., like other forms of habitat conversion) was identified as an important threat to natural habitats statewide. Areas may be converted to either active (facilities based, high ecological impact) recreation areas or more passive (lower impact) recreation areas. The emphasis here is on those conversions which result in significant direct and indirect impacts to the surrounding natural habitats. Impacts of conversion to recreational areas may be lessened if the sensitivity of the habitat to be converted and the relative recreational impacts to the habitat are considered in the recreational use planning.

This source of stress was identified as a threat to the following habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Coastal Strand
- Hardwood Hammock Forest
- Grassland/Improved Pasture
- Natural Pineland
- Sandhill
- Scrub
- Spring and Spring Run

Conservation Actions

Conservation actions to abate conversion to recreation areas were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize preventing the conversion of natural lands to incompatible recreational uses, especially those within existing or new public conservation areas, increasing the compatibility of golf courses with wildlife habitat conservation and ensuring that new recreational development occurs on already impacted lands rather than functional wildlife habitat.

None of the actions identified for abating this source of stress ranked "High" or "Very High." However, the highest ranked actions focused on:

- Providing incentives, guidelines and criteria for siting high impact recreational areas, such as golf courses, and for developing ecologically friendly recreational facilities which include preservation, restoration, and management of natural wildlife habitat
- Developing guidelines for the kinds of recreational uses that are compatible with conservation of the habitats identified by the development of a "Cooperative Conservation Blueprint" (see Chapter Florida's Strategic Vision)

The following actions, organized by action type, were identified to abate this threat:

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Develop and provide incentives within county development codes (such as density bonuses) for golf course community proposals that incorporate green space alternatives focused on maintaining and/or restoring natural habitat for wildlife.	M	M	VH

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Provide funding and enable the purchase of adjacent, already-disturbed lands for locating new public land facilities and infrastructure when they cannot be sited on the existing property in a manner compatible with wildlife conservation.	H	L	H

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Research and potentially enhance voluntary options to improve golf course construction and maintenance to improve habitat quality.	M	L	L
L	Research and potentially enhance habitat-specific standards for golf course construction and maintenance. As appropriate, review and revise the Department of Environmental Protection's standards relevant to golf courses.	M	L	M

Dam Operations

Conservation Threats

Dam operations were treated as a statewide source of stress in the marine workshops and a habitat-specific source of stress in the terrestrial/freshwater workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). Accordingly, the actions presented in this section are associated with marine systems statewide. Many additional actions addressing dam operations and their effects on terrestrial and freshwater habitats are incorporated in the habitat-specific chapters Coastal Tidal River and Stream, Hardwood Swamp/Mixed Wetland Forest, Large Alluvial Stream, Natural Lake and Softwater Stream (see Chapter Habitats). Dam operations focused upon the incompatible releases of water as a source of altered water quality, altered hydrologic regime, habitat disturbance, and habitat destruction. Dams, by themselves, may have a localized impact on freshwater, marine, and estuarine systems, or may have extensive regional impacts. The incompatible release of water can entirely change natural marine and estuarine communities by altering salinity characteristics and is a potential source of wildlife mortality and habitat degradation.

Dam operations were identified as a threat to the following marine and freshwater habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Hardwood Swamp/Mixed Wetland Forest
- Inlet
- Large Alluvial Stream
- Mangrove Swamp
- Natural Lake
- Salt Marsh
- Softwater Stream
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Conservation actions to abate the threat posed by dam operations and the incompatible releases of water into freshwater, marine, and estuarine systems were based on minimizing ecological effects of dam operations to the greatest extent possible, striking a balance between human needs and ecological needs, and maintaining sufficient water within natural systems to ensure their health over the long term.

Highest ranked actions identified for abating this source of stress focus on:

- Supporting large-scale ongoing efforts to improve water management operations that embrace ecological restoration and long-term ecosystem health maintenance, including some components of the Comprehensive Everglades Restoration Project (http://everglades.fiu.edu/taskforce/comprehensive.html)

- Encouraging water conservation through the expansion of water conservation outreach programs
- Restore the natural ecological functions of wetlands on public lands.

The following actions, organized by action type, were identified to abate this threat:

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Encourage water conservation (including water reclamation and personal cistern use). Expand water conservation outreach programs.	VH	M	M
L	Increase natural water retention within the system as a means of increasing wetland protection and restoration without the need for additional acquisition. Develop incentives for private landowners.	L	L	H
L	Provide incentives for existing homeowners and businesses to install cisterns. Also provide incentives to provide cisterns for new housing. (Appropriate leads may be local governments and IFAS). Explore providing incentives for cisterns as with water heater replacement program.	L	L	VH

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Acquire lands to increase water retention within the system.	VH	L	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Encourage and support improved water level management protocols of Lake Okeechobee that will conserve and enhance fish and wildlife resources in the lake and in downstream environments.	VH	M	M
M	Restore ecological functioning of wetlands on public lands (e.g., exotic removal, fire management, soil removal, toxics clean up, etc.)	VH	L	H
M	Encourage and support improved management of water control structures that will protect and enhance nearby fish and wildlife resources and downstream environments.	M	M	M
M	Improve and maintain appropriate salinity regimes in estuarine waters.	M	M	VH
L	Consider the replacement of water control structures with weirs (passive water management control).	H	L	H
L	Build more reservoirs and stormwater treatment areas.	H	L	VH
L	Continue retrofitting water control structures, wherever possible, to prevent injury and entrapment of manatees.	M	L	H
L	Deploy more remote equipment that collects continuous data (salinity, temperature, dissolved oxygen, nutrients, turbidity and chlorophyll.), especially nearshore, downstream from dam, and water control structures (also important for addressing stormwater water quality concerns).	M	L	H
L	Encourage implementing the forward pump strategy to provide greater flexibility for Lake Okeechobee level management.	M	L	VH
L	Enhance opportunities for fish migration across dam boundaries.	L	L	VH

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Further develop species models to better understand ecological processes. Understand the primary variables that may affect a species as a means of forecasting effects of proposed operations and changing ecological conditions. (the FWC may be the most appropriate lead)	VH	L	VH
L	Investigate the feasibility of aquifer storage and recovery (ASR) as a means of retaining water in the system. Consider cost and environmental health as part of an evaluation.	H	L	M
L	Review the extent of the fish and wildlife passage problems and all available potential solutions. Analyze solutions on a species-specific and water-control-structure basis.	H	L	M
L	Provide technical expertise on the fish and wildlife resources that may be impacted by improving the management of operations of water control structures.	M	L	H
L	Investigate the correlation of freshwater releases and the occurrence of harmful algal blooms.	M	L	H

Disruption of Longshore Transport of Sediments

Conservation Threats

Disruption of longshore transport of sediments is one of a complicated set of threats to our coastal habitats which stem from the placement of permanent structures in an otherwise dynamic natural system. Florida's coast, made up in many places of barrier islands, experiences a continuous transfer of sediments that historically would cause many coastal features to erode, and shift position, depending on the mass transfer of sediments. The introduction of permanent man-made features along our coast has disrupted the natural flow of sediments, causing severe impacts to coastal habitats due to sediment starvation or lack of adequate sediment supply in some locations, and unnatural accretion of sediments in others.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Coral Reef
- Hard Bottom
- Inlet
- Salt Marsh
- Submerged Aquatic Vegetation
- Tidal Flat

Conservation Actions

Conservation actions to abate the threats caused by disruption of longshore transport of sediments were based primarily on restoring more natural sediment transport processes to coastal systems, and ensuring that the needs of coastal habitats are considered as part of beach nourishment projects.

Highest ranked actions identified for abating this source of stress focus on:

- Achieving a better understanding of the costs and benefits associated with maintaining permanent, man-made structures on the coastline
- Assist in the development of fish and wildlife resource criteria for recommendations on coastal development
- Restoring natural sediment transport

The following actions, organized by action type, were identified to abate this threat:

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Provide technical expertise on fish and wildlife resources on barrier islands and how changes in sediment dynamics may affect those resources.	M	L	L

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage restoration of natural sediment transport processes where possible.	L	H	M
L	Provide technical expertise on fish and wildlife resources on the potential effects of dredging of natural inlets and passes.	L	M	M
L	Improve implementation of sediment management practices.	L	M	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Assist in the revision of national flood insurance programs and provide technical expertise on fish and wildlife resources for areas of high sediment transport and unstable shorelines.	M	M	L
L	Provide fish and wildlife resource technical expertise in the development of coastal management development plans, particularly for natural inlets.	L	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Conduct an economic analysis of maintaining structures such as inlets and hardened shorelines that includes benefits and costs to fish and wildlife resources.	M	H	M
M	Conduct assessment of anthropogenic features in the coastal zone and their effect on natural sediment transport and natural communities. Determine which structures are disrupting natural sediment transport.	M	M	H
M	Evaluate changes in sediment delivery due to water management projects. Evaluate relative contribution from watersheds to sediment budgets.	M	M	M
M	Conduct regional studies on sediment transport budget and natural sediment processes (not site by site). Collect and map historic information on barrier islands and estuarine sand bars.	M	M	M

Fishing Gear Impacts

The recreational fishing industry is an important natural resource-based industry in Florida. The tradition of recreational fishing is linked to Florida's culture and identity. The number of saltwater anglers in Florida exceeds that of any other state in the nation (National Marine Fisheries Service 2000). Fishing is also important to the state's economy, with over four billion dollars spent each year on fishing expenditures (U. S. Fish and Wildlife Service and U.S. Census Bureau 2002). To ensure that fishing opportunities continue to play an important role to Florida's people and economy, efforts should to be made to promote ecologically suitable fishing practices.

Conservation Threats

Various types of fishing gear and fishing activities were identified as having the potential to cause physical damage or disturbance to marine and estuarine habitats (i.e., monofilament line, stainless steel hooks, derelict gear, lead weights and lures). These impacts occur from both the normal use of fishing gear and discarded or lost fishing gear that continues to pose a threat to marine and estuarine habitats and the species that use them. This threat does not include threats to entire populations; for example, over-fishing is addressed in the Incompatible Fishing Pressure threat section later in this chapter.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Inlet
- Mangrove Swamp
- Pelagic
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Conservation actions to abate threats from fishing gear emphasized understanding the effects fishing gear can have to marine and estuarine communities, and reduction of those effects through incentives and gear clean-up efforts.

Highest ranked actions identified for abating this source of stress focus on:

- Educating the public on the proper use of fishing gear
- Supporting the development of non-destructive, ecologically benign fishing gear and fishing practices
- Support for efforts to clean-up lost or abandoned fishing gear

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Capacity Building	*Feasibility*	*Benefits*	Cost
M	Coordinate statewide, fund, and expand Broward County's Monofilament Recovery and Recycling Program (http://www.brevardcounty.us/mrrp/index.cfm).	VH	L	L

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create incentives to promote the use of ecologically friendly fishing gear (e.g., dissolving lures, non-stainless hooks, and barbless hooks).	M	M	M
L	Create incentive programs for retailers (such as a trade-in of lead for ecologically sensitive, non-toxic sinkers) to have non-toxic sinkers readily available in areas where required for use. (Fish America Foundation is one potential partner)	H	L	M
L	Create a program to encourage fishing guides to use ecologically friendly techniques and gear (Florida Foundation for Responsible Angling is a potential partner).	H	L	L

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Produce and make available outreach materials to educate boaters and fishers about releasing entangled wildlife.	VH	L	L
M	Use fishing tournaments in which participants use ecologically friendly fishing techniques and gear to disseminate information.	VH	L	L

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Continue, support, and expand coastal clean-up into underwater habitats statewide (include the collection of lead sinkers and monofilament line).	VH	L	M
M	Provide technical expertise on the evaluation and prevention of fishing gear effects in critical habitats.	H	M	H
M	Provide educational material on fishing regulations and potential fishing effects on ecologically sensitive habitats.	M	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Provide incentives to use sinkers on lobster and stone crab ropes.	VH	L	L
L	Support the statewide expansion of derelict crab trap removal programs.	H	L	M
L	Provide incentives to use non-toxic sinkers.	H	L	L

Research:

Overall Rank	Research	*Feasibility*	*Benefits*	Cost
M	Fund synthesis of existing information and identify research on fishing gear effects (fishing line entanglement on marine animals, lobster traps, long lining, crab traps, derelict gear/entanglement, lead sinkers, etc.).	H	M	L
M	Fund development of alternative fishing gear with minimal wildlife and habitat effects. (e.g., dissolving lures)	M	M	H
L	Investigate effects of wildlife feeding on sea- and shore-bird populations that lead to entanglement issues and, where warranted, take action to minimize adverse effects of commercial feeding operations on sea- and shore-birds in or over water.	M	L	M

Groundwater Withdrawal

Conservation Threats

Excessive groundwater withdrawal was identified as one of several major sources of hydrologic alteration to wetland and aquatic habitats in Florida. It includes withdrawal of water from aquifers by agricultural, municipal, or industrial uses in excess of levels or amounts needed to sustain the hydrologic regime of habitats embedded in or connected to the groundwater aquifer. Excessive groundwater withdrawal is a highly ranked source of stress in all regions of the state, but with the most severe and widespread impacts occurring in south and central Florida. In north Florida, effects from this source are presently more localized in nature, but experts expressed concern over potential effects that may occur as development pressure increases in this region over the next five to ten years.

This source of stress was identified as a threat to the following terrestrial habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Bay Swamp
- Coastal Tidal River or Stream
- Cypress Swamp
- Freshwater Marsh and Wet Prairie
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Large Alluvial Stream
- Mangrove Swamp
- Natural Pineland
- Natural Lake
- Softwater Stream
- Spring and Spring Run
- Submerged Aquatic Vegetation
- Tidal Flat
- Tropical Hardwood Hammock

Conservation Actions

Conservation actions to abate excessive groundwater withdrawal were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions for groundwater withdrawal emphasize preventing harm from occurring to natural habitats through limits on water allocation and withdrawal, maintaining or restoring natural hydrologic processes (e.g., recharge, groundwater flow, etc.), and decreasing the total amount of water consumed, especially for municipal purposes, the fastest growing segment of water use in Florida.

Highest ranked actions identified for abating this source of stress focus on:

- Support for and expansion of existing tools and programs aimed at preventing negative effects to natural habitats
- Funding actions to protect springs and other groundwater-influenced habitats recommended by the Department of Environmental Protection's Florida Springs Task Force in its report *Florida's Springs: Strategies for Protection and Restoration,* November 2000 (http://www.floridasprings.org/protection/taskforce/).

- Acquisition of lands needed to maintain the hydrologic functioning of ecosystems (e.g., critical recharge areas) through the states' land acquisition program, Florida Forever, Save Our Rivers program

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Fund partnerships between research institutions, water management districts, and other agencies to establish and quantify water reservations needed to maintain the ecological health or natural flow regime of springs, spring runs, wetlands, aquifers, and lakes presently unaffected, but potentially affected, by future groundwater withdrawals.	M	M	H
L	Facilitate Alabama/Florida and Georgia/Florida Comprehensive Wildlife Conservation Strategy (Strategy) meetings to identify joint actions and priorities with respect to groundwater withdrawals in one state affecting habitats and species in another, and needed actions for future updates of each state's respective Strategy. (USFWS lead)	H	L	L
L	Fund partnerships between research institutions and water management districts to develop Minimum Flow and Level criteria for priority water bodies, especially springs, lakes, aquifers, and wetlands affected by groundwater withdrawal.	H	L	H
L	Convene annual workshops in each water management district among local governments and resource management agencies that facilitate the exchange of information on groundwater and dependent fish and wildlife species (locations, needs for natural hydrologic regime, effects of groundwater withdrawals).	H	L	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Develop ecologically friendly standards with respect to water use and provide creative incentives to private developments which comply with or exceed such standards (e.g., for publicly-funded facilities).	M	M	H
L	Explore incentives, such as establishing public competitions between communities or counties for achieving the most savings from water-conservation activities.	M	L	M
L	Create and process economic incentives at the state and local government level to promote developers implementing on-site programs to educate homeowners about amounts and effects of groundwater use and ways to reduce household and landscape water use.	M	L	H

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Fund existing education programs in Florida schools, including FWC Project Wild and Project Wet (http://www.dep.state.fl.us/secretary/ed/wet.htm) and curriculum development and instructor training to increase students' knowledge of freshwater and wetland ecology and the ecological effects of excessive groundwater withdrawals.	VH	L	M
L	Fund Soil and Water Conservation Districts to develop and implement education programs for residents on the effects of groundwater use within their counties.	H	L	M
L	Fund the development and dissemination of simple outreach information in different formats (e.g., brochures, handouts, Public Service Announcements, school curricula, etc.) to educate the public about the ecological values and costs of water.	M	L	M
L	Develop curriculum for grade schools on finite water supplies in Florida, the water budget, effects wildlife from excessive groundwater use and ways to reduce water use.	M	L	M

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Fund, through the Save Our Rivers program, fee simple or less than fee acquisition of xeric uplands and other natural groundwater recharge areas. (Water management districts potential lead)	VH	M	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Support recommendations of the Florida Department of Environmental Protection's Florida Springs Task Force in its report *Florida's Springs: Strategies for Protection and Restoration,* November 2000. Assess the revised report once completed.	H	H	H
L	Fund demonstration projects aimed at restoring the natural hydrologic regime of aquatic systems damaged by excessive groundwater withdrawal.	H	L	H
L	Encourage landowners to meter all groundwater wells. Develop incentives to landowners, particularly agricultural interests, to do so.	H	L	H

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create a priority list to establish reservations of water for water bodies in or adjacent to state parks, preserves, wildlife management areas, state forests, and other conservation lands that would maintain or restore the natural hydrologic regime, especially in systems negatively affected by excessive groundwater withdrawals.	M	M	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Consider availability of water when planning growth.	M	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Fund research at the groundwater basin scale to determine "safe yield" of water supply aquifers necessary to maintain ecological health of freshwater habitats and wildlife.	H	L	M
L	Fund research to identify species that are being negatively affected by excessive groundwater withdrawal.	H	L	M
L	Fund research and development of "marketing" strategies to raise public awareness about finite freshwater supplies in Florida, the potential and existing negative effects to wildlife by excessive groundwater withdrawal and ways to reduce groundwater usage.	H	L	M

Harmful Algal Blooms

Conservation Threats

Harmful algal blooms were identified as a potential source of altered water quality, altered species composition, and habitat disturbance in marine systems. Although harmful algal blooms have most commonly occurred in the Gulf of Mexico, they have also occurred in other marine, estuarine, and freshwater environments of the state. The harmful algal bloom that is commonly known as red tide occurs almost every year in late summer/early fall off Florida's west coast and may affect hundreds of square miles. Harmful algal blooms are a potential source of mortality for many marine species including fish, birds, and mammals. What triggers these events is incompletely understood, including the extent to which anthropogenic factors such as nutrients and other pollutants may be involved.

This source of stress was identified as a threat to the following marine/estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Bivalve Reef
- Coral Reef
- Hard Bottom
- Inlet
- Mangrove Swamp
- Pelagic
- Submerged Aquatic Vegetation
- Tidal Flat

Conservation Actions

Conservation actions to abate the threat of harmful algal blooms were based on outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize better understanding the processes and triggers that cause harmful algal blooms; the extent to which their frequency, size and duration is natural versus exacerbated by anthropogenic activities; the extent to which harmful algal blooms are affecting Florida's marine species and people; reducing anthropogenic factors that may trigger harmful algal blooms; and increasing the capability to rapidly respond in an effective manner to harmful algal blooms causing unacceptable levels of mortality in selected species.

The highest ranked actions identified for abating this source of stress focus on:

- Integrating harmful algal bloom monitoring efforts with remote integrated ocean observing systems
- Reactivating a harmful algal bloom task force to coordinate all ongoing efforts at the state, federal, and regional levels
- Developing local harmful algal bloom working groups to coordinate and conduct research on harmful algal bloom effects on the natural environment and people
- Supporting and enhancing the rapid assessment system currently in place
- Keeping the public and elected officials informed about the ongoing harmful algal bloom research and results
- Conducting research to better understand the harmful algal bloom phenomena

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Integrate harmful algal bloom (HAB) monitoring efforts with remote integrated ocean observing system.	VH	M	H
M	Reactivate the Florida Harmful Algal Bloom Task Force and support its efforts in coordinating HAB research at the state, federal, regional, and local levels.	H	M	L
M	Encourage and support local working groups who conduct and support HAB research.	M	M	H
L	Foster private organizations such as S.T.A.R.T. to raise funds for HAB research.	H	L	L
L	Ensure other actions related to marine resource management have feedback with HAB control efforts. Ensure efforts to eliminate HABs take into account importance to other marine resources.	M	L	M

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Engage local media to report toxic HABs moving into high public-use areas.	H	L	L

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Support and enhance existing rapid assessment system currently in place.	VH	L	H

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Continue collaborative research on the cause(s) of HABs, the conditions that trigger blooms in freshwater and marine ecosystems, and the effect on fish and wildlife resources.	H	M	H
M	Conduct research to better understand toxic algal blooms (include research on HABs other than red tide) and their effects on people and the environment. What causes the blooms to become toxic? What are the triggers and the sources of the triggers?	M	M	H
M	Track the results of ongoing research on HABs, and report to the public.	H	M	L
L	Evaluate the effects of blackwater events (off Florida's west coast). Track movements, etc.	H	L	H
L	Reactivate the Florida Harmful Algal Bloom Task Force to coordinated research and management efforts in Florida.	H	L	H

Inadequate Stormwater Management

The 1972 Clean Water Act and 1987 Water Quality Act established new standards and schedules under which industrial and municipal stormwater would be regulated by the National Pollutant Discharge Elimination System (NPDES), a national permitting program that was designed to control the pollutants discharged into surface water such as lakes, ponds, streams, and even the ocean. Beginning in the early 1990s, Phase I of NPDES required that cities with populations of more than 100,000, as well as large industrial and construction sites, begin permitting stormwater runoff and treating the runoff to reduce pollutants prior to allowing the runoff to flow into surface waters. In December 1999, Phase II of NPDES was announced and required more than 5,000 municipalities and all new developments one acre or larger to implement stormwater treatment Best Management Practices (BMPs) to the "maximum extent practicable."

Beyond the national regulations, state, county and municipal regulations are changing and advancing constantly. Some states require businesses and developers to treat stormwater only to that "maximum extent practicable" standard set forth by the Environmental Protection Agency (USEPA) Phase II regulations. Other states and even municipalities have taken stormwater treatment even further and have specific requirements, such as 80 percent removal of total suspended solids on a net annual basis–in other words contaminated sediments–or even the removal of dissolved pollutants like heavy metals and limiting nutrients. Also, proof of performance for stormwater treatment systems varies widely across the U.S. Some states require third party testing to approve a manufactured BMP and others require only laboratory testing from the manufacturer.

Conservation Threats

Inadequate stormwater management is a significant threat to many marine and estuarine systems. Stormwater carries with it nutrients and harmful chemicals such as pesticides, herbicides, and petroleum hydrocarbons. It is a widespread problem that occurs almost anywhere there is any type of development. Left inadequately addressed, this threat will continue to degrade marine and estuarine systems to the point that they will no longer support wildlife. As development continues, this problem will need to be continually addressed. In the terrestrial and freshwater workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements) stormwater management issues were included in the Surface Water Diversion and Withdrawal source of stress (presented later in this Chapter). Additional related actions may be found in the section under that heading.

This source of stress was identified as a threat to the following marine/estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Mangrove Swamp
- Pelagic
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

The actions recommended to further abate the impacts resulting from inadequate stormwater management were broad and included incentives for improved regulatory compliance, infrastructure, education, standards, and prioritizing where initial actions should be focused. While some of the recommendations would require modest investments, those focusing on infrastructure improvements would be costly.

High ranked actions identified for abating this source of stress focus on:

- Acquiring buffer lands and using wetlands for stormwater treatment
- Incentives to promoting compliance with existing stormwater regulations
- Developing a procedure for prioritizing stormwater management actions on the most sensitive lands

The following actions, organized by action type, were identified to abate this threat:

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Increase funding to assist communities where conversion from septic to centralized systems has been recommended.	M	M	H

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Promote the Naturescape Broward program (http://www.broward.org/naturescape/welcome.htm) as a model for controlling stormwater in other counties across the state. (Note: this program has benefits beyond stormwater improvements that include benefits to native wildlife, etc.)	VH	L	M

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Acquire buffer lands and, where appropriate, use upland areas to create stormwater treatment areas.	VH	M	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Consider developing non-regulatory incentives to increase stormwater permit compliance	VH	M	M
M	Support expansion of and accelerate implementation of agricultural standards statewide through incentive-based programs.	M	M	VH
M	Cooperatively evaluate water basin rules. The water management districts may be the appropriate leads.	M	M	H

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Provide technical expertise on fish and wildlife resources in the development of statewide protocols on stormwater management.	VH	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create adequate septic setbacks based on local conditions (geology, elevation, soil type, etc.)	M	M	M
L	Retrofit antiquated stormwater treatment systems not up to current standards.	M	L	VH
L	Maintain and inspect all on-site wastewater treatment systems on an ongoing basis.	M	L	M
L	Use aerobic technologies to improve treatment on all new septic systems.	M	L	H

Incompatible Fire

Conservation Threats

Incompatible fire is defined as fire that does not adhere to the natural regime, dynamics, and features of the habitat, landscape, or ecosystem. This includes incompatible suppression, timing, frequency, intensity, seasonality, pattern, or extent of fire. Incompatible fire was identified as a major source of stress for fire-adapted habitats in Florida and a more minor source for habitats not adapted to fire but sometimes burned. Vegetation structure and composition can shift to the point of habitat cover change to the detriment of habitat diversity and reduced benefits to wildlife. These changes have resulted in loss of habitat value for particular wildlife, even in lands managed for conservation. This source of stress was uniformly identified for habitats across the state.

This source of stress was identified as a threat to the following terrestrial habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Bay Swamp
- Coastal Strand
- Cypress Swamp
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Natural Pineland
- Pine Rockland
- Sandhill
- Scrub
- Seepage/Steephead Stream
- Tropical Hardwood Hammock

Conservation Actions

Conservation actions to abate incompatible fire focused on increasing both institutional support and capacity within agencies and the ability of landowners to burn so that fire management meets habitat needs on both public and private lands. Experts also identified the need for an assessment of fire needs across habitats to facilitate comprehensive planning to increase the extent and frequency of prescribed fire. Substantial private and public cooperation and coordination will be necessary to meet the outcomes for fire implementation and fuel reduction.

Highest ranked actions identified for abating this source of stress focused on:

- Development of a state-sanctioned prescribed fire management plan and an identified funding source for implementing the objectives of the plan
- Increasing capacity and accountability for prescribed fire management within agencies
- Acquisition of lands needed for effective prescribed fire management of public lands

- Removing barriers to fire caused by smoke generation by identification of and planning for “smoke sheds” on a county or regional basis and developing targeted education programs for residents within these smoke sheds

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Establish a Governor's Prescribed Fire Council of experts responsible for developing a statewide fire management plan, budget, sustainable funding mechanism, and producing an annual fire "report card." (Note: Several components of a management plan are further detailed in additional actions below but are included separately so they could be implemented independently of this action.)	M	VH	M
VH	Expand, strengthen, and fund the existing entity within the Florida Division of Forestry (FDOF) responsible for maintaining prescribed fire on the landscape.	M	VH	H
H	Professionalize the prescribed fire implementation and fire management positions within each state agency. Support each agency by designating a statewide Fire Management Officer position with regional/district Fire Management Specialists. The Fire Management Officer could assist with coordination and capacity-building and represent the agency on a statewide interagency prescribed fire working group (see action re: Establishing a statewide interagency Prescribed Fire Working Group). The Specialist should be a certified burner who has experience implementing prescribed fire. These positions would be compensated at appropriate levels for the risk and responsibility required. Agencies would jointly identify an accountability process to ensure performance regarding the implementation of prescribed fire.	M	H	VH
M	Develop a Memorandum of Understanding (MOU) to officially sanction local fire councils comprised of all public land management agencies and to establish funding mechanisms, procedures for public and private cooperative burning, and personnel and equipment sharing (i.e., develop and support interagency "fire strike teams").	H	M	M
M	Determine the best mechanisms for further interagency communication and coordination to ensure traffic safety while removing road-caused constraints to safely applied prescribed fire (e.g., areas adjacent to prescribed fires could be managed similarly to construction zones). (Note: FDOT initiated a standing agreement with the Florida Highway Patrol and Florida Division of Forestry that establishes protocols when smoke is on a highway or when threat of smoke is eminent.) Expand upon this agreement with local law enforcement and other appropriate agencies.	H	M	L
M	Establish a statewide interagency Prescribed Fire Working Group to coordinate functions to facilitate the application of prescribed fire on the ground and the implementation of a statewide fire management plan (see action re: developing MOU/developing/supporting interagency "fire strike teams").	M	M	H
M	Educate and equip private individuals to form fire strike teams to burn cooperatively on private lands.	M	M	H
L	Increase the number of helicopters and trained operators available for aerial fire ignition.	H	L	VH

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Promote recognition of managers for accomplishing prescribed fire goals that meet ecological objectives.	VH	M	L
M	Increase availability of individuals with prescribed fire training to assist private landowners with burning. Increase funding for federal and state cost-share programs that assist private landowners to cover burning costs.	H	M	H

M	Create and subsidize a liability insurance program that would provide prescribed fire liability insurance to private companies and individuals.	M	M	H
M	Provide incentives (e.g., unit density increases, etc.) for developers to implement the actions that recommend ordinances favoring cluster development and prescribed fire, and discouraging smoke-sensitive development.	M	M	H
L	Develop incentives so that private landowners benefiting from public agency assistance for prescribed fire are encouraged to follow all relevant standards.	H	L	L

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Ensure that televised Public Service Announcements on prescribed fire get continuous and statewide coverage as part of concerted public education campaign (e.g., Tall Timbers' PSA is a good example).	VH	M	L
M	Strengthen training for all fire department staff in the wildland/urban interface on managing wildland fires and provide staff with the opportunity to participate in prescribed burns in the interface. This training might be funded through the National Fire Plan with assistance from the Florida Division of Forestry.	H	M	M
M	Fund and organize a sustained professional marketing campaign aimed at increasing and maintaining public awareness of the benefits of prescribed fire.	H	M	M
M	Enhance current prescribed fire training programs to increase emphasis on the benefits of growing-season burns and fire in ecotones and wetlands.	VH	L	L
M	Locate and disseminate to the development community successful models of cluster developments and covenants, codes and restrictions that are compatible with prescribed fire application.	VH	L	L
L	Enhance current training regarding the ecologically harmful effects of fire plows. Develop alternatives and greater sensitivity in fire suppression.	H	L	L
L	Fund and organize local to regional volunteer groups to educate the public about the role of and need for prescribed fire in managed areas for conservation of Florida's wildlife. For example, these volunteers might provide interpretation whenever the public is in the vicinity of a prescribed fire.	H	L	M

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Connect and consolidate current managed areas into more manageable units by acquiring inholdings and additions that are strategic to landscape-scale management for prescribed fire.	M	H	VH

Land/Water/Species Management

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage private landowners adjacent to fire-adapted public lands to implement a specified suite of practices reducing their vulnerability to fire so that prescribed fire application is not precluded over time (note: Effective practices may be learned from those implemented in other states).	M	M	M

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Initiate a process to identify the areas of "smoke sheds" and corridors necessary for continued implementation of prescribed fire on public and private conservation lands. Encourage the incorporation of such areas into regional and county comprehensive plans with the specifics necessary to allow smoke dispersal for conservation lands.	H	H	M
M	Develop a cooperative effort with local governments to coordinate cluster development and encourage appropriate prescribed fire on public and agricultural lands.	M	M	L
M	Evaluate standards for prescribed burn authorizations and apply set standards in authorization decisions across Florida Division of Forestry districts. Develop and apply separate, more flexible standards for awarding burning authorization for applicants with prescribed fire certification, fire experience, and good track records.	VH	L	L
L	Assure that the Efficient Transportation Decision Making (ETDM) system includes fire management in its analysis so that new roads do not prevent proper prescribed fire management. Promote all proposed roads to include smoke management considerations in design and construction planning.	L	M	H
L	Encourage burning through ecotones and wetlands, and discourage mineral-soil firebreaks.	H	L	L
L	Revise public land management plans to ensure that issues of prescribed fire, invasive species, hydrologic regime, etc., are addressed and integrated within those plans.	M	L	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage incorporating consideration of natural land management needs into local ordinances by discouraging smoke-sensitive development within a quarter-mile of public lands.	M	M	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Fund a project to develop a quantitative assessment of the ecological fire needs of habitats statewide, including acreage needed (building on Florida Natural Areas Inventory (FNAI)/FWC current mapping effort to incorporate ecological fire needs and DOF 2005 fuel maps/models and extrapolate to all managed areas). Use the assessment in conjunction with FDOF's 2005 fuel maps/models to prioritize the areas requiring fire each year.	H	M	L
M	Develop a web-based database of public and private land managers into which they report acres and habitats that require fire. Those acreages reported would be eligible for funding assistance.	VH	L	L
L	Fund a study to identify the impediments to burning on private lands and develop mechanisms to overcome these impediments.	H	L	M

Incompatible Fishing Pressure

The oceans have long provided a seemingly inexhaustible stock of food supplies and recreational opportunities. However, as the potential and actual adverse effect of activities becomes apparent, views of marine ecosystems are changing. It is becoming increasingly clear that the ocean's resources are not inexhaustible. And, in addition to direct societal benefits from fishing, ecosystem goods and services have become recognized as valuable and irreplaceable natural resources. These insights have led to concerns regarding sustainability and to an interest in the potential of ecosystem-based approaches to fishery management.

Sustainable use of a resource means that the resource can be used indefinitely. But even a depleted resource can be used indefinitely at an undesirably low level and perhaps with undesirable consequences. Therefore, sustainable fishing means fishing activities that do not cause or lead to undesirable changes in biological and economic productivity, biological diversity, or ecosystem structure, and they function from one human generation to the next. Fishing is sustainable when it can be conducted over the long term at an acceptable level of biological and economic productivity without leading to ecological changes that limit use for future generations.

Conservation Threats

Incompatible fishing pressure was identified as a threat to maintaining the balance and ecological health of Florida’s marine and estuarine systems. While more specific information is necessary, it is known that the demography and species composition of fisheries have been altered, which, in turn, alter the trophic interactions (i.e., food web) and status of many other species. These impacts have also altered habitat quality of estuarine and marine systems.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Inlet
- Mangrove Swamp
- Pelagic
- Submerged Aquatic Vegetation

Conservation Actions

Conservation actions to abate incompatible fishing pressure address the need to improve understanding of and compliance with existing marine fisheries regulations. Other actions identified included better understanding of the effects of incompatible fishing pressure on natural communities and species, better coordination among agencies charged with fisheries management, and restoration of fish stocks to more closely resemble historically healthy populations.

Highest ranked actions identified for abating this source of stress focused on:

- Improve understanding of and compliance with existing fishing regulations
- Using the best available science when siting protected areas
- Improved coordination among state and federal management agencies to incorporate fisheries management with ecosystem management

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Improve understanding of and compliance with marine fish regulations.	VH	H	VH
M	Support an independent peer review of current fishery stock assessments of marine species.	H	M	H
M	Encourage and support better coordination among and between regional and state fisheries management entities.	H	M	M
L	Identify and earmark non-game species funding sources for the FWC that are not tied to licensing.	H	L	L

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Assist in the development of educational materials on fishing regulations.	VH	L	M
M	Encourage fishing license outlets to provide free information on fishing regulations and regional information on fish and wildlife resources.	VH	L	M
L	Provide more funding for education and research on fishing issues.	H	L	H
L	Promote ecosystem-based management in fisheries (e.g., minimize take of juvenile fish in trawl fisheries).	M	L	L

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Review effectiveness of current no-take areas and develop criteria for future potential no-take areas.	L	H	H

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage and support science-based stock assessments of priority species.	H	M	H
M	Encourage consistency with federal regulations for management of species in state waters.	H	M	M
M	Explore multi-use zoning of Florida's marine and estuarine areas while minimizing socio-economic impacts.	M	M	M
L	Better define ecosystem-based management for fisheries in marine and estuarine systems.	L	L	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage science-based approaches to fisheries management planning that include protection of the associated habitats.	M	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage education of boat operators to promote safe boating and natural resource conservation.	VH	L	H
L	Support balanced stakeholder representation on fisheries management councils.	L	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Fund research to find best locations for siting protected areas in terms of conservation and of the reproductive potential of marine fish species.	VH	M	H
M	Develop case studies like Florida Keys National Marine Sanctuary and conduct research to develop a framework to address ecosystem management and how it can be done.	M	M	H
L	Use species models and fisheries independent monitoring (FIM). Fund FIM at a higher level.	H	L	H
L	Synthesize existing information on Florida's fish/fisheries (spatial, quantitative, and qualitative) from a variety of stakeholders.	H	L	M

Incompatible Forestry Practices

It is important to recognize the benefits of forest timber production to Florida's landscape. Some of these benefits include providing water recharge areas, improving air quality, preventing soil erosion, and providing habitat and travel corridors for certain wildlife. These lands are also vital to the state's economy, rural heritage, and quality of life. Independent surveys by The American Farmland Trust and The Nature Conservancy revealed that Floridians overwhelmingly support programs that assure that farmers, ranchers, and private forest landowners can continue to provide silvicultural commodities to supply the needs of its citizens. The surveys also reflect that the public supports these programs not only for the importance of silviculture to our economy, but for the protection rural lands afford natural resources (American Farmland Trust 2001). It is also important to acknowledge that public and private forest management in Florida is guided by Silviculture Best Management Practices (BMPs). These practices are designed to be the minimum standards necessary for protecting and maintaining the state's water quality as well as certain wildlife habitat values during forestry activities (Florida Department of Agriculture and Consumer Services 2003a). Over 25 years of statewide implementation monitoring by the Division of Forestry has established a long-term BMP compliance rate of 93%. The most recent BMP Implementation Survey (Florida Department of Agriculture and Consumer Services 2003b) evaluated 7,500 practices on 253 individual forestry operations and determined a statewide compliance score of 97 percent. In addition, a three-year study conducted by the Florida Division of Forestry and the Florida Department of Environmental Protection determined that BMPs are effective in protecting water quality and aquatic ecosystems in intensive, silvicultural areas. (Vowell 2001 and Vowell and Frydenborg 2004).

Despite the fact that silvicultural lands do indeed play a vital role in the landscape, certain forestry activities are not always compatible with the management needs of some wildlife species, even when BMPs are followed. Management goals for private and public lands may or may not include objectives for management of certain wildlife species and thus, while a forestry activity (chopping, raking, bedding) may be used to meet certain objectives, the activity may sometimes result in less favorable habitat conditions for some wildlife species. For example, intensive site preparation such as bedding and/or herbicide use immediately adjacent to isolated wetlands, and the exclusion of natural fire regimes are generally not compatible with maintaining habitat conditions and ground cover necessary for certain SGCN–even when these practices are carried out in accordance with BMPs. Incompatible Forestry Practices, then, are defined as forestry activities which significantly alter habitat conditions, especially in unique or sensitive areas, to the extant that the habitat is no longer useable by historically associated native wildlife species. The threat of incompatible forestry practices is to be addressed by helping to preclude loss of existing silvicultural lands and to improve the value of silvicultural areas for wildlife.

Conservation Threats

Incompatible forestry practices impact many aquatic habitat types as well as habitat categories identified in this Strategy, including Industrial/Commercial Pineland, Natural Pineland, Scrub, and Sandhill Effects of incompatible forestry practices can include changes in species composition, loss of dominant species (e.g., cypress, pine native to site), decrease in habitat structure complexity (and concurrent decrease in native biodiversity), altered fire regime, altered hydrologic regime, and altered soil structure. These effects are often not permanent and are generally transitory in nature. This threat was more frequently identified in the north and central Florida habitats than for those in the south.

This source of stress was identified as a threat to the following terrestrial habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Calcareous Stream
- Cypress Swamp
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Hardwood Swamp/Mixed Wetland Forest
- Industrial/Commercial Pineland
- Large Alluvial Stream
- Natural Pineland
- Reservoir/Impoundment
- Scrub
- Seepage/Steephead Stream
- Softwater Stream
- Spring and Spring Run

Conservation Actions

Conservation actions to promote forestry practices that result in wildlife conservation include the following: (1) promote or encourage retention of forest lands rather than conversion to more intensive land uses, such as development of row crops, (2) promote silvicultural management and forest restoration that includes sustainable forestry (to include uneven-aged management or longer rotations), increased fire management, and consideration for native ground cover and wildlife, (3) assure that silvicultural BMPs continue to be followed or expanded upon, as appropriate. Actions that address cypress harvest are included in the habitat-specific chapter under Cypress Swamp (see Chapter Habitats).

Highest ranked actions identified for abating this source of stress focused on:

- Acquisition or easements over forests identified as critical habitat within the "Cooperative Conservation Blueprint" (see Chapter Florida's Strategic Vision)
- Restoration of natural pine species, uneven-aged stands, and longer rotations on publicly owned silvicultural lands

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Support voluntary implementation of BMP's for silviculture activities.	M	M	M
L	Promote development of additional sources of native seed appropriate for restoration of forest groundcover species.	H	L	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Provide incentives to the private sector to encourage continued forest management that incorporates all natural resources and processes, and results in maintaining or increasing native groundcover with pine overstory. E.g., forestry exemptions which are more beneficial than intensive agriculture exemptions, incentives to encourage use of on-site pines and strengthen emphasis on natural forest management (CRP, FLEP, WHIP, LIP, PWF), Safe Harbor programs or other innovative government programs or approaches).	M	M	M
L	Provide incentives for increasing rotation length, reducing tree densities, and improving native groundcover on industrial forests and NIPF ownerships. Promote forest management methods that increase quail, turkey, and other game species' hunting values so hunting leases provide incentives for management of more natural forests.	H	L	L
L	Support and enhance existing forest management award programs on public and private lands that benefit wildlife. Establish new annual, well publicized award systems for the best managed forests for wildlife, as appropriate.	H	L	L
L	Provide national funding for a crop insurance program on tree crops/silviculture.	L	L	VH

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Support and enhance existing programs to disseminate model timber management and site preparation contracts and easement language that landowners can use that result in minimal soil disturbance (including seasonal criteria).	H	M	L
L	Fund an annual or biennial conference for public and private forest land managers to provide updates and training on forest management that support wildlife values.	H	L	L

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Increase acquisition efforts and conservation easements on non-industrial private forests, and industrial forests that have been identified within the Strategic Habitat Conservation Areas (SHCA), and biodiversity hot spots as identified by the FWC's FL Gaps project (Cox et al. 1994), University of Florida's FL Ecological Network project (Hoctor et al. 2000), and Conservation Needs Assessment by FNAI.	H	H	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Support and enhance programs that replace off-site pine with the natural pine for the site as publicly owned stands are harvested.	M	H	L
M	Encourage public land agencies to: (1) manage on long rotations, or, (2) use uneven aged management.	M	M	L
L	Establish demonstration management units on public lands that show forest management that maximizes wildlife and resource values.	H	L	L
L	Discourage new bedding on public lands with healthy groundcover.	H	L	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Encourage that wildlife standards are included within the elements of the Sustainable Forestry Initiative (http://goodforests.com/).	H	L	L
L	Encourage the consideration for the ecological sensitivity of forest management practices within conservation agreements on silvicultural properties.	H	L	M
L	Support and encourage as appropriate the implementation of BMPs for silviculture that focus on biodiversity conservation, ground cover, community structure, and species especially as they relate to herbicides, fire, chopping and bedding.	H	L	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Develop a cooperative effort between public and private entities to create economically viable methodologies for production of seed of native groundcover species available for restoration efforts (IFAS, Plant Materials Center).	M	L	M
L	Research on alternatives to bedding for silvicultural production.	H	L	M

Incompatible Industrial Operations

Conservation Threats

Incompatible industrial operations was identified as a statewide source of stress leading to the following ecological stresses to marine and estuarine habitats: altered water quality, sedimentation, habitat disturbance, habitat destruction, altered water temperature, altered structure, and altered species composition. Marinas, ports, and power plants were identified as industrial operations that were known to cause some level of impact on marine/estuarine systems. Related actions are associated with the multiple threat categories Conversion to Commercial and Industrial Development, Chemicals and Toxins, and Conversion to Recreation Areas found in this chapter under those headings.

This source of stress was identified as a threat to the following marine/estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Inlet
- Mangrove Swamp
- Pelagic
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Actions to abate incompatible industrial operations were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize preventing the release of harmful contaminants into the water and sediments, abating the threat of existing contaminated sediments, appropriately siting industrial activities in order to minimize harm to marine/estuarine species and habitats, minimizing losses of habitat due to industrial expansion and ensuring vessel traffic is maintained at levels compatible with marine/estuarine species and habitat conservation.

Highest ranked actions identified for abating this source of stress focus on:

- Ensuring that all port dredged material management plans are up-to-date and adequate
- Encouraging participation in the Florida Department of Environmental Protection's Clean Marinas Program (http://www.dep.state.fl.us/law/Grants/CMP/default.htm) within specially designated water bodies
- Establishing and encouraging a program with standards (e.g., BMPs) for boatyards and marine testing facilities
- Establishing higher water quality standards that help conserve sensitive species
- Encouraging all power plants to meet current standards for discharge

The following actions, organized by action type, were identified to abate this threat:

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Promote and encourage participation in FDEP's Clean Marina program. Promote stewardship through outreach and awareness.	H	M	L
L	Build public support for reduction of wildlife entrapment and impingement in power plants.	H	L	L

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Develop cooperative public/private partnerships to improve compliance with speed zone regulations.	H	M	M
M	Develop cooperative public/private partnerships to improve compliance with manatee protection regulations.	H	M	H
L	Encourage ports to use best available technology on wharf tenders to aide in protecting wildlife resources.	H	L	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Encourage a periodic multi-agency review of port dredge material management plans.	VH	H	M
L	Encourage the implementation of a multi-agency coordination process in the permit review process for proposed industrial projects.	M	L	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Encourage and support the expansion of FDEP's Clean Marinas Program.	M	H	L
H	Establish and encourage a standards program (e.g., BMPs) for boatyards and testing facilities.	M	H	L
H	Establish sufficient water quality standards to help conserve sensitive habitats.	L	VH	H
H	Improve compliance with discharge regulations for power plants.	L	VH	H
L	Provide technical expertise on fish and wildlife resources in the development of port sedimentation control programs.	L	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Fund research on the effects of speed and density of ship/vessel traffic on seagrass beds, seabirds, and other sensitive habitats.	H	M	H

Incompatible Recreational Activities (Terrestrial and Freshwater)

Conservation Threats

Recreational activities that degrade natural habitat were identified as threats primarily for public lands and waters. Public access was not identified as a direct threat to natural habitats and wildlife. It is important to acknowledge that the vast majority of passive and active recreational uses are compatible with conservation, especially where multiple-use is emphasized. However, it should also be acknowledged that not all recreational uses are best suited to every parcel of publicly acquired land and that efforts need to be made to match conservation management and recreational uses on a parcel-by-parcel basis. On public conservation areas, appropriate selection and siting of recreational activities help prevent potential conflicts with vital natural resource management activities such as prescribed burning. Parcel-appropriate selection and siting of recreational activities also prevents or reduces undesirable direct impacts such as erosion, sedimentation in aquatic systems, and vegetation loss, and prevents or reduces indirect impacts due to impedance of vital resource management priorities (e.g., prescribed burning, nuisance wildlife control, or invasive plant management). Management for hunting and fishing opportunities can and should be consistent with wildlife conservation. Unauthorized or unmanaged off-road vehicle use was consistently identified as seriously impacting many habitats. While research is needed to confirm or refute the assertion, workshop participants also identified recreational use as appearing to be exceeding the carrying capacity for many types of activities on public areas throughout Florida (see Chapter Florida's Approach to Meeting the Eight Required Elements).

This source of stress was identified as a threat to the following terrestrial habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Aquatic Cave
- Beach/Surf Zone
- Coastal Strand
- Freshwater Marsh and Wet Prairie
- Hardwood Swamp/Mixed Wetland Forest
- Large Alluvial Stream
- Natural Lake
- Natural Pineland
- Reservoir/Impoundment
- Sandhill
- Scrub
- Softwater Stream
- Spring and Spring Run
- Terrestrial Cave

Conservation Actions

Conservation actions that identify and allow management of recreational uses at appropriate levels were articulated by experts (see Chapter Florida's Approach to Meeting the Eight Required Elements). Actions expressed involved reduction of conflicts between natural resource management needs and recreational user expectations through an appropriate balance of these activities. Further emphasis on a commitment to a philosophy of public access and multiple-use for recreational activities on public lands should be considered.

Highest ranked actions identified for abating this source of stress focused on:

- Reducing the impacts resulting from incompatible recreation activities; for example, harassment of wildlife by off-road vehicles and personal watercraft.
- Restoring impacted habitats on public lands and waters as a result of incompatible recreation activities

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Develop realistic formulae for state land management budgets, more equitably based on resource management needs in addition to recreation provisions. (State agencies cooperative effort.)	H	H	L
M	Develop a public/private partnership for creating guidelines for ORV use on those public managed areas that allow it, and provide management and remediation recommendations. (FDOF, FDEP, Division of State Lands (DSL) and/or other appropriate agencies cooperate and lead.)	M	M	M
M	Develop a public/private partnership for creating guidelines for recreational vessel use on those public managed areas that allow it, and provide management and necessary remediation recommendations. (FDEP, DSL and/or other appropriate agencies cooperate and lead.)	M	M	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create incentives and reclamation standards for utilizing mined lands for recreational activities that are otherwise determined incompatible with natural area conservation.	H	M	H

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create educational materials and/or interpretive trails that are targeted to specific user groups on the management needs of the habitat traversed. For example, educate equestrian users about the need for hardwood control and prescribed burning which will result in less shaded trails, yet better habitat quality.	VH	L	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Where motorized and non-motorized vehicle trails, equestrian trails, and foot paths occur in ecologically sensitive areas on public conservation lands, develop creative new vegetation management strategies for trail buffer zones to proactively limit the effects of trail use (e.g., address invasive species introduction, mowing/trimming, and reduce maintenance costs.)	H	M	M
M	In management plans for public areas, enhance planning efforts with access plans for motorized and non-motorized vehicle trails, equestrian trails, and foot paths that reflect and maximize the ecological value and context of the landscape. These plans should include specifications for implementation, enforcement, and monitoring.	M	M	M

L	Where horses are not required to stay on trails through natural habitats on public lands, explore ways to redirect horses to trails. Management should educate users about the cost and benefits to natural areas.	H	L	L
L	Improve understanding of and compliance with existing leashing policies on public lands and supplement with educational information.	H	L	L
L	Develop incentives to retrofit old golf courses to improve wildlife habitat quality through changes in management practices, modifications in course design, and/or some degree of restoration.	M	L	H

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage a cooperative public/private effort to develop specific guidelines for which recreational uses are and are not compatible with conservation of each of Florida's habitats. (Note: such guidelines should not preclude public use, but rather guide that use.)	M	M	M
M	Include a management access element in public land management plans, with specific procedures establishing criteria to determine when impacts to natural habitats (caused by both public access and access by managers) exceed acceptable levels.	M	M	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Develop conceptual management plans for public lands that incorporate 'compatible use' guidelines for development and siting of recreational activities or facilities associated with those activities. (Note: such guidelines should not preclude public use but guide that use.)	H	H	M
M	Develop conceptual management plans for public waters that incorporate 'compatible use' guidelines for development and siting of recreational activities or facilities associated with those activities. (Note: such guidelines should not preclude public use but guide that use.)	H	M	M
M	Develop compatible use criteria to be included in area management plans that can be used to evaluate effects to habitat or specific natural resources from recreational activities. Included in such criteria should be decision-making guidelines that would be used to evaluate effects and determine whether changes are needed in terms of how recreational activities are conducted.	M	M	M
M	Acquire land appropriate for ORV recreation.	M	M	L

Incompatible Recreational Activities (Marine)

Conservation Threats

Incompatible recreational activities in or near marine and estuarine habitats are often associated with, but not exclusive to, the use of boats and other watercraft. Clear and frequently occurring threats from inappropriate or ecologically destructive boating activities include physical damage to and destruction of benthic habitats such as seagrass from boat propellers. Habitat loss from these activities cascades though different trophic levels in these productive near-shore systems. Other recreational activities can disturb sensitive habitats and the species that use them, such as waterfowl wintering on seagrass beds, and shorebirds foraging on beaches.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Inlet
- Mangrove Swamp
- Pelagic
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Actions in this section focus on the need to improve boater education, improve understanding of and compliance with existing regulations, and craft more effective non-regulatory approaches to minimizing impacts. The following actions stem from the consensus that better-educated, responsible boaters and other users are less likely to impact sensitive marine and estuarine habitats. There is also a need to increase the mutual understanding of both recreational boaters and resource management agencies on the nature of boating impacts and the effectiveness of regulations in reducing the likelihood of effects to sensitive habitats, especially damage to seagrass from propellers. Increased restoration of areas impacted by recreational activities was also identified.

Highest ranked actions identified for abating this source of stress focused on:

- Improving level of resources to enforcement agencies
- Reducing the impacts of boats and personal watercraft to natural resources through education and awareness

The following actions, organized by action type, were identified to abate this threat:

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Educate boaters, especially new boat operators, about sensitive areas and proper boating techniques, including anchoring, through an outreach program (e.g., kiosks, pamphlets, signage). Fund and develop boater guides for areas where they are currently unavailable and distribute at the time of boater registration and at boat rental offices.	M	M	H
M	Conduct an outreach program to ecotourism operators (including air boat operators and large pontoon boats) to educate them about sensitive habitats and species, and the potential for negative effects of their activity.	H	M	L
M	Encourage the inclusion of navigational charts as safety equipment on all vessels.	M	M	L
L	Conduct an outreach program to educate beachgoers and other recreational users about the potential negative effects of collecting live shells.	H	L	L

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Improve understanding of and compliance with existing environmental and boating safety laws and guidelines.	VH	H	VH
H	Improve understanding of and compliance with existing measures that reduce the likelihood of propeller scars.	VH	M	VH
H	Assist in a multi-agency process in the identification and designation of no-motor zones in ecologically sensitive areas.	VH	M	H
M	Improve understanding of and compliance with existing regulations in sensitive fish and wildlife resource areas. Assist in the multi-agency development of management plans for those areas.	H	M	H
M	Educate watercraft operators on environmental sensitivity and boating safety.	M	M	M
M	Develop and implement management/remediation activities based on synthesis of existing information on effects of use of and potential remediation of marine and estuarine habitats (see research)..	M	M	M
L	Place mooring buoys at intensively used natural areas.	H	L	M
L	Improve understanding of and compliance with manatee protection zones via staffing and signage.	H	L	M
L	Encourage and support statewide underwater cleanup programs.	M	L	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Encourage multi-agency cooperation/collaboration to review and revise seagrass protection measures.	H	L	L
L	Encourage education and training of boat operators to promote safe boating.	L	L	H
L	Educate watercraft operators on environmental sensitivity and boating safety.	M	L	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage comprehensive studies to assess the cumulative effects of use of marine and estuarine habitats.	M	M	H
M	Synthesize all existing information on effects of uses and on potential remediation to marine and estuarine habitats.	H	M	L

Incompatible Resource Extraction: Mining/Drilling

Conservation Threats

Mining was identified as a significant source of habitat destruction or conversion, as well as a source of indirect stress by altering hydrology and altering water quality (e.g., via introduction of contaminants) in a variety of habitats statewide, though the most serious effects to wildlife habitats have occurred in and around the mined lands of central and south Florida. This source includes phosphate, sand, metals (e.g., titanium) and limerock aggregate mining and associated processing activities, and is concentrated in relatively well known locations (e.g., phosphate mining in the Bone Valley, sand and metals mining on the sandy ridges of central Florida and the northern peninsula, limerock mining in the south Florida "lake belt" and karst regions of north Florida). Impacts occur from direct conversion of natural habitat to mines and from alteration of the hydrology and water quality of adjacent lands or receiving waters as a result of mine creation or activities associated with processing of mining products.

This source of stress was identified as a threat to the following terrestrial habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Aquatic Cave
- Beach/Surf Zone
- Calcareous Stream
- Coastal Tidal River or Stream
- Coral Reef
- Cypress Swamp
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Hardwood Hammock Forest
- Natural Pineland
- Sandhill
- Seepage/Steephead Stream
- Scrub
- Softwater Stream
- Terrestrial Cave

Conservation Actions

Conservation actions to abate the impacts from mining were based on desired outcomes identified in threat workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize restoring habitats damaged by past mining activities and preserving critical, irreplaceable habitats within mined landscapes through planning, strategic land acquisition, and mitigation policies.

Highest ranked actions identified for abating this source of stress focus on:

- Creating incentives for preserving large, contiguous scrub and other sensitive upland habitats, as part of the permitting for new mines

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Pursue cooperative relationships with the mining industry to leverage mitigation in sensitive habitats with other conservation land acquisition and protection efforts.	H	M	M
M	Secure the long-term financing of Florida Institute of Phosphate Research (FIPR), research money, and ensure that an increased percentage of those funds go to mine reclamation, and habitat and wildlife related research.	M	M	M
L	Expand FIPR to fund research on reclamation of all types of mines, not just phosphate.	L	M	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Create incentives to encourage preservation of large contiguous patches of scrub and other sensitive upland habitats in lieu of current practice of protecting habitat piecemeal.	H	H	H
M	Create incentives to avoid loss of, and effects to, Strategic Habitat Conservation Areas (SHCAs) http://www.biodiversitypartners.org/state/fl/gaps.shtml and sensitive habitats from mining, particularly wet and dry prairie, scrub, and bat caves.	H	M	H

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Create incentives for wider, more naturally vegetated buffers between mining operations and conservation-managed lands.	M	L	H

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Develop incentives for a mined-habitat management and monitoring program that will increase invasive species control, native plantings, and prescribed fire.	M	M	H

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Identify irreplaceable habitats or ecological features (e.g., habitats that are near impossible to restore or replace (i.e., caves, streams, recovery populations/units, and old growth) and work with companies to explore ways to avoid mining those locations.	L	H	M
M	Ensure wetland mitigation for mining activities includes indirect effects (i.e., hydrologic and/or water quality) from the creation of altered land forms.	M	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Encourage activities to promote conservation of bats and bat habitats in state mine reclamation projects.	H	L	L
L	Develop statewide processes and procedures to ensure better response to contamination events.	M	L	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Fund more research into technological improvements and economic efficiencies to further decrease the reliance of mining operations (particularly non-phosphate mines) on new groundwater in favor of reuse.	H	M	H

Incompatible Wildlife and Fisheries Management Strategies

Conservation Threats

Incompatible wildlife and fisheries management was identified as a statewide source of stress to marine habitats (see Chapter Florida's Approach to Meeting the Eight Required Elements). While sustainable management of marine fisheries is a desired outcome, management may become a source of stress when management measures trade one or a group of species' needs against another, or trade human needs against wildlife species' needs. As more wildlife and fisheries management programs move towards an ecosystem management approach, these types of conflicts will be reduced.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Bivalve Reef
- Hard Bottom
- Mangrove Swamp
- Pelagic
- Salt Marsh

Conservation Actions

Actions to abate the impacts from threats posed by incompatible wildlife and fisheries management strategies were based on outcomes that emphasize managing systems comprehensively to maximize the health of marine wildlife and the habitats on which they depend, by limiting single-species/taxa management activities that may result in adverse effects to the broader array of wildlife.

Highest ranked actions identified for abating this source of stress focus on:

- Encouraging the transition of fish and wildlife management strategies from a species-level focus to an ecosystem-level focus

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Improve understanding and awareness of current laws that protect wildlife and fisheries resources.	M	M	M
M	Encourage all state agencies to work collaboratively to achieve ecosystem management.	M	M	L

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Promote interstate actions to prohibit introduction of non-indigenous fishery species.	M	L	L

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage the conservation and management of marine and estuarine habitat as a primary component of fisheries and wildlife management.	M	M	M
M	Where possible, improve management to better accommodate needs of multiple species (e.g., in the case of impoundment management for ducks).	M	M	L
L	Support the goals of the Florida Invasive Species Working Group (http://www.dep.state.fl.us/lands/invaspec/2ndlevpgs/ISWG.htm).	M	L	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Encourage ecosystem-level management approaches to fish and wildlife resource management.	H	VH	L
L	Support and develop educational materials on the regulations prohibiting the release of non-native fish and wildlife species into state waters or on state lands.	M	L	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Promote the development of multi-species, ecosystem-based management plans.	M	M	M

Industrial Spills

Conservation Threats

Industrial spills are relatively infrequent yet present a sizeable threat to many marine and estuarine habitats. This source of stress was identified as causing stresses that include habitat disturbance, altered water quality, altered species composition, and sediment contamination. The effects of industrial spills can range from severe and transient to severe and persistent, depending on the substance spilled. While some substances may leave no residual effects and the affected habitats may recover quite rapidly, in others, as in some petroleum hydrocarbon spills, the effects can last from years to decades.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Coastal Tidal River or Stream
- Coral Reef
- Inlet
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Tidal Flat

Conservation Actions

Conservation actions to abate industrial spills were based on desired outcomes of response planning and prevention, including ensuring that all prudent prevention measures are implemented. Industrial groups or operations that have the potential for large oil, chemical, or toxin spills were particularly identified for precautionary actions that include the appropriate level of response planning and strategic placement, and availability of response equipment.

The highest ranked actions identified for abating this source of stress focus on:

- Continuing support for the ban on oil and natural-gas drilling off the Florida coast

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Annually make available an updated inventory of chemicals transported on waterways to local response entities.	L	L	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Integrate the state's emergency spill response so that funding is available and used to update equipment and plans, and provide training at regular intervals.	M	M	H
L	Implement spill response and HAZMAT training on a regular basis; provide online updates.	H	L	M

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Implement emergency response plans for coastal waters where water-borne transport of oil and chemicals occurs. Update plans bi-annually and ensure contacts are current and include county EOCs in revision.	H	M	M
M	Implement emergency response plans for coastal waters that may be subject to land-based spills of oil or chemicals. Update plans bi-annually and ensure contacts are current and include county EOCs in revision.	H	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Continue support for ban on oil and natural-gas drilling off Florida's coast, including federal waters.	VH	VH	M

Invasive Animals
(Terrestrial and Freshwater)

Conservation Threats

Invasive non-native animals have been identified as a critical source of stress across many of Florida's habitats. These species can change community structure and composition, alter hydrological and fire regimes, alter soil sedimentation and erosion processes, and modify habitat values for both wildlife and humans. Ecological and economic costs have been identified by public and private land managers. While the problem species are different in different regions of Florida, the threat posed by these species is statewide.

Many of the threats and actions in this section apply both to invasive and nuisance animals, partially because of overlap in the species considered in each category. Invasive animals are defined as non-native animals (vertebrate and invertebrate); nuisance animals are defined as native animals at densities sufficient to threaten other wildlife. Both types of animals pose threats through competition, predation, habitat destruction, and pathogen movement. While domesticated species (cats, dogs, and livestock) were considered invasive species by some experts, others included them as nuisance species. Because nuisance species were identified as a critical source of stress for a few habitats only, this source is addressed in the habitat-specific chapters. However, some actions articulated in this section apply to those species as well.

This source of stress was identified as a threat to the following terrestrial and freshwater habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Bay Swamp
- Beach/Surf Zone
- Bottomland Hardwood Forest
- Calcareous Stream
- Coastal Strand
- Coastal Tidal River or Stream
- Cypress Swamp
- Freshwater Marsh and Wet Prairie
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Large Alluvial Stream
- Natural Lake
- Natural Pineland
- Pine Rockland
- Reservoir/Impoundment
- Sandhill
- Scrub
- Seepage/Steephead Stream
- Softwater Stream
- Spring and Spring Run
- Tropical Hardwood Hammock

Conservation Actions

Outcomes to reduce the effects of invasive animals focused on reducing resources for those animals through effective containment and disposal of solid waste. Feral hogs and cats were considered so threatening to several habitats and wildlife that these animals were identified for directed public education to support their population control. Similarly, actions were developed to reduce the releases and movement of invasive fish species. Several invertebrate species (e.g.,

bromeliad weevil, lobate lac scale, channeled apple snail, and other aquatic invertebrates) were also identified for increased research and control efforts by the experts.

Highest ranked actions identified for abating this source of stress focused on:

- Establishing an early detection, warning, and rapid-response protocol among agencies that triggers a coordinated and strategic response to incipient invasions
- Implementing a biological risk assessment process to review importation and movement of non-native animal species

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Build and expand taxonomic expertise on invasive animals within the state. Provide training for existing field staff on taxonomy. (Florida Museum of Natural History (FMNH) may be the appropriate entity to take the lead).	VH	M	M
M	Create and fund a single, coordinated interagency "Center for Invasive Species" in Florida to elevate the importance of and be a clearinghouse for invasive issues, and increase research, identification, prevention, detection, management, eradication, control, and education related to non-native invasive plants and animals nationwide and in Florida.	M	M	VH
M	Coordinate control and use of exotic animals among agencies (e.g., one agency not managing for a species that another agency is controlling).	M	M	L
M	Create a network for identifying and reporting invasive marine animals. Work with charter dive operations, commercial and other professional divers, and agency personnel. (REEF as a potential lead).	VH	L	L
M	Convene a working group on the Green Mussel to discuss whether a fishery for this species should be promoted in the state as a means of control and eradication.	VH	L	L
L	Develop a statewide feral hog management plan designed to minimize effects of hogs in natural areas and to native wildlife. Include incentives as part of the federal CRP to reduce hogs via a variety of different control techniques. Work with neighboring states to coordinate hog management efforts. (Note: if this plan is developed, several of the other actions addressing feral hog control would not be necessary as they would be included here.)	L	M	M
L	Build capacity for authority, training, and funding at the county level to dispose of/euthanize non-native animals that have not been adopted. Resolve authority between federal, state, and county government for all animal species.	M	L	H
L	Expand the capabilities and funding of animal shelters to accept a broader range of invasive and nuisance animals.	M	L	M
L	Increase county capacity (staff, facilities) to accept unwanted pets (mammals, fish, reptiles, invertebrates, etc.) from the public.	M	L	H
L	Fund and establish a coordinated interagency control program for pythons.	H	L	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Investigate funding mechanisms to provide for sufficient control of imported non-native species should they become invasive.	M	M	M
M	Create incentives for research labs to develop assays to streamline efforts aimed at identifying whether invasive, non-native animals are present to support survey and monitoring of these animals.	M	M	M

L	Increase capacity of pet stores to receive unwanted fish/animals that people purchased (e.g., explore with the industry the creation of a deposit fee for every animal sold). Encourage pet stores to advise purchasers of laws regarding disposal of animals and educate purchasers about proper disposal of unwanted pets.	M	L	M
L	Offer a bounty for sexually immature hogs for a limited timeframe to reduce the hog population in Florida.	H	L	H
L	Develop incentives to promote hunting of hogs on private lands designed to reduce the hog population in Florida (explore creative marketing such as temporarily changing Florida's motto from "fishing capital" to "hog hunting capital").	M	L	M
L	Explore the potential of developing a publicly run feral hog meat production and distribution center in Florida as a mechanism for increasing removal of feral hogs and providing a food source (beneficial disposal of meat). If such a facility would result in greater hog breeding in Florida, do not develop the concept further.	L	L	H
L	Develop a program for provision and distribution of animal-resistant trash containers (locking, self-closing lids) to homeowners, commercial operations, and municipal trash transfer stations.	M	L	M

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Increase the training for and number of animal inspectors at ports, and coordinate state and federal efforts to prevent entry of non-native species that are or may become invasive in Florida's natural areas.	M	M	H
M	Develop educational materials and disseminate to pet store owners and veterinarians in order to educate them and their clients about pet diseases and symptoms that may be transferred from pets to native wildlife.	VH	L	L
M	Coordinate with existing media campaigns, including those by the FWC, NPS, and Habitattitude (http://www.habitattitude.net/), to develop and fund a multi-lingual, multi-cultural, visual media campaign that would target various levels of the public, informing them of the potential for negative effects of exotic animals, the need for their control, and how to appropriately dispose of unwanted pets. Work with veterinarians and pet stores to disseminate.	VH	L	M
L	Develop a website to facilitate exotic pet exchange as an alternative to release or euthanasia.	M	L	L
L	Educate property owners adjacent to conservation areas to reduce garbage-related increases in invasive animal populations ("Wildlife-Wise" http://ontariosoilcrop.org/PDF_Files/wildlifewise.pdf program).	H	L	M
L	Educate county law enforcement staff about invasive species effects and regulations in order to increase scope and capacity of enforcement efforts.	H	L	L
L	Implement an outreach or education program at public access points to water bodies focused on stopping the release of non-native animals to those habitats.	H	L	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Establish an early-detection, warning, and rapid-response protocol among agencies that triggers a coordinated and strategic response based on existing National Invasive Species Council recommendations for invasive animals. Fund early-detection and rapid-response teams focused on different groups of invasive animals that would work to eradicate new invasions.	M	H	H
M	Create hog management plans for all managed conservation lands that have a goal of zero hogs unless they are needed as a prey species for semi-dependent species like the Florida panthers. Coordinate and integrate all plans among agencies.	M	M	M
M	Remove from pet trade those animals that are already invasive and threatening Florida's wildlife and habitats (e.g., Burmese pythons).	M	M	M

M	Develop standards (BMPs) for aquaculture in advance of industry expansion in non-native species.	M	M	M
L	Fund local control programs, including "round-ups" of invasive fish.	H	L	M
L	Fence areas that have been identified as particularly sensitive to feral hog damage (e.g., slope forests, stream banks in Apalachicola).	M	L	L
L	Fund and expand control of cactus moth across its expanding range.	H	L	M
L	Fund a directed eradication program for the purple swamp hen, which is dispersing from Broward Co.	M	L	H
L	Immediately fund a directed eradication program for the Gambian pouch rat before any further dispersal.	M	L	L
L	Discourage popularizing non-indigenous species in fisheries management, e.g., length limits (apply to agencies, organizations and individuals and businesses).	M	L	M
L	Recommend microchips for all pets sold commercially to track ownership when pets are lost/abandoned pets are found.	L	L	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Develop and implement risk assessment for importation and movement of animals.	M	H	H
L	Develop standards (BMPs) for waste management in areas where wildlife or habitats are subject to high depredation or disturbance rates by exotic and nuisance animals with populations elevated by garbage (providing a supplemental food source).	M	L	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Develop a statewide cooperative stakeholder approach to resolve invasive nuisance animal control issues that applies to counties. Specifically address roles and authority and provide a mechanism to dispose of invasive animals.	M	H	M
H	Coordinate a statewide effort to decrease the importation of invasive animals.	M	H	M
M	Authorize all state agencies to conduct animal control activities on public lands.	M	M	L
M	Streamline the process for regularly updating the lists of exotic and unprotected animals.	H	M	L
M	Strengthen public understanding that spay/neuter/release programs are not the only solution to the effects nuisance and exotic animals have on wildlife.	H	M	M
M	Limit introduction of non-native animal species for the purpose of establishing their populations in natural areas, except for classical biological control purposes.	M	M	M
M	Expand the existing state animal euthanasia policy on exotic non-domestic animals that applies to pet owners and pet stores when these pets are no longer wanted.	M	M	M
L	Reclassify feral hogs as a state nuisance species instead of a game species, thereby eliminating bag limits and seasonal limits on hog hunting.	H	L	L
L	Encourage landowners to reduce feral hog populations by allowing hog hunters on private property.	L	L	L
L	Fund staff and provide the capacity to improve management and control of natural area boundaries/access with regard to prohibited activities (i.e., dumping of unwanted pets, waste materials, etc.).	M	L	H
L	Develop incentives that promote garbage storage for pickup in hard-sided containers (not bags) in all counties and municipalities.	M	L	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Conduct a risk assessment on all commercially available exotic marine/estuarine animals in Florida's pet trade (NOAA may be the appropriate lead). Identify and prioritize potential invasive animals including bacterial, viral, algal, etc.	H	H	H
M	Provide funding to accelerate research on classical biological control for current problem species like the: lobate lac scale, bromeliad weevil, channeled apple snail, and invasive fish species.	H	M	H
M	Conduct a comprehensive survey on invasive, non-native marine and estuarine animals. Assemble existing information, review literature and conduct field surveys. Produce an inventory of what is known.	M	M	M
L	Develop predictive models of potential pathways and sensitive areas that would inform and direct early detection and rapid response efforts for eradication of different groups of invading taxa.	H	L	M
L	Evaluate the feasibility of Florida adopting the four-tiered system of permissible/prohibited species that has been implemented in Minnesota.	M	L	M
L	Explore the utility of screening or gating areas identified for deep-water refugia creation so that they are less likely to be invaded. Develop a demonstration project related to this effort.	M	L	M
L	Fund veterinary research for medical solutions for feral hog population control. For example, hog-specific sterilization using bait.	M	L	H

Invasive Animals
(Marine)

Conservation Threats

Invasive non-native animals have been identified as a critical source of stress across many marine habitats. The scope, seriousness, and economic impacts of this threat in the marine environment is unknown and considerable additional research is necessary to develop effective conservation actions. Many invasive organisms now emerging as serious threats in the marine environment are invertebrates (e.g., green mussels) and microorganisms, some of which may be considered parasites and/or pathogens of native species. Consequently, related conservation actions may be found in habitat-specific sources of stress (see Chapter Habitats), in the sections that address parasites and pathogens.

Many of the threats and actions presented here apply to both invasive and nuisance animals, partially because of overlap in the species considered in each category. Invasive animals are defined as non-native animals (vertebrate and invertebrate); nuisance animals are defined as native animals at densities sufficient to threaten other wildlife. Both types of animals pose threats through competition, predation, habitat destruction, and pathogen movement.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Hard Bottom
- Inlet
- Mangrove Swamp
- Pelagic
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Outcomes to reduce the effects of invasive animals focused on reducing resources for those animals. Similarly, actions were developed to reduce the release and movement of invasive fish species.

The highest ranked actions identified for abating this source of stress are similar to those developed in the terrestrial/freshwater section. These actions focused on:

- Reviewing importation of non-native animals to demonstrate that no harm is likely
- Creating an interagency and researcher consortium to coordinate actions to identify, prevent, detect, prioritize, and control invasive animals

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	**Action**	*Feasibility*	*Benefits*	**Cost**
H	Support the goals of the Florida Invasive Species Working Group (http://www.dep.state.fl.us/lands/invaspec/2ndlevpgs/ISWG.htm).	M	H	H
M	Develop educational tools to highlight the disruptive effects of invasive species on native fish and wildlife resources.	VH	L	H
L	Improve education on and inspection for invasive species at all entry points.	L	M	L

Education and Awareness:

Overall Rank	**Action**	*Feasibility*	*Benefits*	**Cost**
M	Conduct an education campaign to inform the public about the availability of the invasive animal clearinghouse for pet drop-off.	VH	L	M
M	Expand already established outreach programs addressing feral animals and effects on marine systems.	VH	L	L
L	Implement a public education campaign to encourage the reporting of invasive, non-native marine and estuarine species (REEF may be an appropriate party to implement)	H	L	L
L	Educate the pet industry about the risk of invasive animals.	M	L	L

Land/Water/Species Management:

Overall Rank	**Action**	*Feasibility*	*Benefits*	**Cost**
M	Provide technical expertise on fish and wildlife resources to assist in the development of new or improved technologies to treat ballast water.	H	M	H
L	Improve predation control for turtle and bird nests, beach mice, and other beach fauna. Improve protection of native beach species through better control of invasive animals and nuisance species such as cats.	M	L	L

Policy:

Overall Rank	**Action**	*Feasibility*	*Benefits*	**Cost**
VH	Improve understanding of and compliance with invasive, non-native species regulations. Encourage a multi-agency review and revision of the list of restricted species as needed.	VH	H	H
M	Support the goals of the Florida Invasive Species Working Group (http://www.dep.state.fl.us/lands/invaspec/2ndlevpgs/ISWG.htm).	H	M	H
M	Improve and clarify the authority for Florida law enforcement regarding invasive and nuisance control. Provide a mechanism for counties to dispose of invasive animal species. (the FWC potential lead)	M	M	L
M	Provide technical expertise on marine fish and wildlife resources to assist in the development of new or improved technologies to treat ballast water.	M	M	M
L	Support the statewide implementation of marine aquaculture standards (BMPs.)	M	L	L

Invasive Plants

Conservation Threats

Invasive non-native plants have been identified as a critical source of stress across most of Florida's terrestrial, freshwater, and marine habitats. These species change community structure and composition, alter hydrological and fire regimes, alter soil sedimentation and erosion processes, and modify habitat values for both wildlife and humans. High ecological and economic costs of this stress have been identified by public and private land managers. While the problem species are different in different regions of Florida, the threat posed by these species is statewide.

This source of stress was identified as a threat to the following habitats. Additional habitat-specific threats are found in Chapter Habitats.

- Bay Swamp
- Beach/Surf Zone
- Bottomland Hardwood Forest
- Calcareous Stream
- Coastal Strand
- Coastal Tidal River or Stream
- Coral Reef
- Cypress Swamp
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Hard Bottom
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Hydric Hammock
- Inlet
- Mangrove Swamp
- Natural Lake
- Natural Pineland
- Pine Rockland
- Reservoir/Impoundment
- Sandhill
- Salt Marsh
- Scrub
- Softwater Stream
- Spring and Spring Run
- Submerged Aquatic Vegetation
- Tropical Hardwood Hammock

Conservation Actions

Outcomes to address the invasive non-native plant threat were simplified because statewide plans have already been developed. Thus, funding and implementation of existing plans was a priority identified by the experts. Improved policies, control methods, cooperative control efforts, and mechanisms for identifying both invaders and the pathways of invasion were emphasized. Adequate resources and partnerships to control invasive plants on private as well as public lands were also identified outcomes on which conservation actions were based.

Highest ranked actions identified for abating this source of stress focused on:

- Implementing existing plans for invasive non-native plant control in Florida
- Increasing interagency coordination on invasive plant detection, management, and control programs
- Implementing a biological risk assessment process to determine if further action on importation and movement of non-native plant species is warranted

- Producing targeted educational materials on invasive plant identification and pathways of movement for public area managers and the public
- Augmenting the University of Florida's Florida Exotic Pest Plant Council (http://aquat1.ifas.ufl.edu/welcome.html) lists to include marine and estuarine plant species
- Increasing research on control methods for Old World and Japanese climbing fern
- Improving survey methods for invaders and assessing invasion along Florida's coastline

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Implement the key strategies for management of exotic plants on a statewide level as identified in the "Weeds Won't Wait" program (http://everglades.fiu.edu/taskforce/www/).	M	VH	VH
VH	Increase coordination among invasive species detection, control, and management among agencies.	VH	H	L
M	Develop effective partnerships to control invasive exotic plant infestations in adjacent public and private properties.	H	M	VH
M	Create and fund a single, coordinated interagency "Center for Invasive Species" in Florida to elevate the importance of and be a clearinghouse for invasive issues, and increase research, identification, prevention, detection, management, eradication, control, and education related to non-native invasive plants and animals.	M	M	VH
M	Using the western regional model of invasive species management, develop a southeast U.S. program among states to cooperatively list, control, and manage invasive species.	M	M	M
M	Support the Florida Invasive Species Working Group to effectively implement the strategies within the Florida Invasive Species Management Plan (http://www.dep.state.fl.us/lands/invaspec/).	H	M	H
L	Establish partnerships with utility companies to implement standards (BMPs) and Hazard Analysis and Critical Control Point Plans to prevent spread of exotics along utility corridors.	M	L	L

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Provide agency authority and additional federal and state funding for cost-sharing the control of non-native invasive species on private lands. Allocation of funding should be coordinated with control efforts on public lands to assure that control needs will be assessed at least annually with repeated control efforts if necessary.	L	H	VH
M	Identify, develop, and implement effective incentives for private landowners to better control invasive plant species. Develop these incentive programs to operate on a regional scale.	H	M	H
L	Provide landowners incentives to remove invasive species.	L	M	VH
L	Develop incentives for nurseries and plant distributors to label species as either native to south, central, or north Florida, or exotic, and encourage the marketing of native plants that benefit Florida's wildlife.	M	L	M

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Create better, more informative "key" of invasive plants for educating managers and the public.	VH	M	L
H	Educate industry and the public about introducing invasive, exotic species, including introductions through bilge and bait-well releases. Use education campaign that includes outreach, pamphlets, and media. Ensure education within schools by including as part of curriculum.	VH	M	M
M	Work with agricultural associations (i.e., Association of Florida Conservation Districts, Florida Cattlemen's Association, Florida Farm Bureau, etc.) to both educate the agricultural community and develop economic incentives for reducing invasive exotic species.	H	M	H
M	Develop demonstration programs to show how to control invasive exotic species using The Area Wide Management and Evaluation (TAME) *Melaleuca* program as an example.	VH	L	M
L	Provide options for natural habitat management efforts, such as invasive species control, to fulfill state-required community service projects for graduating high school seniors (age 18+).	H	L	L
L	Encourage the development of and provide training for volunteer programs to help control target invasive species on local public lands.	M	L	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Implement a rapid-response group to conduct rapid assessments and treatment; first detection of localized infestations.	M	L	M

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Encourage the addition of non-native invasive marine and estuarine plant species to the Florida Exotic Pest Plant Council (FLEPPC) lists.	VH	M	L
M	Replicate the Palm Beach County cost-share model for control of invasive species on lands adjacent to public conservation lands in other counties.	M	M	VH
L	Work with Florida and county Departments of Transportation to establish standards (BMPs) based upon the model Hazard Analysis and Critical Control Point Plans (http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/afs4338?opendocument) to prevent spread of exotics along transportation corridors.	H	L	L

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Develop and implement a statewide biological risk assessment process and use it to review the importation of non-native species.	M	VH	VH
M	Improve inspection for non-native plant species at ports (including review of documentation on origin).	H	M	VH
M	Encourage that property is free of specified invasive plant species prior to ownership transfer (e.g., Palm Beach and Monroe counties).	M	M	M
L	Encourage agencies to coordinate about plant species that are locally invasive.	M	L	L
L	Limit use of invasive species (FLEPPC Category 1 and 2) when planting along infrastructure rights-of-way and encourage the use of natives.	M	L	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Improve the methods that use remote sensing (satellite/air) and implement a better method for estimating percent cover of invasive plants versus natives to detect biggest invasion locations. Conduct a statewide invasion assessment in coastal areas.	H	H	H
H	Fund more research on the effective control of both climbing fern species.	VH	M	H
M	Fund the development of a program for on-going survey and mapping of infestations of exotic species statewide for early detection of species that are becoming invasive and prioritize control efforts.	H	M	M
M	Assess and monitor introductions of invasive plants through aquaculture and the aquarium trade. Determine which invasives are being distributed/sold.	M	M	H
M	Fund research on the interactions of fire, hydrology, and nutrient-level alteration that influence spread of, and successful control of, plant species identified as invasive or potentially invasive in Florida.	VH	L	H
L	Research the true ecological and economic costs of invasive plant species.	H	L	M
L	Fund research on alternative economic uses for invasive non-native plant species (mulch, fuel, pulp, etc.).	M	L	L

Key Predator/Herbivore Loss

Conservation Threats

Many marine and estuarine habitats contain species with a key role in maintaining the health of that particular system. In marine and estuarine systems, there are both herbivores and predators that are critical for maintaining the population dynamics of other species. For example, the loss of grazing *Diadema* sea urchins in the coral reef community has resulted in an overabundance of algae that threatens the health of the entire community. Identifying the key predators and herbivores in Florida's coastal waters and understanding their role in maintaining the ecological health of their associated communities are vital to protecting the ecological health of the marine and estuarine system.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in Chapter Habitats.

- Beach/Surf Zone
- Coral Reef
- Hard Bottom
- Pelagic
- Submerged Aquatic Vegetation

Conservation Actions

Outcomes to reduce the effects of key predator/herbivore loss focus on better understanding the role these species play in maintaining marine ecosystem health, identification of losses to key predator/herbivore species, and reversal of those losses.

The following actions, organized by action type, were identified to abate this threat:

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Develop strategies and implement restoration where effects to the selected key predator and herbivore populations have been documented.	M	M	H
M	Promote the development of ecosystem-based fisheries management.	M	M	H
L	Evaluate the potential of restoring of native algae communities.	L	L	VH

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	*Cost*
M	Develop a statewide sampling protocol to assess disease parameters in native marine organisms.	H	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Identify native key predators, herbivores, and prey that the state could track.	H	M	L
M	Collect baseline information on benthic communities in various habitats to better understand what alters community composition (which species are better or more aggressive colonizers).	M	M	H
M	Identify key habitat needs for missing native herbivores and predators.	M	M	H
L	Fund research on the bacterial/viral signature of healthy versus diseased specimens of selected species (e.g., urchins and corals).	M	L	H
L	Conduct research on the reintroduction of missing species to restore a more natural trophic balance and assess the feasibility of reintroduction.	M	L	H
L	Fund and conduct research on basic trophic interactions, such as diet and feeding habits in marine food webs and soil fauna effects and processes.	M	L	M
L	Assemble data on selected key predators and herbivores and identify data gaps.	M	L	L

Management of Nature – Beach Nourishment/Impoundments

Three types of economic benefits result from beach nourishment: Hurricane and Storm Damage Reduction (HSDR), recreational, and other benefits (e.g., regional economic, or optional). HSDR benefits represent the protection against storm damage to the beach, upland property, and infrastructure. These benefits accrue to the owners of beachfront property. Recreational benefits accrue to beach visitors who enjoy the beach. Regional economic benefits accrue to businesses, such as restaurants, lodging, food and beverage, gasoline, and gift shops that provide goods and services to beach visitors. Other benefits are cited less frequently. Beach nourishment may also be a habitat restoration technique which benefits wildlife such as sea turtles and nesting shorebirds.

Conservation Threats

Two threats are covered in this section under the collective heading of Management of Nature–beach nourishment and impoundments. Beach nourishment was identified as a key source of stress to several marine habitats in Florida, especially in the south and central parts of the state. Stresses caused by beach nourishment were identified in threats workshops as habitat disturbance; altered water quality, habitat destruction, and altered species composition (see Chapter Florida's Approach to Meeting the Eight Required Elements). Experts noted that some impacts of beach nourishment are incompletely known due to the high natural variability in beach and nearshore communities and the poor understanding of this natural variability.

Impoundments were identified as an important source of stress to Mangrove Swamp and Salt Marsh habitat, primarily along the east-central coast of the state. Impoundments were constructed extensively in this area as a mechanism to control saltwater mosquitoes as the area developed. Impoundments, especially those completely cut off from adjacent coastal waters, are a source of habitat fragmentation, altered hydrologic regime, altered water quality, altered structure, altered species composition, and habitat disturbance. Substantial efforts have been made in recent years to reconnect impoundments to adjacent coastal waters. Doing so greatly enhances wildlife and habitat values while preserving the ability to effectively manage mosquitoes as needed.

Beach nourishment and impoundments were identified as threats to the following marine/estuarine habitats. Habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Bivalve Reef
- Coastal Tidal River or Stream
- Coastal Strand
- Coral Reef
- Hard Bottom
- Inlet
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

The actions identified to abate the stresses caused by beach nourishment were based on desired outcomes identified in the threats workshops (See Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize:

- Thoroughly understanding longshore sediment transport in Florida and how it is affected by inlets and structures
- Understanding the effects of beach nourishment on the environment, quantifying these affects, ascribing an economic value and providing natural resources with an appropriate level of protection, and abating the negative effects of nourishment
- Maintaining and enhancing population levels of wildlife potentially affected by beach nourishment activities including sea turtles that nest along Florida beaches
- Reducing the need to nourish beaches through restoration of beach habitat (e.g., dunes, etc.) as a means of stabilization
- Discouraging rebuilding in high-risk coastal areas
- Mitigating the effects to marine/estuarine habitats and associated wildlife resulting from beach nourishment that cannot be avoided

The actions identified to abate the stresses caused by impoundments were based on desired outcomes identified in the threats workshops. The following outcome was developed: Encourage the reconnection of all existing salt marsh/mangrove impoundments to the tide and manage them to maximize resource values while maintaining adequate levels of mosquito control.

Highest ranked actions identified for abating this source of stress focus on:

- Acquiring coastal lands for habitat protection to reduce the need for nourishment
- Managing public coastal lands in a manner that reduces the need for nourishment
- Increasing the state's land acquisition program, Florida Forever, to accommodate a specific coastal zone acquisition component
- Support increasing the funding to improve and expand impoundment management to enhance ecological values

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Establish a statewide data clearinghouse or public-private partnership to house all beach nourishment project monitoring results to facilitate the evaluation of cumulative project effects and future project design (i.e., lessons learned). Review the economics of projects including natural resource values pre and post project construction. Synthesize the data collected from all projects.	M	M	M
M	Create data management infrastructure for statewide wildlife conservation including data management, QA/QC, archiving and storage, protocol development, maintenance and fulfilling information requests. (Overarching Recommendation)	M	M	M

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Inform the public about the long-term public cost required for insuring beachfront property damaged as a result of climate variability, storms, and beach dynamics. Explore partnership between FEMA, JUA and non-governmental organizations (NGOs) (NGOs may be the most appropriate lead).	VH	M	M
M	Encourage beach resorts to protect turtle nests through awareness and education programs and by providing logistical support for beach assessment teams.	H	M	L
M	Implement an outreach program targeted at informing the general public about the pros, cons and tradeoffs related to beach nourishment projects. Provide funding for organizations to provide awareness support.	M	M	L

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Acquire coastal lands for habitat protection to reduce the need for nourishment and to facilitate impoundment reconnection.	VH	VH	VH
H	Increase the state's land acquisition program, Florida Forever, funding to accommodate a specific coastal zone acquisition component like the "Blue Acres" coastal land acquisition program in New Jersey (http://www.state.nj.us/dep/greenacres/blue.htm). Acquire more land where sea turtles are nesting and are known to nest.	H	H	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Manage acquired lands in a manner that reduces the need for nourishment.	VH	VH	H
H	Develop a statewide monitoring protocol (the analytical framework and adaptive management) to assess ecological effects related to beach nourishment projects similar to BACI (before-after-control-impact design). Include affects to both beach (including soft bottom communities, etc.) and offshore habitats including fish communities. Examine the protocols currently in place and possibly expand to other impacted biological communities (include Hard Bottom, Submerged Aquatic Vegetation, turtle/bird nesting areas, etc.).	VH	M	L
H	Increase funding to improve and expand impoundment management to enhance ecological values. Funding ideas: partner with sport fishers and sportfishing groups. Potential partners include mosquito control and water management districts.	H	M	H
M	Investigate and develop, as necessary, sand management technologies to avoid using beach nourishment. Develop statewide standards for sand management.	M	M	M
L	Establish a statewide beach dune restoration protocol for nourishment projects based on existing programs, if they exist.	M	L	L
L	Identify and prioritize beach dune restoration projects where it is possible and warranted. Be proactive as a means of avoiding the need for beach nourishment where possible. Potential partner is the USACE.	M	M	M

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Create a system for projects and future nourishment permits which avoids previous negative effects; the system includes integrating proposed nourishment projects with a state database, and encourages mitigation for any unavoidable negative effects.	H	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Investigate options for encouraging development in storm damaged communities that lies outside of high risk areas.	L	M	H

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Conduct modeling and other quantitative analyses to understand the long-term patterns of climate variability and sea-level rise, the cost of sand mining, location of sand sources, benefits, and effects on ecological condition and economic value of the resources. Analyze cumulative effects of existing nourishment projects and effects from structures on sand transport. The USACE-ERDC may be the appropriate partner to conduct these analyses.	M	M	VH

Nutrient Loads–Agriculture

Conservation Threats

Nutrient loads from agricultural sources was identified as one of several important sources of altered water quality in aquatic and wetland habitats statewide, and was implicated as the source of many secondary stresses (e.g., altered species composition, altered community structure, etc.) as well. This source includes nutrient loading from row and field crop agriculture where nutrients, primarily nitrogen and phosphorus, are applied as fertilizers, as well as nutrient loading due to the concentration of wastes in dairy, poultry, and other confined animal operations. Nutrient loading to surface and ground waters from agricultural sources typically originates as non-point source pollution, and is carried to aquifers and surface water bodies in runoff or as recharge from agricultural fields or facilities.

This source of stress was identified as a threat to the following terrestrial habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Calcareous Stream
- Coastal Tidal River or Stream
- Cypress Swamp
- Freshwater Marsh and Wet Prairie
- Natural Lake
- Reservoir/Impoundment
- Softwater Stream
- Spring and Spring Run

Conservation Actions

Conservation actions to abate nutrient loads from agriculture were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize preventing eutrophication of water bodies by developing and implementing water quality criteria that limit nutrient loading based on the tolerance of specific wetland and aquatic habitats in Florida and reducing nutrient loads through improved technology and management practices, especially for nutrient loading to groundwater.

Highest ranked actions identified for abating this source of stress focus on:

- Refining and expanding the development of habitat-specific numeric nutrient criteria aimed at preventing negative effects to natural ecosystems
- Developing new agricultural standards (and evaluating and refining existing practices) specifically designed to meet numeric nutrient criteria

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Improve the priority setting and coordination for federal and state granting, loan and cost-share programs that could address nutrient loading reduction priorities in certain high value landscapes, e.g., springs, Everglades, coastal systems (for example, the Florida Department of Environmental Protection [FDEP] administered 319 and other funding programs such as 6217 CZMA, Natural Resource Conservation Service programs).	M	M	L
L	Create a new program "Ecologically Friendly Farming" in Florida - led by IFAS in cooperation with FL Dept of Agriculture and FDEP with a goal of minimizing nutrient loads in runoff as well as pesticide/herbicide use and improving the position of agriculture in Florida's economy.	H	L	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create a stream/wetland buffer subsidy program for agriculture using federal Farm Bill or other existing federal programs supplemented by state funds. For example, pay farmers an annual "rental" fee not to grow in the buffer on a yearly basis. Guarantee them their "loss of productivity" value.	H	M	H
M	Create incentives for native vegetative buffers set at a minimum threshold for reducing nutrient loads for all aquatic habitats and karst features (including karst depressions in agricultural fields). Form a partnership to identify funding sources within existing cost-share and granting programs like CWA Section 319 Grant Program.	M	M	H
M	Work with user groups to identify and create subsidies to enable agriculture to implement ecologically friendly agriculture in Florida.	M	M	H

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Create an education program quantifying the full costs, including the costs of any natural resource degradation, resulting from agricultural production without nutrient BMPs.	M	L	M

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage the funding the proposed Rural and Family Lands Protection Act (http://www.fl-dof.com/forest_management/fm_pdfs/RandF_landprotection_act.pdf) to acquire conservation easements to promote appropriate low impact agriculture, especially in karst areas, and ranches with substantial acreage of native or semi-native range or other sensitive landscapes.	H	M	VH
M	Create an easement and restoration program (perhaps within the Rural and Family Lands program) to convert higher impact (nutrient loading) agriculture into lower impact (nutrient loading) agriculture and establish buffers.	H	M	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Build Advanced Wastewater Treatment facilities or equally effective alternatives to treat agricultural runoff to certain "high value" landscapes, (e.g., springs, Everglades, coastal systems). Encourage development of new funding sources as necessary to implement this strategy.	M	M	VH

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Develop voluntary standards for agricultural nutrient effects to groundwater.	M	L	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Fund and implement a research program to determine the efficacy of agricultural standards to meet ecological targets/numeric nutrient criteria for different landscapes, different regions of the state, different nutrients (e.g., P vs. N)	H	H	H
M	Fund IFAS research and development of "zero-loading technologies" in concentrated animal feeding operations and waste operations.	H	M	H
M	Fund a research program to identify certain types of agriculture and agricultural practices that are more ecologically compatible with specific habitats and facilitate their development through land use planning and funding/subsidies (including silviculture and ranching).	M	M	H
L	Research which agricultural products are ecologically friendly and assess whether consumer will pay more for the "ecologically friendly" produce to offset the reduction in production and/or increased production costs.	H	L	M
L	Research how agriculture can transfer the full cost of standards implementation to the marketplace.	M	L	M

Nutrient Loads–Urban
(Terrestrial and Freshwater)

Conservation Threats

Nutrient loads from urban sources was identified as one of several important sources of altered water quality in freshwater habitats statewide, and was implicated as the source of many secondary stresses (e.g., altered species composition, altered community structure, etc.) as well. This source includes nutrient loading to ground and surface waters from residential fertilizer applications and wastewater treatment, especially septic systems. Nutrient loading to surface and ground waters from urban sources typically originates as non-point source pollution, and is carried to aquifers and surface water bodies in stormwater runoff or as groundwater recharge from developed areas.

This source of stress was identified as a threat to the following habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Cypress Swamp
- Freshwater Marsh and Wet Prairie
- Natural Lake
- Reservoir/Impoundment
- Softwater Stream
- Spring and Spring Run

Conservation Actions

Conservation actions to abate nutrient loads from urban sources were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). Outcomes for wetlands and freshwater habitats emphasize preventing eutrophication of water bodies by developing and implementing water quality criteria that limit nutrient loading based on the tolerance of specific wetland and aquatic habitats. Other outcomes include reducing nutrient loads, especially from lawn fertilizer applications and septic systems through improved technology and management practices, and promoting the conservation of the water quality of natural habitats.

Highest ranked actions identified for abating this source of stress focus on:

- Creating incentives for local government to work together to develop appropriate mechanisms to minimize the negative effects from excessive nutrients in wastewater
- Refining and expanding the development of habitat-specific numeric nutrient criteria aimed at preventing negative effects to natural ecosystems
- Reviewing Outstanding Florida Waters to determine if water quality has degraded

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Create incentives for local government to work together to develop appropriate mechanisms to minimize the negative effects from excessive nutrients in wastewater.	M	VH	VH
M	Encourage funding research, education and restoration activities related to nutrient impacted systems.	L	H	L
M	Assemble existing information on nutrient loading into one repository (e.g., Fill gaps, expand monitoring, and build on existing programs such as NERRs, NEPs, IMAP and CREMP.) (State suggested to take a leadership role).	H	M	M
M	Coordinate Southeast Florida Coral Reef Initiative (SEFCRI) with the statewide effort to capture economies of scale. See http://www.dep.state.fl.us/coastal/programs/coral/	H	M	M
M	Integrate the FWC into the numeric nutrient criteria development process to ensure that criteria are protective of aquatic wildlife. This could include appointment of a representative to the Technical Advisory Council (TAC) for numerical standard development.	VH	L	M
L	Compile a comprehensive list of agencies and other entities and all ongoing/planned programs, projects and activities that address land-based sources of nutrients that enter coastal waters (expanded SEFCRI and land based sources of pollution (LBSP). Identify gaps, problems and resource needs associate with ongoing projects and activities.	H	L	L
L	Identify the links between pollution and marine/estuarine systems/communities (expanded SEFCRI/LBSP). Convene a working group to identify how to proceed.	M	L	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create voluntary incentives for implementing nutrient removal technologies for new septic systems and retrofitting old septic systems in low density, highly vulnerable areas.	H	M	VH

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Educate and inform all stakeholders including the general public concerning the value and importance of Florida's marine and estuarine systems, land-based sources of pollution, pollution effects on marine/estuarine resources and the strategies recommended to address identified problems. (i.e., expanded SEFCRI/LBSP)	M	M	M
M	Continue and expand the cooperative campaign to educate the public about the "greening" of Florida's waters. (Potential partners are Water Management Districts, IFAS, Florida Department of Environmental Protection (FDEP), non-governmental organizations and the fertilizer industry)	VH	L	M
M	Develop water quality curriculum in all turf grass management education programs. (IFAS potential lead)	VH	L	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Expand SEFCRI/LBSP statewide and to include all marine/estuarine habitats. (see below)	VH	M	M
M	Design activities to reduce nutrient loading into coastal waters. Research and identify standards (i.e., BMPs) that appropriately and effectively address the identified high priority sources of pollution. Develop specific projects for designated hot spots (engineering and management actions). Expanded SEFCRI/LBSP.	M	M	M

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Cooperatively develop more effective urban standards for growth management planning purposes that reduce nutrient loading in natural systems.	M	H	H
H	Review Outstanding Florida Waters (OFW) http://www.dep.state.fl.us/water/wqssp/ofw.htm water and sediment quality to determine whether water quality in OFWs has degraded. (Potential lead is the Office of Program Policy and Government Analysis).	VH	M	M
L	Expand and increase funding for TMDL basin load modeling concept to OFWs, Aquatic Preserves, first and second order magnitude springs, and "Florida Natural Areas Inventory conservation managed areas".	L	M	VH

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Work cooperatively with FDEP and DOF to monitor and minimize nutrient loading from development in support of OFW standards.	M	VH	H

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Fund research to more fully understand the relationship between nutrients and the health of the marine and aquatic ecosystems.	H	M	VH
M	Characterize existing condition of marine and estuarine systems in Florida by: assembling and assessing existing information and establish a long-term monitoring program for marine and estuarine systems where none currently exists (Expanded SEFCRI/LBSP Team).	H	M	H
M	Fund research on the development of nutrient standards (BMPs) designed to benefit fish and wildlife and their habitats more directly (i.e., rather than simply reducing nutrient loading or concentrations by X%).	M	M	H
M	Fund and implement a research program to determine the efficacy of urban standards (BMPs) to meet ecological targets/numeric nutrient criteria for different landscapes, different regions of the state, different nutrients (e.g., P vs. N)	M	M	VH
M	Quantify, characterize and prioritize the land-based sources of pollution that need to be addressed based on which have known or suspected effects to marine and estuarine systems/communities. Develop a set of mass balance budgets for specific geographic areas to assess nutrient loads. (Expanded SEFCRI/LBSP)	M	M	M
M	Research potential nutrient loading effects associated with wastewater reuse.	VH	L	M

Nutrient Loads–Urban
(Marine)

Conservation Threats

Nutrient loading from urban sources was identified as a pervasive threat to many marine habitats statewide. Many estuarine and near-shore habitats are particularly vulnerable to changes in primary production, changes in food webs, and possibly synergistic interactions with other threats (e.g., harmful algal blooms) as a result of excessive nutrient loading.

This source of stress was identified as a threat to the following habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Bivalve Reef
- Calcareous Stream
- Coastal Strand
- Coastal Tidal River or Stream
- Coral Reef
- Mangrove Swamp
- Pelagic
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment

Conservation Actions

Conservation actions to abate nutrient loads from urban sources were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize better understanding nutrient loading into Florida's marine and estuarine systems and related impacts, preventing eutrophication of water bodies by developing and implementing water quality criteria that limit nutrient loading based on the tolerance of specific marine and estuarine habitats in Florida, reducing nutrient loads from ocean outfalls, septic systems, and deep-well injection through improved technology and management practices, and ensuring that local land-use actions are protective of the water quality of natural habitats.

Highest ranked actions identified for abating this source of stress focus on:

- Expanding the recommendations made by the Land Based Sources of Pollution Issue Team of the Florida Department of Environmental Protection's Southeast Florida Coral Reef Initiative (http://www.dep.state.fl.us/coastal/programs/coral/) statewide to include all estuarine and nearshore areas of the state

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Assemble existing water quality data and establish a long-term status and trends water quality monitoring program for coastal and offshore waters throughout Florida. Assess the data and identify data gaps. Select the ecological factors that will be used to assess water quality data and establish a long-term status and trends in specific marine and estuarine communities throughout the state. (Expand Southeast Florida Coral Reef Initiative (SEFCRI) recommendations on Land Based Sources of Pollution-LBSP. http://www.dep.state.fl.us/coastal/programs/coral/)	H	M	VH
M	Assemble existing information into one repository; fill gaps, expand monitoring, build on existing programs such as NERRs, NEPs, EMAP and CREMP. (State potential leadership role).	H	M	M
M	Coordinate SEFCRI with the statewide effort to capture economies of scale.	H	M	M
L	Compile a comprehensive list of agencies and other entities and all ongoing/planned programs, projects and activities that address land-based sources of nutrients that enter coastal waters (expanded SEFCRI/LBSP). Identify gaps, problems and resource needs associate with ongoing projects and activities.	H	L	L
L	Identify the links between pollution and marine/estuarine systems/communities (expanded SEFCRI/LBSP). Convene a working group to identify how to proceed.	M	L	M

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Educate and inform all stakeholders including the general public concerning the value and importance of Florida's marine and estuarine systems, land-based sources of pollution, pollution effects on marine/estuarine resources and the strategies recommended to address identified problems. (Expanded SEFCRI/LBSP).	M	M	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Expand SEFCRI recommendations on LBSP statewide and to include all marine/estuarine habitats. (see below)	VH	M	M
M	Design activities to reduce nutrient loading into coastal waters. Research and identify standards that appropriately and effectively address the identified high priority sources of pollution. Develop specific projects for designated hot spots (engineering and management actions). (Expanded SEFCRI/LBSP).	M	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Characterize existing condition of marine and estuarine systems in Florida by: assembling and assessing existing information and establish a long-term monitoring program for marine and estuarine systems where none currently exists (Expanded SEFCRI/LBSP).	H	M	H
M	Quantify, characterize and prioritize the land-based sources of pollution that are known or are suspected to effect marine and estuarine systems/communities.	M	M	M

Roads, Bridges and Causeways

Conservation Threats

Roads were identified as one of the most critical sources of many of the stresses identified for terrestrial, freshwater, and marine systems in Florida. Not only do roads have direct effects on habitat destruction, fragmentation, sediment movement, hydrological and fire regimes, etc., but they also exacerbate development and conversion effects. Thus the ecological effects of roads far exceed their footprint across habitats.

This source of stress was identified as a threat to the following habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Bivalve Reef
- Bottomland Hardwood Forest
- Calcareous Stream
- Coastal Strand
- Coastal Tidal River or Stream
- Coral Reef
- Cypress Swamp
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Grassland/Improved Pasture
- Hard Bottom
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Industrial/Commercial Pineland
- Inlet
- Mangrove Swamp
- Natural Pineland
- Pelagic
- Pine Rockland
- Salt Marsh
- Sandhill
- Scrub
- Seepage/Steephead Stream
- Softwater Stream
- Submerged Aquatic Vegetation
- Tidal Flat
- Tropical Hardwood Hammock

Conservation Actions

Outcomes on which the conservation actions are based attempt to minimize indirect effects to habitats and wildlife caused by fragmentation of habitats and water impoundment as well the more direct impacts of roadkill. Reduction of impacts is only likely with high-level cooperation between the transportation infrastructure and “green infrastructure” (professional planners for a strategically managed network of parks and green spaces, see Chapter Glossary of Terms). Outcomes addressing placement and design of new roads and retrofitting of old roads with bridges and underpasses were articulated. On public lands, experts suggested that all roads be re-evaluated relative to ecological considerations.

Highest ranked actions identified for abating this source of stress focused on:

- Support multi-agency review and coordination of the planning and permitting process for roads, bridges, and causeways, i.e., the Florida Department of Transportation’s

Efficient Transportation Decision Making (ETDM) process (http://etdmpub.fla-etat.org/website/PublicInfo/help/ETDM.pdf)

- Multi-agency and partner adoption of the "Cooperative Conservation Blueprint" process (see Chapter Florida's Strategic Vision) that can be used for transportation planning
- State-sanctioned approach for identification of areas where new roads may or may not be constructed and development of criteria for best protecting wildlife and supporting smart growth where road expansion is likely
- Acquisition of areas identified through the "Cooperative Conservation Blueprint" (see Chapter Florida's Strategic Vision) process to maintain critical connectivity of wildlife habitat
- Defining standards (BMPs) for vegetation along rights-of-way to reduce effects to sensitive habitats along those corridors
- Increasing efforts to reduce roadkill effects through effective use of the new ETDM approach

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Improve inter-agency coordination in the process for road, bridge and causeway construction and design.	M	H	L
M	Incorporate any increased conservation management costs associated with new road construction that are incurred by adjacent land managers into the road mitigation budget and compensate the management budget accordingly.	H	M	H
M	Promote coordination between state agencies and federal agencies for permit review and planning.	H	M	M
L	Promote participation in local/regional/state transportation planning, routine communication with county commissioners and availability of the Efficient Transportation Decision Making (ETDM) website http://etdmpub.fla-etat.org/ for opportunities to become involved early in the decision-making process.	H	L	L
L	Support better coordination between wildlife conservation experts within agencies and transportation planners (e.g., participation in conferences, meetings etc.)	M	L	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create incentives for improving the capacity and ecological design features of existing roads instead of creating new roads.	H	M	H
M	Create mitigation projects or develop other funding sources that would create strategically located corridors for wildlife crossing on transportation corridors.	H	M	VH
L	Provide incentives to encourage the development and use of alternative modes of transportation.	H	L	VH

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Educate the public about the conservation benefits of removing or redesigning roads, bridges and causeways and encourage participation of transportation planners in "green infrastructure" training.	H	M	M
M	Fund creation and placement of signage to identify wildlife crossings.	VH	L	L
L	Develop and implement public outreach program to inform public about the ecological effects from roads, bridges and causeways to the wildlife and habitat and solutions to those effects.	H	L	L

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Strategically acquire land that crosses existing and proposed road corridors to maintain or enhance connectivity for wildlife, with highest priority for acquisition given to critical linkages.	VH	H	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Promote that crossings for wildlife accompany any expansion and bridge improvement projects at identified wildlife-vehicle collision hotspots in the existing road network.	H	M	M
M	Fund the retrofitting of existing roads with wildlife crossings where appropriate.	M	M	H
M	Replace causeways with bridges where appropriate (e.g., where significant conservation benefits will result), and mitigate for any related recreational losses.	M	M	VH
L	Improve management of pollution discharge from existing roads and causeways to adjacent waters. Use the most effective technologies available to capture and treat runoff.	M	L	VH
L	Evaluate use of corridors for sheetflow and wildlife in places where roads, bridges and causeways have disrupted or eliminated natural corridors.	M	L	M
L	Improve habitat values of roads, bridges, and causeways and, where necessary, divide use and non-use areas to better protect sensitive areas.	M	L	M

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Ensure that the ETDM includes technical information about sensitive habitats and roadkill hotspots so that these data are incorporated into the road siting, design, and construction process at an early stage.	VH	M	M
H	Develop corridor management plans for all roads through ecologically-sensitive areas. Include roadside management criteria (use of vegetation that is non-invasive, soil stabilization, restrictive mowing/trimming specifications, etc.).	VH	M	L
M	Develop incentives for an integrated planning process that ensures compatibility between transportation and conservation planning in local governments (comprehensive land use plans and annual transportation plans) at an early stage.	H	M	M
M	Develop vehicle access plans that reflect and maintain the ecological values and context in public area management plans. These plans should include specifications for implementation and monitoring, and thresholds that would trigger additional management actions.	H	M	L

M	Expand Florida Department of Transportation's (FDOT) "Green Book" (and associated GIS and CAD/CAM tools) to include a suite of road, bridge, and causeway design standards, practices, and design measures necessary to minimize wildlife-road interactions (including a land bridge design like those on trans-Canadian Highway).	H	M	M
M	Implement the Intelligent Transportation System (http://www.its.dot.gov/) to increase the efficiency of the existing transportation system in Florida and reduce the need for new transportation infrastructure.	H	M	VH
M	Create partnerships between FDOT and other state and federal agencies in the planning and permit review elements of the regulatory process (Potential lead is ETAT: review team).	M	M	L
M	Link permit approval to implementation of standards for road, bridge, and causeway design and construction.	M	M	M
M	Develop interagency agreement for the evaluation of existing roads for potential closure and ecological restoration on public lands. Upgrades of roads should be carefully considered to minimize effects to wildlife and habitats.	M	M	L
L	Create incentives and develop guidelines for implementing unpaved road grading and maintenance standards into County codes.	M	L	M
L	Work with state and local transportation departments to ensure that road improvements in Okaloacoochee Slough and new state lands to reduce ecological effects of the roads.	L	M	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Investigate the feasibility of an interagency commission (including DCA, FDOT, FDEP, FNAI, the FWC, Turnpike Authority, USFWS) to articulate an agreed-upon network of areas where new roads should not be constructed and also would recommend most compatible corridors for future road expansion -- that best protects wildlife and supports smart growth.	H	VH	M
VH	Determine whether the "Cooperative Conservation Blueprint" (see Chapter Florida's Strategic Vision) process can be incorporated into the transportation planning process.	M	VH	L
M	Encourage the implementation of the waste removal option that causes the least ecological impact rather than the least expensive option when causeways are removed.	M	M	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Research and identify effective policy models for providing incentives for improving existing roadways. Do the same for design and construction of any new roads into/through natural lands and other undeveloped areas.	H	L	M
L	Survey ecological and hydrological losses to habitats and habitat shifts caused by construction of bridges and causeways on a regional scale.	H	L	M
L	Conduct baseline survey before and after road construction projects to determine resources lost to project.	M	L	M
L	Research and develop wildlife mortality thresholds linked to traffic volume.	M	L	L

Shoreline Hardening

Conservation Threats

Shoreline hardening was identified as a statewide source of stress leading to ecological stresses to marine and estuarine habitats, such as habitat destruction and altered species composition. As with many of the other sources discussed in this analysis, it is the cumulative impacts of this source that are most significant. Shoreline hardening typically takes place concurrently with coastal development and is expected to expand rapidly along with coastal development in Florida. Another factor that will likely increase use of shoreline hardening is sea level rise. As sea level increases, there will be a tendency to increase shoreline hardening to abate impacts on coastal properties.

This source of stress was identified as a threat to the following marine/estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Annelid Reef
- Beach/Surf Zone
- Coastal Strand
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Inlet
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Tidal Flat

Conservation Actions

Actions to abate the impacts of shoreline hardening were based on desired outcomes identified in actions workshops (See Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize abating the loss of intertidal habitat; protecting coastlines in their natural, dynamic state; restoring shorelines that have been "fixed" in place to a more natural, dynamic condition; stabilizing shorelines using natural vegetation and other natural methods; and informing new and existing residents about shoreline management issues and options, and ensuring that the cumulative impacts of shoreline hardening are taken into consideration.

Highest ranked actions identified for abating this source of stress focus on:

- Creating and funding a state program to provide technical assistance on shoreline management options to coastal homeowners
- Creating incentives for homeowners to use ecologically sound alternatives to shoreline hardening
- Training "frontline" agency staff on shoreline management options so that they may convey this knowledge to property owners seeking shoreline hardening permits, etc.
- Improving efforts to ensure compliance with existing shoreline hardening regulations

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create and fund a state program to provide technical assistance on shoreline management options to homeowners (e.g., Virginia program). Include information on shoreline management issues, the importance of coastal wetlands, shoreline management alternatives and costs and benefits of alternatives, including ecological costs and benefits. Fund a coordinator to determine regional differences in shoreline hardening alternatives, provide overall program oversight and track status and trends of shoreline hardening. Potentially align the proposed program to the Coastal Zone Management Program (http://coastalmanagement.noaa.gov/czm/) for access to funds for outreach, monitoring, city/county groups, other programs. Determine if additional media campaigns are necessary. Institute model programs at statewide level. Educate and fund additional extension agents to focus on shoreline hardening (NERR, SeaGrant).	H	M	M
M	Improve understanding of and compliance with existing environmental regulations.	L	H	H

Economic Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Promote the development of incentives to use ecologically responsible shoreline management techniques.	VH	L	L

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Provide technical expertise on fish and wildlife resources and the impact of shoreline management techniques on those resources.	H	M	M
M	Provide technical expertise on fish and wildlife resources in the development of educational materials on shoreline management techniques.	VH	L	L
M	Assist in a multi-agency review and revision of educational materials and standards on shoreline management techniques.	VH	L	L
L	Assist in the development of educational materials on ecologically responsible shoreline management techniques.	H	L	L
L	Promote media coverage recognizing riparian property owners who are ecologically responsible, (e.g., shoreline of the month)	H	L	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage and support the development of statewide standards of the Environmental Resource Permitting process.	M	M	H
L	Include minimizing of shoreline hardening in growth management planning.	L	M	VH

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Improve understanding of and compliance with shoreline hardening regulations.	L	H	M
L	Assist in the revision of national flood insurance programs and provide technical expertise on fish and wildlife resources for areas of high sediment transport and unstable shorelines.	L	M	H
L	Provide technical expertise on fish and wildlife resources in coastal development management plans.	L	M	M

Surface Water Withdrawal/Diversion

Conservation Threats

Surface water diversion and withdrawal was identified as one of several major sources of hydrologic alteration to terrestrial, wetland, and aquatic habitats throughout Florida. This source includes drainage or channelization of wetlands and other habitats for agricultural, urban, or silvicultural development purposes; consumptive withdrawal of water from surface sources such as lakes and streams; and "diversion" of rainfall that would otherwise recharge groundwater. Surface water diversion and withdrawal is considered a high-ranked source of stress statewide but, in terms of spatial extent of habitat affected, drainage impacts are more prevalent in south and central Florida. Diversion or withdrawal of surface water for consumptive uses is expected to increase in Florida in the next five to ten years as limits on groundwater withdrawals are reached.

This source of stress was identified as a threat to the following habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Bay Swamp
- Bivalve Reef
- Coastal Tidal River or Stream
- Cypress Swamp
- Dry Prairie
- Freshwater Marsh and Wet Prairie
- Hardwood Hammock Forest
- Hardwood Swamp/Mixed Wetland Forest
- Inlet
- Large Alluvial Stream
- Mangrove Swamp
- Natural Lake
- Natural Pineland
- Salt Marsh
- Softwater Stream
- Spring and Spring Run
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediments
- Tidal Flat
- Tropical Hardwood Hammock

Conservation Actions

Conservation actions to abate excessive surface water diversion and withdrawal were based on desired outcomes identified in threats workshops (see Chapter Florida's Approach to Meeting the Eight Required Elements). The actions emphasize preventing harm to natural habitats through limits on water allocation and withdrawal, restoring substantial acreage (or length) of drained wetlands and channelized streams, designing stormwater management systems to minimize hydrologic impacts to receiving water bodies, and decreasing the total amount of water consumed, especially for municipal purposes. Related actions associated specifically with the hydrologic impacts of water control structures are summarized in habitat chapters containing that source of stress.

Highest ranked actions identified for abating this source of stress focus on:

- Encouraging voluntary incentives for local governments to work together to reduce stormwater effects to vulnerable habitats
- Continuing support for appropriate minimum flows and levels for Outstanding Florida Waters important for the conservation of wildlife

- Developing annual restoration targets and establishing a new grant program to fund targeted stream and wetland restoration projects

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Continue funding projects that address ecological restoration within the Comprehensive Everglades Restoration Program and Restoration Coordination and Verification plans.	VH	H	VH
VH	Continue funding and expand the Kissimmee River Restoration and Headwaters Revitalization Projects to meet wildlife conservation needs.	VH	H	VH
VH	Encourage voluntary incentives for local governments to work together to form regional stormwater authorities and utilities in areas that include vulnerable habitats.	M	VH	VH
H	Encourage annual wetland and stream restoration targets (in acres of wetlands and/or linear miles of stream) for public lands.	M	H	VH
M	Develop voluntary incentives to implement restoration of prior hydrologic alterations (that would improve wildlife habitat and groundwater recharge where appropriate) on priority public lands (e.g., Three Lakes, Kissimmee Prairie, Tosohatchee). Prioritize state conservation lands, wetlands, and water bodies in need of restoration.	M	M	VH
L	Create an extension field-officer position focused on working with private landowners on stream and wetland restoration issues, including identifying funding sources.	H	L	M

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Create incentives for local governments to develop appropriate mechanisms to minimize stormwater effects to natural aquatic habitats.	M	M	H
L	Give highest priority to cooperative funding for projects that better utilize demand reduction and "wasted" water (e.g., avoided-use water, reclaimed wastewater, irrigation water, gray water) as a source of "new" water rather than turning to alternative sources (e.g., desal, ASRs). (Water management districts the suggested lead)	H	L	L
L	Support implementation of the recommendations of the April 2002 Florida Water Conservation Initiative report (http://www.dep.state.fl.us/water/waterpolicy/pubs.htm).	M	L	H
L	Develop voluntary incentives for private-sector actions that significantly contribute to stormwater reduction and increased recharge from existing developed areas.	M	L	H

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Encourage that every state land management plan have an element addressing hydrologic restoration in the context of the whole watershed scale.	H	M	M
M	Fund and develop a comprehensive ditch restoration program to survey and evaluate the existing network of ditches, and strategically fund (i.e., State Wildlife Grants, Water Management Districts (WMD), federal match, FDOT, counties) activities that would decrease the spatial extent and cumulative impacts of this network. For example, water control structures that could be added to existing ditches/canals to raise the water table (e.g., where control elevation is set too low) and significantly improve surface wetlands.	M	M	VH

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Continue support for appropriate minimum flows and levels (MFLs) that are protective of sensitive water bodies (e.g., Outstanding Florida Waters) important for the conservation of wildlife.	L	VH	M
M	Encourage interagency coordination for review and evaluation of MFLs.	M	M	L
M	Continue to support measures that conserve water, and increase the use of reclaimed water, to minimize impacts to natural resources.	M	M	L
L	Develop incentives to retrofit stormwater management systems (e.g., retention ponds) in grandfathered urban and commercial developments.	M	L	M

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Calculate ecosystem services and water/cost savings provided by protected lands within each surface water basin and establish a formula that relates these services and savings to flows and levels and sustains these flows and levels through a reservation that removes this water from the allocation process.	M	M	M
M	Fund research to aid development of stormwater management systems that benefit and conserve fish and wildlife resources.	VH	L	L
L	Fund and support research on the minimal requirements of the hydrological conditions and natural variable range of aquatic habitat and species.	H	L	M

Surface and Groundwater Withdrawal

Conservation Threats

Surface and groundwater withdrawal are critical threats to Florida's marine and estuarine habitats, many of which are highly dependent on regular (or seasonal) input of fresh water to sustain ecological functioning. Diversion and withdrawal of water alters freshwater flows to these habitats, resulting in changes to salinity, water temperature, and other water chemistry characteristics that often serve as ecological cues to marine wildlife. Coastal habitats such as Mangrove Swamp and Salt Marsh are vital producers of nutrients for the entire marine and estuarine system. A key to maintaining this productivity is maintaining adequate flows of fresh water to coastal areas. Flow of fresh groundwater (both diffuse and from submarine springs) is being recognized as critically important in sustaining vital ecological processes, including soil and water salinity regimes, delivery of nutrients, and possibly preventing outbreaks of parasites and pathogens, that allow fish and invertebrate species to survive during the dry season, especially during droughts.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Bivalve Reef
- Coastal Tidal River or Stream
- Inlet
- Mangrove Swamp
- Salt Marsh
- Submerged Aquatic Vegetation
- Subtidal Unconsolidated Marine/Estuary Sediment
- Tidal Flat

Conservation Actions

Conservation actions to abate the threat posed by surface and groundwater withdrawals were based on desired outcomes that included restoring appropriate flow regimes, ensuring key coastal habitats maintain their productivity, and reducing human demand for freshwater resources (see Chapter Florida's Approach to Meeting the Eight Required Elements).

Highest ranked actions identified for abating this source of stress focus on:

- Acquisition of lands vital for freshwater recharge
- Implementation of water conservation measures
- Restoring appropriate flow regimes to coastal habitats

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Promote and build partnerships with the agriculture community to implement new technologies in water conservation.	H	H	M

M	Support the implementation of the FDEP's Springs Task Force 2000 report recommendations. Assess support for the report revision, in progress.	H	M	VH
L	Build institutional capacity that builds support and identifies funding for small, non-release dam removal (e.g., antiquated, low-head dams).	M	L	L

Economic and Other Incentives:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Provide technical expertise (example: mobile irrigation labs) to agriculture for onsite water audits and water conservation improvements.	H	M	M

Education and Awareness:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Promote municipal and industrial water conservation measures statewide.	H	M	M
M	Coordinate outreach efforts for agricultural water conservation.	H	M	M

Land/Water Protection:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Acquire land critical to watershed recharge of springs.	H	VH	VH

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Characterize and restore appropriate salinity regimes in estuarine and coastal tidal streams.	M	M	VH
L	Support small dam removal (non-water release).	M	L	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Limit interbasin water transfer.	H	H	L
H	Improve protection of submarine springs.	H	H	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Explore alternative technology for additional freshwater needs.	M	L	M
L	Research effects of ponds (small impoundments/no-release/passive) on surface water flow and groundwater recharge.	M	L	M
L	Research alternative water control mechanisms that serve same purposes as small, non-release ponds.	M	L	L

Vessel Impacts

Conservation Threats

Vessel impacts were identified as a threat primarily to benthic habitats, although some nearshore vegetative communities can also be impacted. This threat relates to larger vessels such as cruise and merchant ships. Damage from small, recreational boats is addressed in the section on incompatible recreational activities. The most prominent impact to benthic habitats is physical damage to Coral Reef and Hard Bottom habitats resulting from vessels running aground. Damage from anchors can have a cumulative impact on benthic habitats where this practice is done on a regular basis. Additionally, waste discharges from vessels can contaminate coastal habitats and species. Releases of ballast water from ocean-going vessels, a major pathway for introduction of invasive animals in the marine environment, is addressed in the statewide section on Invasive Animals.

This source of stress was identified as a threat to the following marine and estuarine habitats. Additional habitat-specific threats are found in the Chapter Habitats.

- Beach/Surf Zone
- Coastal Tidal River or Stream
- Coral Reef
- Hard Bottom
- Inlet
- Salt Marsh
- Submerged Aquatic Vegetation
- Tidal Flat

Conservation Actions

Outcomes for abating the threat of vessel impacts focus on the need to ensure that ship anchorages are not sited over sensitive areas and to reduce the probability that vessels run aground. The cumulative impact of continued vessel traffic and mooring on marine and estuarine communities needs to be fully understood, and restoration of habitat functions should be a priority. The most important outcome is the prevention of vessel impacts in the first place.

Highest ranked actions identified for abating this source of stress focused on:

- Improving the vessel grounding damage remediation program
- Developing a vessel-anchoring management plan

The following actions, organized by action type, were identified to abate this threat:

Capacity Building:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Create an interagency team to review vessel impacts and develop solutions.	M	L	M

Land/Water/Species Management:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
VH	Establish a marine/estuarine restoration trust fund with support from sources, including: fines, anchorage fees, waste or fuel tax, port usage fee, etc as appropriate.	M	VH	H
M	Develop a passive warning system for vessels to alert operators of sensitive or danger zones (shallows, reefs).	M	M	H
M	Provide technical expertise on fish and wildlife resources in the development of anchorage and mooring plans for ecologically sensitive areas	M	M	M
M	Improve identification of appropriate anchorage and mooring areas and improve education on appropriate anchorage techniques to reduce damage to ecologically sensitive areas.	M	M	M
L	Assist in the revision of national flood insurance programs and provide technical expertise on fish and wildlife resources for areas of high sediment transport and unstable shorelines.	H	L	H
L	Encourage ports to use best available technology wharf tenders to protect wildlife resources.	H	L	L

Planning and Standards:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
H	Provide technical expertise on fish and wildlife resources in the development of port anchorage management plans.	M	H	M

Policy:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
L	Encourage and support implementation of improved wastewater treatment protocols for all vessels in state waters.	L	M	H
L	Explore options and alternative methods for marine pollution protection.	M	L	L

Research:

Overall Rank	Action	*Feasibility*	*Benefits*	Cost
M	Research and identify effective restoration methodologies for marine habitats.	M	M	H
L	Assemble information on vessel impacts to marine mammals.	M	L	L
L	For bulk shipments, examine the reduction of product loss from vessels.	L	L	L

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References/Literature Cited

Abell, R., D. M. Olson, E. Dinerstein, P. Hurley, J. T. Diggs, W. Eichbaum, S. Walters, W. Wettengel, T. Allnutt, C. Loucks and P. Hedao. 2000. Freshwater ecoregions of North America: a conservation assessment. Island Press. Washington, D.C., USA.

Aipanjiguly, S., S. K. Jacobson and R. Flamm. 2003. Conserving manatees: Knowledge, attitudes, and intentions of boaters in Tampa Bay, Florida. Conservation Biology 17:1098-1105.

Ajzen, I. and M. Fishbein. 1980. Understanding attitudes and predicting social behavior. Prentice-Hall Publishing. Upper Saddle River, New Jersey, USA.

Aldridge, C. L., M. S. Boyce and R. K. Baydack. 2004. Adaptive management of prairie grouse: how do we get there? Wildlife Society Bulletin 32:92-103.

Allen, J. A. 2001. A guide to bottomland hardwood restoration. U.S. Geological Survey, Biological Resources Division and U.S. Department of Agriculture, Southern Research Station. Reston, Virginia, USA.

American Farmland Trust. 2001. Nationwide voter poll on conservation and agriculture. [http://www.farmland.org/news_2001/071101_survey_main.htm.].

Bass, G., T. Hoehn, J. Couch and K. McDonald. 2004. Florida imperiled fish species investigation. Final report to the U.S. Fish and Wildlife Service. Florida Fish and Wildlife Conservation Commission, Blackwater Fisheries Research and Development Station. Holt, Florida, USA.

Bick, G. H. 2003. At-risk Odonata of conterminous United States. Bulletin of American Odonatology 7(3): 41-56.

Chen, E. and J. F. Gerber. 1990. Climate. Pages 11-34 *in* Myers, R. L. and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press. Orlando, Florida, USA.

Cox, J. A., R. S. Kautz, M. MacLaughlin and T. Gilbert. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Office of Environmental Services, Florida Game and Fresh Water Fish Commission. Tallahassee, Florida, USA.

Cox, J. A. and R. S. Kautz. 2000. Habitat conservation needs of rare and imperilled wildlife in Florida. Office of Environmental Services, Florida Game and Fresh Water Fish Commission. Tallahassee, Florida, USA.

Deyrup, M. and F. Franz (eds.). 1994. Rare and endangered biota of Florida. Volume IV. Invertebrates. University Press of Florida. Gainesville, Florida, USA.

Dimmick, R. W., M. J. Gudlin and D. F. McKenzie. 2002. The northern bobwhite conservation initiative. Miscellaneous publication of the Southeastern Association of Fish and Wildlife Agencies. South Carolina, USA.

Enge, K. M., B. A. Millsap, T. J. Doonan, J. A. Gore, N. J. Douglass, M. S. Robson and G. L. Sprandel. 2003. Conservation plans for biotic regions in Florida that contain multiple rare or declining wildlife taxa. Final report. Florida Game and Fresh Water Fish Commission. Tallahassee, Florida, USA.

Fishbein, M. and I. Ajzen. 1975. Beliefs, attitudes, intentions, and behavior: An introduction to theory and research. Addison-Wesley Publishing. Reading, Massachusetts, USA.

Florida Department of Agriculture and Consumer Services. 2003a. Best management practices for silviculture. Tallahassee, Florida, USA.

Florida Department of Agriculture and Consumer Services. 2003b. Silviculture best management practices 2003 implementation survey report. Tallahassee, Florida, USA.

Florida Department of Environmental Protection. 2004. Recreation and Parks information. [http://www.dep.state.fl.us/parks/]. Accessed September 2005.

Florida Fish and Wildlife Conservation Commission. 1999. Checklist of Florida's mammals. Tallahassee, Florida, USA.

Florida Fish and Wildlife Conservation Commission. 2002a. Checklist of Florida's birds. Tallahassee, Florida, USA.

Florida Fish and Wildlife Conservation Commission. 2002b. Letter from FWC Executive Director Allan Egbert to USFWS Director Steve Williams dated May 9, 2002, c/o Division of Federal Aid. Tallahassee, Florida, USA.

Florida Fish and Wildlife Conservation Commission. 2004. Objective-based vegetation management: a science-based approach for plant community management. Brochure. Tallahassee, Florida, USA.

Florida Game and Fresh Water Fish Commission and Nongame Wildlife Advisory Council. 1984. A plan of operation for a nongame wildlife program for Florida. Florida Game and Fresh Water Fish Commission. Tallahassee, Florida, USA.

Florida Natural Areas Inventory and Department of Natural Resources. 1990. Guide to the natural communities of Florida. Gainesville, Florida, USA.

Gilbert, C.R. (ed). 1992. Rare and endangered biota of Florida. Volume II. Fishes. University Press of Florida. Gainesville, Florida, USA.

Goldenhar, L. M. and C. M.Connell. 1993. Understanding and predicting recycling behavior: An application of the theory of reasoned action. Journal of Environmental Systems 22(1):9-103.

Gordon, D., D. Shaw, L. Geselbracht, E. Contreras and R. Torres. 2005. Problem and conservation action identification - terrestrial, freshwater and marine - using The Nature Conservancy's planning process. Final report. Florida Fish and Wildlife Conservation Commission Contract No. 04101 and 04122. The Nature Conservancy. Gainesville, Florida, USA.

Harris, L. D. and W. P. Cropper. 1992. Between the devil and the deep blue sea: implications of climate change for wildlife in Florida. Pages 309-324 *in* Peters, R. L. and T. E. Lovejoy, editors. Global warming and biological diversity. Yale University Press. New Haven, Connecticut, USA.

Hoctor, T. S., M. H. Carr and P. D. Zwick. 2000. Identifying a linked reserve system using a regional landscape approach: the Florida ecological network. Conservation Biology 14:984-1000.

Hoctor, T. S. 2003. Regional landscape analysis and reserve design to conserve Florida's biodiversity. Unpublished Ph.D. dissertation. University of Florida, Gainesville, Florida, USA.

Hoehn, T. 1998. Rare and imperiled fish species of Florida: a watershed perspective. Florida Game and Fresh Water Fish Commission. Tallahassee, Florida, USA.

Jue, S., C. Kindell and J. Wojcik. 2001. Florida Conservation Lands 2001. Florida Natural Areas Inventory. Tallahassee, Florida, USA.

Kale, H. W., Jr. and D. S. Maehr. 1990. Florida's birds: a handbook and reference. Pineapple Press, Inc. Sarasota, Florida, USA.

Kiker, C. F. and A. W. Hodges. 2002. Economic benefits of natural land conservation: case study of northeast Florida. Final report submitted to Defenders of Wildlife in support of sponsored project agreement. University of Florida, Institute of Food and Agricultural Sciences. Gainesville, Florida, USA.

Knight, G., A. Knight and J. Oetting. 2000. Florida Forever conservation needs assessment summary report to the Florida Forever advisory council. Florida Natural Areas Inventory. Tallahassee, Florida, USA.

Low, G. 2003. Landscape-scale conservation; a practitioner's guide. The Nature Conservancy. Arlington, Virginia, USA.

Madley, K. A., B. Sargent and F. J. Sargent. 2004. Development of a system for classification of habitats in estuarine and marine environments (SCHEME) for Florida. Report to the U.S. Environmental Protection Agency, Gulf of Mexico Program (Grant Assistance Agreement MX-97408100). Florida Marine Research Institute, Florida Fish and Wildlife Conservation Commission. St. Petersburg, Florida, USA.

Master, L. L., S. R. Flack and B. A. Stein. 1998. Rivers of life: critical watersheds for protecting freshwater biodiversity. The Nature Conservancy. Arlington, Virginia, USA.

Millsap, B. A., J. A. Gore, D. E. Runde and S. I. Cerulean. 1990. Setting priorities for the conservation of fish and wildlife species in Florida. Wildlife Monographs 111:1-57.

Moler, P. E. (ed). 1992. Rare and endangered biota of Florida. Volume III. Amphibians and reptiles. University Press of Florida. Gainesville, Florida, USA.

Moler, P. E. 1999. Checklist of Florida's amphibians and reptiles. Florida Fish and Wildlife Conservation Commission, Nongame Wildlife Program. Tallahassee, Florida, USA.

Moler, P. E. 2004. Personal communication e-mail messages pertinent to ranking of crayfish.

Muller, J. W., E. D. Hardin, D. R. Jackson, S. F. Gatewood and N. Caire. 1989. Summary report on the vascular plants, animals and plant communities endemic to Florida. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Technical Report No. 7. Tallahassee, Florida, USA.

Musick, J. A., S. A. Berkeley, G. M. Cailliet, M. Camhi, G. Huntsman, M. Nammack and M. L. Warren, Jr. 2000. Protection of marine fish stocks at risk of extinction. Fisheries 25(3):6-8.

Myers, R. L. 1990. Scrub and high pine. Pages 150-193 *in* Myers, R. L. and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press. Orlando, Florida, USA.

Myers, R. L. and J. J. Ewel (eds). 1990. Ecosystems of Florida. University of Central Florida Press. Orlando, Florida, USA.

National Marine Fisheries Service. 2000. Fisheries of the United States, 1999. Current Fishery Statistics Number 9900. Silver Springs, Maryland, USA.

Natural Resources Conservation Service. 2000. 1997 National Resources Inventory, revised December 2000. U.S. Department of Agriculture, Washington, D.C., USA.

Noss, R. F. and R. L. Peters. 1995. Endangered ecosystems: a status report on America's vanishing habitat and wildlife. Defenders of Wildlife. Washington, D.C., USA.

Ringold, P. L., J. Alegria, R. L. Czaplewski, B. Mulder, T. Tolle and K. Burnett. 1996. Adaptive monitoring for ecosystem management. Ecological Applications 6: 745–747.

Rodgers Jr., J. A., H. W. Kale II and H. T. Smith (eds). 1996. Rare and endangered biota of Florida. Volume V. Birds. University Press of Florida. Gainesville, Florida, USA.

Sheppard, B. H., J. Hartwick and P. R. Warshaw. 1988. The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. Journal of Consumer Research 15:325-343.

Smith, R. K., P. L. Freeman, J. V. Higgins, K. S. Wheaton, T. W. Fitzhugh, A. A. Das and K. J. Engstrom. 2002. Priority areas for freshwater conservation action: a biodiversity assessment of the southeastern United States. The Nature Conservancy. Arlington, Virginia, USA.

Stys, B., R. Kautz, D. Reed, M. Kertis, R. Kawula, C. Keller and A. Davis. 2004. Florida vegetation and land cover data derived from 2003 Landsat ETM+ imagery. Florida Fish and Wildlife Conservation Commission. Tallahassee, Florida, USA.

Taylor, C. A., M. L. Warren, J. F. Fitzpatrick, H. H. Hobbs, R. F. Jezerinac, W. L. Pflieger and H. W. Robison. 1996. Conservation status of crayfishes of the United States and Canada. Fisheries 21(4): 25-38.

U.S. Census Bureau. 2000. 2000 Census of Population and Housing. Washington, D.C., USA. [http://www.census.gov/main/www/cen2000.html]

U.S. Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Atlanta, Georgia, USA.

U.S. Fish and Wildlife Service and U.S. Census Bureau. 2002. National survey of fishing, hunting, and wildlife-associated recreation (2001).

Vowell, J. L. 2001. Using stream biomass to monitor best management practice effectiveness. Forest Ecology and Management 143:237-244.

Vowell, J. L. and R. B. Frydenborg. 2004. A biological assessment of best management practice effectiveness during intensive silviculture and forest chemical application. Water, Air, & Soil Pollution: Focus 4:297-307.

Walters, C. J. and R. Hilborn. 1978. Ecological optimization and adaptive management. Annual Review of Ecology and Systematics 9:157–188.

Webb, S. D. 1990. Historical biogeography. Pages 70-102 *in* Myers, R. L. and J.J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press. Orlando, Florida, USA.

Whitney, E., D. B Means and A. Anne. 2004. Priceless Florida: natural ecosystems and native vegetation. Pineapple Press, Inc. Sarasota, Florida, USA.

Wilhere, G. F. 2002. Adaptive management in Habitat Conservation Plans. Conservation Biology 16:20-29.

Glossary of Acronyms

A	Accidental
APAFR	Avon Park Air Force Range
ASR	Aquifer Storage Recovery
ATV	All-Terrain Vehicle
BACI	Before After Control Impact
BMP	Best Management Practices
CAD	Computer Aided Drafting
CAFO	Confined Animal Feeding Operations
CAM	Computer Aided Modeling
CAP	Conservation Action Plan
CERP	Comprehensive Everglades Restoration Plan
CEU	Continuing Education Unit
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CREMP	Coral Reef Evaluation and Monitoring Project
CRP	Conservation Reserve Program
CWA	Clean Water Act
CWCS	Comprehensive Wildlife Conservation Strategy
CZMA	Coastal Zone Management Act
DCA	Department of Community Affairs
DOH	Department of Health
DRI	Development of Regional Impact
DSG	Dynamic Solutions Group LLC
DSL	Division of State Lands
EIS	Environmental Impact Statement
EMAP	Environmental Monitoring and Assessment Program
EOC	Emergency Operation Center
EOG	Executive Office of the Governor
EQIP	Environmental Quality Incentive Program
ERDC	Engineer Research Development Center
ESWM	Ecologically Sustainable Water Management
ETAT	Environmental Technical Advisory Team
ETDM	Efficient Transportation Decision Making
ETM	Enhanced Thematic Mapper
FCREPA	Florida Committee on Rare and Endangered Plants and Animals
FDEP	Florida Department of Environmental Protection
FDOACS	Florida Department of Agriculture and Consumer Services
FDOF	Florida Department of Forestry
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FIM	Fisheries Independent Monitoring
FIPR	Florida Institute of Phosphate Research

FLEP	Forest Land Enhancement Program
FLEPPC	Florida Exotic Pest Plant Council
FLULCCS	Florida Land Use Land Cover Classification System
FMNH	Florida Museum of Natural History
FNAI	Florida Natural Areas Inventory
FPSC	Florida Public Services Commission
FRPP	Farm and Ranch Protection Program
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information System
HAB	Harmful Algal Blooms
HAZMAT	Hazardous Materials
HSDR	Hurricane and Storm Damage Reduction
IFAS	Institute of Food and Agricultural Sciences
IRL	Indian River Lagoon
IUCN	International Union for the Conservation of Nature
JUA	Joint Underwriting Association
LBSB	Land Based Sources of Pollution
LIP	Landowner Incentive Program
MDC	Monitoring Design and Coordination
MFL	Minimum Flow Levels
MOU	Memorandum of Understanding
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NGO	Non-governmental Organization
NIPF	Non Industrial Private Forest
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	National Resources Conservation Service
NRI	National Resources Inventory
OFW	Outstanding Florida Waters
OGT	Office of Greenways and Trails
ORV	Off-Road Vehicle
PCB	Polychlorinated Biphenyls
PSA	Public Service Announcement
PSC	Public Service Commission
PWF	Permanent Wood Foundation
QA	Quality Assurance
QC	Quality Control
REEF	Reef Environmental Education Foundation
SAFER	South Florida Angler for Everglades Restoration
SAV	Submerged Aquatic Vegetation
SCTC	Stream Crossing Technical Center
SEFCRI	Southeast Florida Coral Reef Initiative
SFI	Sustainable Forestry Initiative

SFWMD	South Florida Water Management District
SGCN	Species of Greatest Conservation Need
SH	State Historic
SHCA	Strategic Habitat Conservation Areas
SNR	State Not Ranked
SPOT	Systeme Pour L'Observation de la Terre
START	Solutions To Avoid Red Tide
SWFRPC	Southwest Florida Regional Planning Council
SWG	State Wildlife Grants
SX	State Extinct
TAC	Technical Advisory Committee
TAME	The Area-wide Management and Evaluation
TDR	Transfer Development Rights
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UNESCO	United Nations Educational, Scientific, and Cultural Organization
URTD	Upper Respiratory Tract Disease
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDOD	United States Department of Defense
USDOI	United States Department of Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WHIP	Wildlife Habitat Incentives Program
WMD	Water Management District
WRP	Wetlands Reserve Program

Glossary of Terms

Action
An activity or program of any kind intended to conserve a Species of Greatest Conservation Need (SGCN) or its habitat.

Adaptive Management
A method of natural resource management that integrates design, management, and monitoring to systematically test assumptions in order to modify and adapt the activities in response to the observed responses.

Alluvial
Pertaining to material that is transported and deposited by running water.

Anthropogenic
Conditions that result from human activities. “Anthropo-” meaning *human* and “-genic” meaning *produced from*.

Aquifer
An underground geologic formation in which water can be stored.

Bedding Plane
In sedimentary or stratified rocks, a surface that separates each layer from those above or below it. It usually records a change in depositional circumstances by grain size, composition, color, or other features. The rock may tend to split or break readily along bedding planes.

Benefit
In terms of threat abatement benefit, the degree to which the proposed action, if successfully implemented is likely to achieve the desired outcome(s).

Benthic
Bottom of rivers, lakes, or oceans; organisms that live on the bottom of water bodies.

Best Management Practice (BMP)
A recommended suite of the best available technologies or processes that are practical and achieve the desired goal or objective.

Biota
Animal or plant life of a region considered as a total ecological entity.

Biodiversity
The number of different species inhabiting a specific area or region.

Biological Legacy
The organisms, organic matter and structures, and biologically-created patterns that persist from the pre-disturbance ecosystem and influence recovery processes in the post-disturbance ecosystem. (i.e., organisms such as animals, mature and intact live trees or seedlings, organic matter such as fine litter and particulate material, organically-derived structures such as snags or logs, or organically-derived patterns such as soil chemical properties). They are the patterns and types of what remains following a disturbance. It is important to have organic legacies of pre-disturbance ecosystems in recovery processes.

Bleaching
Loss of pigment in stony and soft corals due to the expulsion of the symbiotic algae that live inside coral polyps, sometimes causing death of the coral. This phenomenon is not entirely understood, but may be caused by higher water temperatures, altered light levels, chemicals or toxins in the water, or any combination of the above.

Carrying Capacity
The maximum number of organisms that can be supported in a given area or habitat.

Community
An association of interacting populations, usually defined by the nature of their interactions or the place in which they live.

Comprehensive Wildlife Conservation Strategy (CWCS or Strategy)
The Strategy sets a plan of action for conserving all of Florida's wildlife. The Strategy addresses conservation issues, management needs, and priorities. The Strategy is intended to be used by anyone with an interest in wildlife conservation.

Conservation
The protection, improvement, and use of natural resources according to principles that will assure their highest economic or social benefits.

Corridor
A route that permits the direct travel or spread of animals or plants from one area or region to another, either by the gradual spread of a population of a species along the route or by actual movement of animals, seeds, pollen, spores, or microbes.

Cost
Simply defined as the order of magnitude in dollars. Total cost of implementing the action estimated for the time horizon of the action, but no longer than 10 years.

Crustacean
A class of invertebrates including shrimps, crabs, barnacles, and lobsters that usually lives in water and breathes through gills. They have hard outer shells and jointed appendages and bodies.

Data Gap
A clear data need identified.

Density
The number of individual plants or animals per unit of habitable area.

Diversity
The number of species that live together in an ecosystem; a measure of the variety of species in an ecosystem that takes into account the relative abundance of each species.

Dominant
The characteristic species in a particular plant community, contributing most to the general appearance and influencing which other plants and animals live there; typically the largest plant species or the one with the greatest aerial coverage.

Ecosystem
A community of organisms and their physical environment interacting as an ecological unit; the entire biological and physical content of a biotope; biosystem.

Ecosystem Management
An integrated, flexible approach to management of Florida's biological and physical environments--conducted through the use of tools such as planning, land acquisition, environmental education, regulation, and pollution prevention--designed to maintain, protect and improve the state's natural, managed, and human communities.

Ecotone
The boundary or transitional zone between adjacent communities or biomes; tension zone.

Effectiveness Monitoring
Evaluating system status and trends resulting from the implementation of an action; evaluating whether the action achieves the desired outcomes or predicted targets, i.e., were the implemented actions successful?

Endangered Species
A species in danger of becoming extinct that is protected by the Endangered Species Act. Or, as designated by the FWC in Florida, a species, subspecies, or isolated population of a species or subspecies which is so few or depleted in number or so restricted in range or habitat due to any man-made or natural factors that it is in imminent danger of extinction or extirpation from Florida as determined by FWC Rule 68A-1004 (27). (see Imperiled Species below).

Endemic
Native to, and restricted to, a particular geographical region.

Epifauna
Animals that live on the ocean bottom, either attached or moving freely over it.

Estuary
A water passage where the tide meets a river current; an arm of the sea at the lower end of a river.

Exemplary Freshwater Communities
Watersheds that are not already included as a SGCN basin and which do not contain occurrences of any freshwater SGCN species, but which are considered "reference" examples of one or more of the freshwater habitat types. Initial identification of exemplary freshwater communities was based on viability criteria for freshwater systems developed by The Nature Conservancy.

Exotic Species
Introduced species not native to the place where they are found.

Experimental Non-Essential
The USFWS defines "experimental population" as a group of individuals of an endangered species that has been established outside the current range of the animals. Animals may be reintroduced to their historical range or to new areas because there is insufficient habitat in the animals' traditional range.

Extirpate
The removal, elimination, or disappearance of a taxon from a part of its range.

Fauna
Animal life of a particular region.

Feasibility (Ease of Implementation)
Actions that are less complex have been successfully implemented previously, fit within the core competencies of the lead institution, and that appeal to key constituencies has a higher likelihood of success than other actions.

> **Very High Ease of Implementation**
> Implementing the action is very straightforward; this type of action has been done often before and will appeal to key constituencies.
>
> **High Ease of Implementation**
> Implementing the action is relatively straightforward, but not certain; this type of action has been done before and will appeal to key constituencies.
>
> **Medium Ease of Implementation**
> Implementing the action involves a fair number of complexities, hurdles, and/or uncertainties; this type of action has rarely been done before; constituency support uncertain.
>
> **Low Ease of Implementation**
> Implementing the action involves many complexities, hurdles, and/or uncertainties; this type of action has never been done before and/or is unlikely to appeal to key constituencies.

Feral
An animal that has reverted to a wild or untamed state from a domesticated state.

Fire Regime
A prevailing condition in which ecosystems have evolved under periodic exposure to natural fires such that the vegetative communities have adapted to, are dependent upon, and are reproductively enhanced by this exposure.

Fragmentation
The disruption of extensive habitats into isolated and small patches.

Game Species
Species that is hunted or fished.

Gastropods
A mollusk with well-developed foot, head, and body. Class Gastropoda ("stomach-footed") is the largest group of mollusks and can be found in terrestrial, freshwater, and marine habitats. Members of this group may be shell-less (slugs and sea hares), or typically possess a spiral-shaped shell (snails or conch).

Geographical Information System (GIS)
A computerized system of organizing and analyzing any spatial array of data and information.

Green Infrastructure
The Nation's natural life support system–a strategically planned and managed network of wilderness, parks, greenways, conservation easements, and working lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for America's communities and people (http://www.greeninfrastructure.net/).

Groundwater
Water stored underground in pore spaces between rocks and in other alluvial materials and in fractures of hard rock occurring in the saturated zone.

Habitat
The area or type of environment in which a specific kind of organism normally lives.

Habitat Conservation Plan (HCP)
A comprehensive planning document that is a mandatory component of an incidental take permit pursuant to section 10(a) (2) of ESA.

Harmful Algal Bloom (HAB)
The rapid growth of a toxic or nuisance algae species that negatively affects natural resources or humans.

Hydric
An environment that contains an abundance of moisture.

Hydroperiod
The temporal pattern of water level.

Implementation Monitoring
A form of status and trend detection that helps to evaluate how closely the prescribed actions were followed, i.e., was the planned action completed as desired?

Imperiled Species
A species found on the state's consolidated list of the official state and federal lists of endangered species, threatened species, and other species designated in some way by the respective jurisdictional agencies as meriting special protection or consideration.

Impoundment
A body of water or sludge confined by a dam, dike, floodgate, or other barrier.

Incompatible Fire
Fire that is not adhering to the natural regime, dynamics and features of the habitat, landscape or ecosystem. This includes incompatible suppression, timing, frequency, intensity, seasonality, pattern, or extent of fire. It is incompatible or inappropriate for the habitat's natural functioning and composition. If the appropriate fire is not on the landscape, the vegetation structure and composition can shift to the point of habitat cover change.

Incompatible Release of Water
Release of freshwater into marine/estuarine systems in a manner that is inconsistent with the natural timing, distribution, and quantity of fresh water into that system. This includes large pulses of fresh water into estuaries during high rain events to prevent flooding of urban areas, when the natural flow would be much slower and of much less quantity.

Incompatible Fishing Pressure
Harvesting of fish and other marine resources to an extent that results in decreased populations of these species to levels that jeopardize their ecological integrity and the integrity of the ecosystem of which they are a part. An example is over-harvesting of herbivorous fish such as parrotfish that consume algae on coral reefs, thereby allowing the algae to overpopulate the reef and out-compete corals for space.

Incompatible Forestry Practices
Forestry activities which significantly alter habitat conditions, especially in unique or sensitive areas, to the extant that the habitat is no longer useable by historically associated native wildlife species. For example, intensive site preparation such as bedding and/or herbicide use immediately adjacent to isolated wetlands, and the exclusion of natural fire regimes are generally not compatible with maintaining habitat conditions and ground cover necessary for certain SGCN.

Incompatible Recreational Activities
Recreational activities that disturb, degrade, or destroy natural habitat. This can include unmanaged or unauthorized recreation; motorized and non-motorized uses such as off-road vehicles, ATVs, motorboats, motorcycles, mountain bicycles; incompatible hiking; ultralight planes; anchor damage to coral; or driving on beaches, which can create habitat that is not compatible with native wildlife and habitat usage of that system due to disturbance, degradation, or destruction of habitat. This can also include unmanaged or unauthorized recreation, vehicles and boats traveling outside of established transport corridors, as well as recreation exceeding carrying capacity for the natural system.

Incompatible Wildlife and Fisheries Management
Wildlife or fisheries management activities or policies that harm native habitats and/or wildlife. For example, maintaining high water levels in salt marshes to promote waterfowl hunting when natural water levels would be lower. This type of management is usually done as a socio-economic, rather than ecological benefit.

Indigenous
Native; living or occurring naturally in a specific environment.

Invasive Species
Non-native species at densities sufficient to threaten other Species of Greatest Conservation Need through competition, predation, habitat destruction, or pathogen movement.

Irreversibility of a Stress
Reversibility of the stress caused by the Source of Stress.

> **Very High Irreversibility**
> The source produces a stress that is not reversible (e.g., wetlands converted to a shopping center).
>
> **High Irreversibility**
> The source produces a stress that is reversible, but not practically affordable (e.g., wetland converted to agriculture).
>
> **Medium Irreversibility**
> The source produces a stress that is reversible with a reasonable commitment of resources (e.g., ditching and draining of wetland).
>
> **Low Irreversibility**
> The source produces a stress that is easily reversible at relatively low cost (e.g., off-road vehicles trespassing in wetland).

Karst
A region underlain by limestone rock and typified by caves, sinkholes, springs, and distinctive water chemistry.

Keystone Species
A single species whose activities determine community structure; a species whose presence is critical to that community.

Management of Nature
Actions that convert habitat in service of "managing" natural systems to improve human welfare (flooding from dam construction, land reclamation projects, wetland filling for mosquito control, levees and dikes). The management occurs to improve the habitat anthropogenically, but also might disturb, degrade, or destroy the habitat in its natural state and create habitat that is not compatible with native wildlife and habitat usage of that system due to disturbance, degradation, or destruction of habitat.

MARXAN Modeling
A site selection algorithm used to help select and design a portfolio of priority marine and estuarine sites that may warrant additional conservation or management selection.

Mitigation
Compensation required for the alteration of natural resources or habitat pivotal to the survival or well-being of listed species.

Monitoring
The systematic measurement of environmental characteristics over an extended period of time to determine the status or trends of some aspect of environmental quality to detect any changes that may occur.

Monitoring Metrics
The actual measurement units that we use to quantify the impact of our conservation efforts. Examples of metrics might include the number of snares found per person/day of patrolling or the number of protected animal species found at roadblocks per person/day.

Mosaic
A pattern of vegetation in which two or more different plant communities are interspersed in patches.

Neotropical Migrants
Birds that breed in North America and winter in the neotropic.

Nonfederal
Referring to all lands in private, municipal, state, or tribal ownership.

Nongame Wildlife
Species of wildlife that are not subject to legal hunting or harvesting.

Nuisance Species
Native species at densities sufficient to threaten other Species of Greatest Conservation Need through competition, predation, habitat destruction, or pathogen movement.

Overall Rank
The average weighted rank combining Feasibility and Benefits.

Partnership
A formal or informal effort by two or more partners to achieve a shared objective or complete a project.

Pathogens
Any agent, most commonly a microorganism, capable of causing disease.

Performance Measure
The specific qualitative or quantitative measures for ecosystem initiative goals. A combination of performance measures provide an index of ecosystem condition and chart the overall progress of a management plan towards achieving its goals.

Planktonic
Pertaining to organisms dependent on water movement and currents as their means of transportation, including phytoplankton, zooplankton, and ichthyoplankton.

Population
A group of fish or wildlife in the same taxon below the subspecific level, in common spatial arrangement that interbreed when mature.

Portfolio Springs
Those springs in the FDEP springs database that occur within a SGCN basin, SGCN karst site or a basin identified as an exemplary freshwater community.

Recovery
Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of ESA; the process by which species' ecosystems are restored so they can support self-sustaining and self-regulating populations of the listed species as persistent members of native biotic communities.

Reintroduction
A plant or animal moved to a location where it occurred historically.

Restoration
Management actions to return a vegetative community or ecosystem to its original, natural condition.

Riparian
Areas along or adjacent to a river or stream bank whose waters provide soil moisture significantly in excess of that otherwise available through local precipitation.

Scope of Damage
The geographic scope of impact on the conservation target at the site that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

> **Very High Scope of Damage**
> The stress is likely to be very widespread or pervasive in its scope, and affect the conservation target throughout the target's occurrences at the site.
>
> **High Scope of Damage**
> The stress is likely to be widespread in its scope, and affect the conservation target at many of its locations at the site.
>
> **Medium Scope of Damage**
> The stress is likely to be localized in its scope, and affect the conservation target at some of the target's locations at the site.
>
> **Low Scope of Damage**
> The stress is likely to be very localized in its scope, and affect the conservation target at a limited portion of the target's location at the site.

Shoreline Hardening
The clearing of the natural vegetation along the shore and into the water and putting in things like concrete docks and walls right next to the water’s edge. Cutting the grass right to the water’s edge is another way of hardening the shoreline. Water becomes dirty and both natural plants and animal communities are destroyed causing a dramatic loss of habitat.

Slough
A depression associated with swamps and marshlands as part of a bayou, inlet, or backwater.

Source of Stress
Expected contribution of the source, acting alone, to the full expression of a stress (as determined in the stress assessment) under current circumstances (i.e., given the continuation of the existing management/conservation situation).

> **Very High Source of Stress**
> The source is a very large contributor of the particular stress.
>
> **High Source of Stress**
> The source is a large contributor of the particular stress.

Medium Source of Stress
The source is a moderate contributor of the particular stress.

Low Source of Stress
The source is a low contributor of the particular stress.

Species
Organisms of the same kind that interbreed and produce fertile offspring including any subspecies of fish or wildlife or plants, and any distinct population segment of any species or vertebrate fish or wildlife which interbreeds when mature.

Species of Greatest Conservation Need (SGCN)
In Florida, this includes animals that are at risk or are declining. It includes federal-listed and state-listed species as well as many other species whose populations are of concern.

Species of Greatest Conservation Need Basins
Those watersheds (based on FDEP basins layer) containing one or more occurrences of a SGCN freshwater species.

Species of Greatest Conservation Need Karst Sites
These sites are similar to the SGCN Basins, except that the "basin" boundaries reflect clusters of aquatic caves, rather than surface watersheds, and are determined using a combination of geological and groundwater information. Species of greatest conservation need karst sites are only used in areas where locations of caves and SGCN cave species are not already included in a SGCN basin.

Species of Special Concern
A species, subspecies, or isolated population of a species or subspecies which is facing a moderate risk of extinction or extirpation from Florida in the future, as determined by the FWC Rule 68A-1004 (27).

Stakeholder
Any person or organization having an interest in the actions discussed or affected by the resulting outcomes of a project or action.

Status
A position or rank in relation to others.

Strategic Habitat Conservation Areas (SHCA)
Uplands and wetlands that are important habitat areas and are currently not protected.

Strategy
An adaptation or complex of adaptations that serve or appear to serve an important function in achieving success.

Stress
The factor that destroys, degrades, or impairs habitats by impacting habitat size, condition, or configuration in the landscape.

> **Very High Stress**
> The stress is likely to destroy or eliminate the conservation target over some portion of the target's occurrence at the site.
>
> **High Stress**
> The stress is likely to seriously degrade the conservation target over some portion of the target's occurrence at the site.
>
> **Medium Stress**
> The stress is likely to moderately degrade the conservation target over some portion of the target's occurrence at the site.
>
> **Low Stress**
> The stress is likely to only slightly impair the conservation target over some portion of the target's occurrence at the site.

Subspecies
A group of interbreeding natural populations differing taxonomically and with respect to gene pool characteristics, and often isolated geographically, from other such groups within a biological species.

Subtropical
A region outside the tropics that demonstrates climatic and vegetation characteristics and species similar to the tropics.

Take
To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Target
Something to be affected by an action or development.

Taxon (plural - taxa)
A general term for any taxonomic category (e.g., a species, genus, family, or order).

Temperate
Having a moderate climate.

Terrestrial Watershed Protection Sites
Large terrestrial planning areas that comprise the headwaters of two or more SGCN or exemplary freshwater community basins and whose protection is deemed critical for maintaining the functionality of important freshwater habitats or ecosystems.

Threat Abatement Benefit
The degree to which the proposed action, if successfully implemented, is likely to achieve the desired outcome(s). How much will this action, by itself, reduce the critical threat over the scope and scale it is degrading the habitat?

> **Very High**
> The action, in itself, will abate the threat (source of stress) (or will get 76-100% of the way there).
>
> **High**
> The action will make a substantial contribution towards abating the threat, but is not by itself sufficient (will get 51-75% of the way there).
>
> **Medium**
> The action makes an important contribution towards abating the threat (will get 26-50% of the way there).
>
> **Low**
> The action makes a relatively small contribution towards abating the threat (will get 1-25% of the way there).

Threatened Species
Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Or as designated by the FWC in Florida, a species, subspecies, or isolated population of a species or subspecies which is facing a very high risk of extinction or extirpation from Florida in the future, as determined by the FWC Rule 68A-1004 (27).

Total Maximum Daily Loads (TMDLs)
Total Maximum Daily Loads are a tool for implementing state water quality standards and are based on the relationship between pollutants and in-stream water quality conditions.

Trend
To extend in a general direction; follow a general course.

Tropical
Refers to a region or climate that is frost free with temperatures high enough to support year-round plant growth given sufficient moisture, generally occurring between latitudes 22.5°N and 22.5°S. (see subtropical).

Turbidity
In water bodies, the condition of having suspended particles that reduce the ability of light to penetrate beneath the surface. Soil erosion, runoff, and phytoplankton blooms can increase turbidity.

Wetland
A zone periodically or continuously submerged or having high soil moisture, which has aquatic and/or riparian vegetation components, and is maintained by water supplies significantly in excess of those otherwise available through local precipitation.

Wildlife
Any species of wild, free-ranging fauna including fish. Wildlife may also be fauna in captive breeding programs, the object of which is to reintroduce individuals of a depleted indigenous species in a previously occupied range.

Appendix A: Identified Conservation Partners

The people of Florida have an unprecedented opportunity to shape the future of our state's fish and wildlife conservation programs by helping create Florida's Wildlife Legacy Initiative. The Initiative is a far-sighted approach to avert future declines of native wildlife, with a goal of keeping common species common for the enjoyment and use of all Floridians and future generations. This list of potential conservation partners was identified by the experts and stakeholders who attended Comprehensive Wildlife Conservation Strategy Science Workshops I and II (see Chapter Florida's Approach to Meeting the Eight Required Elements), but it is not exhaustive. If you would like to be added or are aware of any federal, state, municipal, or private entity which may be a potentially important partner for the Initiative, than please visit the FWC website at http://MyFWC.com/wildlifelegacy to recommend an addition.

Federal Government

- Atlantic States Marine Fisheries Commission
- Department of Agriculture
    - Agricultural Research Service
    - Natural Resource Conservation Service
    - U.S. Forest Service
    - Wildlife Services
- Department of Commerce
    - National Oceanic and Atmospheric Administration
        - Apalachicola National Estuarine Research Reserve
        - Guana Tolomato Matanzas National Estuarine Research Reserve
        - Rookery Bay National Estuarine Research Reserve
        - National Marine Fisheries Service
        - Coastal Services Center
        - Florida Keys National Marine Sanctuary
        - Florida Coastal Zone Management Program
- Department of Defense
    - U.S. Air Force
        - Avon Park Bombing Range
        - Canaveral Air Force Station
        - Eglin Air Force Base
        - Patrick Air Force Base
    - U.S. Army
        - Camp Blanding Training Site
        - Army Corps of Engineers
    - U.S. Navy
        - Kings Bay Naval Submarine Base

        - Naval Air Station Key West
        - Naval Observatory
- Department of Homeland Security
    - Federal Emergency Management Agency
    - U.S. Coast Guard
    - U.S. Customs and Border Protection
- Department of Interior
    - Bureau of Indian Affairs
    - Bureau of Land Management
    - National Park Service
    - U.S. Fish and Wildlife Service
    - U.S. Geological Survey
- Environmental Protection Agency
- Federal Highway Administration
- Gulf States Marine Fisheries Commission
- National Aeronautics and Space Administration
- U.S. Coral Reef Task Force

State Government

- Department of Agriculture and Consumer Services
    - Division of Agricultural Environmental Services
    - Division of Animal Industry
    - Division of Aquaculture
    - Division of Dairy
    - Division of Forestry
    - Division of Plant Industry
    - Office of Agricultural Water Policy
- Department of Community Affairs
- Department of Education
- Department of Environmental Protection
    - Coastal and Aquatic Managed Areas
    - Bureau of Laboratories
        - Environmental Assessment Section
    - Division of Recreation and Parks
    - Division of State Lands
        - Bureau of Invasive Plant Management
        - Office of Greenways and Trails
    - Exotic Plant Bureau
- Department of Law Enforcement
- Department of Military Affairs
- Department of Transportation
- Florida Fish and Wildlife Conservation Commission
- Florida Inland Navigation District

- Florida Institute of Phosphate Research
- Florida National Guard
- Florida Natural Areas Inventory
- Governor and Cabinet
- States of Georgia and Alabama
- Universities and Community Colleges
    - Florida A & M University
    - Florida Gulf Coast University
    - Florida Institute of Technology
    - Florida State University
    - University of Central Florida
    - University of Florida
        - Institute of Food and Agricultural Sciences, County Extension Service Units
        - Program for Efficient Communities
        - SeaGrant Program
        - Marine Mammal Program
    - University of Miami
    - University of North Florida
    - University of South Florida
    - University of West Florida
- Water Management Districts
    - Northwest Florida Water Management District
    - South Florida Water Management District
    - Southwest Florida Water Management District
    - St. Johns River Water Management District
    - Suwannee River Water Management District

Municipal

- City agencies
    - Local community fire departments
    - Municipalities (utilities, waste, power)
    - Parks and recreation
- Chambers of commerce
    - Ocala Chamber of Commerce
- City, county, and private zoos
- County agencies
    - County commissioners and local government
    - Brevard County Natural Resources Management
    - Lake County Water Authority
    - Miami-Dade County Environmentally Endangered Lands
    - Miami-Dade County Environmental Resource Management Planning and Growth Management
    - Miami-Dade County Mosquito Control

    - Miami-Dade County Natural Areas Management
    - Miami-Dade County Parks and Recreation
    - Palm Beach County Department of Environmental Resources Management
    - Seminole County
    - Volusia County Growth and Resource Management
- Law enforcement agencies
- Local drainage districts
- Mosquito control districts
- School districts
- Tourist development councils
- Regional planning councils
    - Gopher Tortoise Conservation Initiative
    - The Institute for Regional Conservation
    - Withlacoochee Regional Planning Council

Private

- 1000 Friends of Florida
- 4-H clubs
- Agriculture land owners
- American Association of Zoological Keepers
- American Association of Zoos and Aquariums
- American Farmland Trust
- American Fisheries Society
- American Fisheries Society–Florida Chapter
- Ashton Biodiversity Research & Preservation Institute
- Audubon Society
- Bass Anglers Sportsman Society
- Biodiversity Research and Preservation Institute, Inc.
- Boys Scouts of America®
- Busch Wildlife Center
- Cockroach Bay Users Group
- Caribbean Conservation Corporation
- Celebrities interested in conservation
- Center for Plant Conservation
- Chicken Farmers Association
- Civic groups (Lions, Rotary, Optimist Club, etc.)
- Coastal Conservation Association
- Coastal Plains Institute
- Coastal Services Center
- Community watch programs
- Conservancy of Southwest Florida
- Coral Reef Task Force
- Dairy Farmers Association

- Defenders of Wildlife
- Ducks Unlimited
- Environmental law organizations
- Environmental learning/research centers
- Everglades Bass Anglers
- Everglades Coordinating Council
- Farm Service Association
- Florida Airboat Association
- Florida Association of Benthologists
- Florida Bat Center
- Florida Cattleman's Association
- Florida Chapter of the American Planning Association
- Florida Chapter of the Sierra Club
- Florida Council of Yacht Clubs
- Florida Exotic Pest Plant Council
- Florida Farm Bureau
- Florida Forestry Association
- Florida Key Electric Cooperative
- Florida Keys Invasive Species Task Force
- Florida Marine Contractors
- Florida Native Plant Society and local coastal chapters
- Florida Recreation Access Network
- Florida Turtle Conservation Trust
- Florida Wildlife Federation
- Florida Wildlife Rehabilitators Association
- Florida Yards and Neighborhoods
- Freshwater bait and tackle shops
- Future Farmers of America
- Girls Scouts of the USA®
- Gopher Tortoise Council
- Gulf Coastal Plain Ecosystem Partnership
- Gulf State Marine Fisheries Commission and Atlantic States Marine Fisheries Commission
- Harbor Branch Oceanographic Institution
- Hog Farmers Association
- Home Builders Society
- Humane societies
- Industrial forest owners
    - International Paper
    - Neal Land and Timber Company
    - Plum Creek Timber Company
    - Rayonier
    - Soterra
    - St. Joe Timberland Company

- Industry
    - Bottling companies
    - Paper mills
- Keep Florida Beautiful
- Key Deer Protection Alliance
- Large and small private landowners
    - Nokuse Plantation
    - Ted Turner
- League of Environmental Educators of Florida
- Local nongovernment organizations and land conservancies
- Longleaf Alliance
- Major aquaria, zoos, and botanical gardens
    - Bok Tower Gardens
    - Fairchild Botanical Gardens
    - Florida Aquarium
    - Lowry Park Zoo
    - SeaWorld
    - Marine Conservation Biology Institute
- Marine Industries Association of Florida
- Mote Marine Laboratory
- Museums
    - Miami Museum of Science
- National Marine Manufacturers
- National Wild Turkey Federation
- Native American tribes
- North American Butterfly Association
- Ocean Conservancy
- Partners for Amphibian and Reptile Conservation
- Partners in Flight
- Permitted wildlife rehabilitation specialists
- Personal Watercraft Association
- Private research stations
    - Archbold Biological Station
    - Joseph W. Jones Ecological Research Center
    - Tall Timbers Research Station
    - White Oak Conservation Center
- Professional/science societies and associations
- Publishers and media
- Quail Unlimited
- Regional planning councils
    - Withlacoochee Regional Planning Council
    - The Institute for Regional Conservation
- Regional Prescribed Fire Councils
- Rookery Bay National Estuarine Research Reserve

- Sanibel Captiva Conservation Foundation
- Save Our Scrub
- Save the Manatee Club
- Sport Fishing Association
- Society of American Foresters
- South Florida Anglers for Everglades Restoration
- South Florida Bass Anglers
- St. Augustine Alligator Farm
- Standing Watch
- The Conservation Fund
- The Nature Conservancy
- The Wildlife Society, Florida Chapter
- Trust for Public Lands
- USA Waterski
- User groups, clubs and organizations
    - Angler Societies
    - Bait and tackle shops
    - Boating clubs
    - Botanical societies
    - Caving groups
    - Garden clubs
    - Local hunting clubs
    - Local marinas
    - Master Gardeners (IFAS FL Cooperative Extension Service)
    - Mountain Biking
    - Orienteering
    - Paddlers
    - SCUBA diver clubs
- Utility companies
- Wildlife Trust

Appendix B: Conservation Education Objectives in Florida

The eloquent Senegalese poet and conservationist Baba Dioum once said: "In the end we will conserve only what we love, we will love only what we understand and we will understand only what we are taught." Today, this philosophical statement guides most large- and small-scale conservation education programs targeting youth and adults throughout the world. As is the case with all educational programs, the goal of conservation education is to lead individuals from awareness to responsible action and behavior.

Conservation education is an important tool for accomplishing wildlife conservation goals and objectives. Conservation education is not intended to replace the need for research, monitoring and management but rather to complement those critical components by providing an important mechanism for exchanging information about conservation challenges with people who can most help. Many of the conservation challenges we face involve people and their actions. In other words, many wildlife problems are people problems. Therefore the goal is to provide people with the awareness, knowledge and skills they need to help wildlife. The Be Bear Aware example given below underscores the need and illustrates how knowledge and skills empower people to take the appropriate actions for greater safety of people and conservation of bears. Other important conservation education programs include those aimed at developing outdoor skills (e.g., hunting, fishing and wildlife viewing), programs addressing the youth aiming to foster a stewardship ethic (e.g., the FWC's Kids Fishing, Project WILD, and summer youth camp programs), and programs engaging the public in specific conservation actions (e.g., exotic species, bear, alligator, sea turtles, mottled duck and manatee efforts). To ignore the role of conservation education is to turn a blind eye to one of the best tools for resolving many wildlife challenges and engaging the public's support for natural resource conservation.

Conservation Education is Important for Florida

As one of the fastest growing states in the United States., Florida serves as a vacation site, seasonal home, or permanent home to increasing numbers of visitors and new residents each year. As of April1, 2004, Florida's permanent resident population exceeded 17.5 million and approximately 75 million tourists visit the state each year. Most tourists and new Floridians know very little about Florida's unique and diverse wildlife species and the natural environments in which they live. As a result, many tourists and residents engage in behaviors that have significant negative impacts on Florida's wildlife and environment. Examples include tourists who feed human food to American alligators, brown pelicans, and Key deer; recreational fishermen who discard tangled fishing line in waterways; boaters who unintentionally drag their props in shallow waters, severely scarring seagrass beds; lakeside homeowners who pour used motor oil directly onto the ground or use broad-spectrum pesticides and excessive fertilizers to maintain green lawns; and motorists who exceed speed limits on highways bisecting critical wildlife habitats, such as the

Ocala National Forest and Everglades National Park. Unknown to most of these well-intentioned individuals, uninformed behaviors such as these often have disastrous impacts on terrestrial and aquatic habitats and wildlife. Sadly, without targeted education efforts, most members of the general public do not realize how their individual actions collectively contribute to the three root causes of wildlife population decline: habitat loss, habitat degradation, and habitat fragmentation. Clearly, the continued survival of Florida's natural ecosystems and the species that inhabit them cannot be ensured without continuous, sustained, and systemic educational outreach efforts designed to increase conservation knowledge, influence positive attitudes about wildlife and result in improved conservation behavior.

Conservation Behavior

As a result of decades of research conducted by internationally recognized psychologists and behavior theorists, including Ajzen, Bandura, Fishbein, Rutherford, and Triandis, several valid and reliable models now exist for predicting human behavior. Numerous studies investigating the Theory of Reasoned Action, the Theory of Planned Behavior, and the Flow Theory of Behavior Dynamics have found that the two most significant predictors of behavior are knowledge and attitudes (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980; Sheppard et al. 1988; Goldenhar and Connell 1992; Aipanjiguly and Jacobson 2003). Interestingly, when investigating factors that determine behavior regarding topics as diverse as smoking, seat-belt use, underage drinking, hunting, and wildlife viewing, research has clearly shown that external factors such as laws or the threat of fines or citations have little impact on an individual's decision to engage in responsible behavior. For example, theft of orchids and other rare plants in cypress swamps like the Fakahatchee Strand in south Florida continues to be a serious problem despite the fact that: (1) the area is designated as a state preserve; (2) legislation makes it illegal to remove native plants from the area; and (3) violators who remove native plants face stiff fines and even jail time. Clearly, enforcement without education is ineffective over the long term. As the popular saying indicates, "Knowledge is power." Without current and accurate knowledge and the willingness to act based on this knowledge, there can be no long-term and sustained change in behavior.

Education Promotes Conservation

In her meticulously researched 2000 book *The Orchid Thief : A True Story of Beauty and Obsession*, Susan Orlean, interviewed several known "orchid poachers" and found that they only agreed to stop stealing orchids in Fakahatchee Strand after they learned how important the plants were to the ecosystem and how difficult it was for many of them, like the ghost orchid, to survive outside their natural habitat. These poachers were well aware of the laws and penalties related to orchid poaching, and many continued poaching even after they had been arrested or convicted. For these individuals, it was education, not enforcement that ultimately led to a change in their behavior. Her findings illustrate the vital role education must play in order to promote conservation behavior and protect Florida's critical habitat areas and threatened and endangered plant and animal species.

Is Awareness Enough?

More than 30 years of research have clearly shown that, in order to promote ecological literacy and change behavior, educational programs should progress from awareness to action. All effective conservation education programs focus on five major outcomes: (1) awareness, (2) knowledge, (3) attitudes, (4) problem solving and critical thinking skills, and (5) opportunities for responsible action. Each year, the National Environmental Education and Training Foundation conducts a nationwide Roper Starch poll of environmental literacy among the U.S. general public. Their most recent "National Report Card" indicates that short-term awareness level messages do not result in long-term sustained changes in environmental behavior. While awareness level messages can promote simple changes in behavior, such as turning off a light when leaving a room or turning off the faucet while brushing teeth, more significant lifestyle changes only occur when individuals are exposed to programs targeting additional outcomes, such as knowledge and attitudes.

Effective Statewide Conservation Education Programs in Florida

When evaluating the role education can, and should, play in a statewide wildlife conservation plan, two case studies illustrating the documented impact of education efforts on conservation-related behavior may be helpful.

Case Study 1: Florida's Be Bear Aware Program

As Florida's human population has grown, residential development has spread closer and closer to remaining areas of critical black bear habitat. Increases in residential development near regions like the Wekiva Protection Area in Seminole County have resulted in a corresponding increase in human/bear conflicts and nuisance bear reports. In an attempt to reduce the number of human/black bear conflicts in Florida, the Fish and Wildlife Conservation Commission, along with their partners the (U.S. Forest Service and Defenders of Wildlife), implemented a "Be Bear Aware" educational campaign in 2001. Components of the program include a video, information pamphlets and other print media, public forum presentations and exhibits, and recruitment and education of neighborhood bear liaisons. As part of a comprehensive evaluation of the program's effectiveness, researchers at Pandion Systems, Inc. found that the multi-dimensional Be Bear Aware campaign resulted in significant increases in citizen knowledge regarding ways to prevent human/bear conflicts, significant increases in positive attitudes toward bears, and significant increases in behaviors that reduce human/bear conflicts. Although many of the citizens studied told researchers they didn't even know bears lived in their area before implementation of the educational campaign, almost half of those who received bear information reported a change in their knowledge, attitudes, and behavior. Clearly, well-designed, multi-dimensional public education programs can and do work. Interestingly, citizens participating in the campaign's evaluation requested additional educational resources including repeated direct mailing of bear information throughout the year, incentives for citizens who implement desired behaviors, and web-based resources for citizens interested in increasing their general knowledge regarding black bears. These requests indicate the public is interested in access to conservation education materials and programs.

Case Study 2: Wildlife Festivals

Providing wildlife-related education to members of the general public is always a challenge, especially for nonprofit agencies and organizations such as the Florida Fish and Wildlife Conservation Commission. The goal of such efforts is to reach segments of the population that may not realize the negative impacts their actions and behaviors often have on wildlife species and their habitats. One tool for reaching such target audiences is sponsorship of wildlife festivals that provide opportunities for both education and entertainment. Over the past seven years, the Florida Fish and Wildlife Conservation Commission has sponsored two different types of wildlife festivals targeting specific geographic and demographic groups: Birding Festivals and Florida Black Bear Festivals. Each year the Florida Government Performance Survey Research Center analyzes the effectiveness of these festivals via follow-up surveys. Surveys of more than 1,000 past festival participants indicate that the aspects of the festivals people find most useful are the educational seminars and lectures, and the educational exhibits. These educational components are even more highly valued than the more "entertaining" aspects of the festivals, such as opportunities to see live animals, musicians, or puppet shows. Almost 100 percent of attendees surveyed plan to attend future wildlife festivals and plan to recommend the festivals to others. Follow-up survey findings also indicate that the majority of people attending wildlife festivals do improve their wildlife-related knowledge and attitudes as a result of these targeted education efforts. In addition, when asked to identify their reasons for attending wildlife festivals, the most common response given by more than half of all attendees was a desire to learn more about wildlife. Finally, as a result of festival attendance, the vast majority of participants surveyed can identify specific behaviors that are helpful to wildlife and nearly 100 percent of participants say they plan to implementing these desirable behaviors. Wildlife festival survey results clearly indicate that Florida's citizens are interested in learning about the state's wildlife, and human impacts on wildlife and that the educational aspects of festivals are highly valued and highly effective in changing knowledge, attitudes, and ultimately, behavior.

Summary

The challenge facing Florida involves finding a way to meet the needs of people while meeting the needs of wildlife at the same time. Both humans and wildlife must have access to habitats that provide basic needs such as food, water, shelter, and space. Without quality wildlife habitat, we will eventually have no wildlife. Targeted educational programs are essential in order to help Florida's citizens and tourists develop understanding and appreciation of, and support for, Florida's wildlife and wild areas. Conservation education is one of the few tools agencies such as the Florida Fish and Wildlife Conservation Commission can use to help land managers, policymakers, businesses, and the public create a sustainable balance between meeting the needs of people and the needs of wildlife.

Appendix C: Stress and Sources of Stress Categories

A resource for the terrestrial/freshwater and marine/estuarine Threats and Action Workshops (See Chapter Florida's Approach to Meeting the Eight Required Elements).

A. Source of Stress categories used in the terrestrial/freshwater workshops.

	Potential Sources	**Description**
1.	Conversion to Housing and Urban Development	Expansion of human cities, towns, and settlements including non-housing development typically integrated with housing (urban areas, suburbs, villages, ranchettes, vacation homes, shopping areas, offices, schools, hospitals); *may be informed by impervious surface, land-use intensity, and/or land-use change analyses.*
2.	Conversion to Commercial and Industrial Development	Factories and other commercial centers (factories, stand-alone shopping centers, office parks, train yards, docks, ship yards, airports); *may be informed by impervious surface, land-use intensity, and/or land-use change analyses.*
3.	Conversion to Agriculture	Agricultural operations (commercial farms, industrial plantations, cattle ranches, pastures, aquaculture); *may be informed by dairy/feeding operations, land-use intensity, and/or land-use change analyses.*
4.	Conversion to Recreation Areas	Recreation sites with a substantial footprint (golf courses, resorts, county parks); *may be informed by land-use intensity, and/or land-use change analyses.*
5.	Management of Nature (specify)	Actions that convert habitat in service of "managing" natural systems to improve human welfare (flooding from dam construction, land reclamation projects, wetland filling for mosquito control, levees and dikes).
6.	Military Activities	Actions by formal or paramilitary forces (military training, defoliation, munitions testing).
7.	Roads	Surface transport on roadways (highways, primary roads, secondary roads, primitive roads, logging roads, trails); *may be informed by road density analysis.*
8.	Railroads	Surface transport on dedicated tracks (freight and passenger lines, mining lines).
9.	Utility Corridors	Transport of energy and resources (electrical and telephone wires, aqueducts, oil and gas pipelines).
10.	Channel Modification/Shipping Lanes	Modifications to rivers, estuaries, and ocean habitats to enhance shipping (dredging, canals, shipping lanes).
11.	Incompatible Resource Extraction: Mining/Drilling	Exploring, developing, and producing minerals or fossil fuels (phosphates, rock quarries, sand and gravel mines).
12.	Incompatible Fire	Changes community composition and structure.
13.	Surface Water Withdrawal	Withdrawal or diversion of surface water; *may be informed by canal and ditch density.*

	Potential Sources	**Description**
14.	Groundwater Withdrawal	Withdrawing water from aquifer; *may be informed by aquifer vulnerability models.*
15.	Dam Operations	Influencing flow regimes; *may be informed by dam location data.*
16.	Incompatible Wild Animal Harvest	Harvest of wild animals for commercial, recreation, subsistence, research, or management purposes.
17.	Incompatible Vegetation Harvest	Harvest of plants, fungi, and other non-timber/non-animal products for commercial, recreation, or subsistence purposes.
18.	Incompatible Forestry Practices	Forest and forest product management (bedding, silviculture adjacent to aquatic sites, herbicide use, road construction).
19.	Incompatible Grazing and Ranching	Using natural habitats to support domestic or semi-domesticated animals that are allowed to roam in the wild (livestock, hatchery salmon).
20.	Incompatible Recreational Activities	Motorized and non-motorized uses (off-road vehicles, ATVs, motorboats, motorcycles, mountain bicycles, hiking, ultralight planes, anchor damage to coral).
21.	Chemicals and Toxins (specify source)	Industrial chemicals and toxins in the air, land, and water (mercury, heavy metals, PCBs, acid rain, smog, oil from cars, chemical dumping, oil spills, agricultural pesticides, lead bullets, endocrine disrupters, caffeine in sewage).
22.	Nutrient Loads (specify source)	Excess nutrients (agriculture, septic systems, municipal sewage, runoff).
23.	Solid Waste	Garbage and other materials (garbage, litter, flotsam and jetsam).
24.	Greenhouse Gases	Gases that alter atmospheric composition (CO_2, methane).
25.	Sonic Pollution	Excess noise (noise from highways, airplanes, sonar).
26.	Thermal Pollution	Excess heat (from power plants and other industrial emissions).
27.	Light Pollution	Artificial light that disturbs animals and disrupts migration patterns (urban areas, lamps attracting insects).
28.	Invasive Plants	Plants (trees, shrubs, herbs, vines, algae).
29.	Invasive Animals	Animals (mammals, birds, herps, fish, invertebrates).
30.	Parasites/Pathogens	Disease-causing agents (parasites, fungi, bacteria, viruses, prions).
31.	Introduced Genetic Material	Human-altered or created organisms and genes (pesticide resistant crops, genetically modified insects).
32.	Sea Level Rise	Coastal flooding, salinity changes in surface or groundwater.
33.	Shoreline Hardening	Sea walls or other shoreline stabilization methods, jetties.
34.	Climate Variability	Intensification and/or alteration of normal weather patterns (droughts, hurricanes/cyclones/typhoons, monsoons).
35.	Key Predator/Herbivore/Pollinator Losses	Changes in native herbivore grazing patterns, loss of key predators or pollinators causing community structure and composition changes.
36.	New Dams	Dams that are being newly constructed.
37.	Incompatible Agricultural Practices	Agricultural practices that are not compatible with native wildlife and habitat usage of that system and adjacent areas. This can include irrigation return flows, incompatible irrigation and invasive and/or exotic grasses.
38.	Nuisance Animals	Native species with predatory or other impacts because of high densities facilitated by habitat alterations.
39.	Degraded Habitat	Habitat that has already historically been degraded, destroyed, or disturbed from its

	Potential Sources	Description
		natural condition and persists at a less-than-optimal state.
40.	Incompatible Residential Activities	Activities of residents adjacent to habitats (dumping, pets, yard maintenance, etc.).

B. Source of Stress categories used for the marine/estuarine workshops.

	Potential Sources of Stress	Description
1.	Coastal Development	Expansion of human cities, towns, and settlements including non-housing development typically integrated with housing (urban areas, suburbs, villages, ranchettes, vacation homes, shopping areas, offices, schools, hospitals).
2.	Incompatible Industrial Operations	Ports, factories, docks, ship yards, etc.
3.	Inadequate Stormwater Management	Leading to the introduction of pollutants, nutrients, etc.
4.	Incompatible Aquarium Trade	Excessive collection of tropical fish and invertebrates.
5.	Management of Nature (specify)	Actions that convert habitat in service of "managing" natural systems to improve human welfare (beach nourishment, wetland filling for mosquito control, levees and dikes, regulatory filling of dredged spoils associated with dredging and ditching).
6.	Military Activities	Actions by formal or paramilitary forces (military training, munitions testing).
7.	Roads, Bridges and Causeways	Presence of roads adjacent to coastlines; causeways across water bodies.
8.	Vessel Impacts	Groundings, anchor dragging, etc.
9.	Utility Corridors	Transport of energy and resources (electrical and telephone wires, aqueducts, oil and gas pipelines).
10.	Channel Modification/Shipping Lanes	Modifications to rivers, estuaries, and ocean habitats to enhance shipping (dredging, canals, shipping lanes).
11.	Incompatible Resource Extraction: Mining/Drilling	Exploring, developing, and producing minerals or fossil fuels (phosphates, rock quarries, sand and gravel mines).
12.	Fishing Gear Impacts	Direct impacts to habitat caused by fishing gear.
13.	Surface Water Withdrawal	Withdrawal or diversion (drainage) of surface water.
14.	Groundwater Withdrawal	Withdrawing water from aquifer.
15.	Dam Operations	Influencing flow regimes.
16.	Incompatible Fishing Pressure	Harvest of wild animals for commercial, recreation, subsistence, research, or management purposes.
17.	Industrial Spills	Major pollutant (oil or other chemical) spills.
18.	Incompatible Forestry Practices	Forest and forest product management (bedding, silviculture adjacent to aquatic sites, herbicide use, road construction).
19.	Incompatible Aquaculture Operations	Using natural habitats to support fish or shellfish rearing.
20.	Incompatible Recreational Activities	Motorized and non-motorized uses (motorboats, jet skis, excessive snorkeling or scuba diving pressure, anchor damage to coral).

	Potential Sources of Stress	Description
21.	Chemicals and Toxins (specify source)	Industrial chemicals and toxins in the air, land, and water (mercury, heavy metals, PCBs, acid rain, smog, oil from cars, chemical dumping, oil spills, agricultural pesticides, lead bullets, endocrine disrupters, caffeine in sewage).
22.	Nutrient Loads (specify source)	Excess nutrients (agriculture, septic systems, municipal sewage, runoff).
23.	Solid Waste	Garbage and other materials (garbage, litter, flotsam and jetsam).
24.	Sonic Pollution	Excess noise (noise from highways, airplanes, sonar).
25.	Thermal Pollution	Excess heat (from power plants and other industrial emissions).
26.	Light Pollution	Artificial light that disturbs animals and disrupts migration patterns (urban areas, lamps attracting insects).
27.	Invasive Plants	Plants (algae).
28.	Invasive Animals	Animals (mammals, birds, herps, fish, invertebrates).
29.	Parasites/Pathogens	Disease causing agents (parasites, fungi, bacteria, viruses, prions).
30.	Shoreline Hardening	Sea walls or other shoreline stabilization methods, jetties.
31.	Climate Variability	Intensification and/or alteration of normal weather patterns (droughts, hurricanes/cyclones/typhoons, monsoons).
32.	Key Predator/ Herbivore/Pollinator Losses	Changes in native herbivore grazing patterns, loss of key predators or pollinators causing community structure and composition changes.
33.	Disruption of Longshore Transport of Sediments	As a result of inlets, groins, etc.
34.	Harmful Algal Blooms	Excessive blooms of algae causing mortality and/or morbidity in fish, invertebrates, reptiles and mammals as a result of oxygen depletion or the release of toxins.
35.	Placement of Artificial Structures	Placement of artificial reefs either legally or illegally.
36.	Boating Impacts	Prop scarring, channels into individual docks, etc.
37.	Incompatible release of water (quality, quantity, timing)	Release of fresh water into marine/estuarine systems in a manner that is inconsistent with the natural timing, distribution, and quantity of fresh water into that system. This includes large pulses of fresh water into estuaries during high rain events to prevent flooding of urban areas, when the natural flow would be much slower and of much less quantity.
38.	Incompatible wildlife and fisheries management strategies	Wildlife or fisheries management activities or policies that harm native habitats and/or wildlife. This type of management is usually done as a socio-economic, rather than ecological benefit.
39	Bleaching	Loss of pigment in stony and soft corals due to the expulsion of the symbiotic algae that live inside coral polyps, sometimes causing death of the coral. This phenomenon is not entirely understood, but may be caused by higher water temperatures, altered light levels, chemicals or toxins in the water, or any combination of the above.

Appendix D: GIS Data Tables

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Aquatic Cave	Point	FNAI	Element Occurrence (fleo0103.shp)	Derived from all Florida Natural Areas Inventory (FNAI) elem ent occurrences for "aquatic cave," but only represents a fraction of all the caves.	Statewide	fw_caves.shp
Calcareous Stream	Line	USGS FGS / FDEP FDEP	National Hydrography dataset (NHDRCH.shp) Surficial Geology Dataset (SURGEO.shp) Major Rivers (MJRIVL.shp)	Derived by selecting all NHD stream reaches located within the area of limestone outcrop in Florida Geological Survey's Surficial Geology dataset and then deleting areas of overlap with other habitats (e.g., coastal/tidal rivers, etc.). Made other changes based on expert input - Added lower portion and main stem of Chipola; portion of Ocklawaha; added Holmes Creek from Major Rivers dataset. Removed portion of Waccasassa per expert advice.	Statewide	nhd_calcar.shp
Canal/Ditch	Line	USGS	National Hydrography Dataset (NHDRCH.shp)	Derived by selecting "ditches and canals" feature from the NHD stream reach data.	Statewide	nhd_canals.shp
Coastal Tidal River or Stream (freshwater map)	Line	FWC-FWRI USGS	Florida coastline and tidal rivers National Hydrography dataset (NHDRCH.shp)	Derived by overlaying "Florida coastline and tidal rivers" layer with NHD stream reaches. Presumably rivers and streams are included in the FWRI data up to head of tide. Note that this includes the St. Johns River up to about Sanford.	Statewide	coastal_rivers2d.shp

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Large Alluvial Stream	Line	USGS Florida's Geological Survey / FDEP	National Hydrography dataset (NHDRCH.shp) Surficial Geology dataset (SURGEO.shp)	Derived by overlaying National Hydrography Dataset (NHD) stream reach data with the "alluvium" category in Florida Geological Survey's (FGS) surficial geology dataset. Ground truthing indicates that all known alluvial portions of rivers in Florida are correctly identified. Made other changes based on expert input – Removed Blackwater River, Telogia Creek, Econfina Creek Tributary, Yellow, Shoal, Chipola, Sopchoppy. Retained only Escambia, Choctawhatchee, Apalachicola, and portion of Oclockonee.	Statewide	alluvial2new.shp
Natural Lake	Polygon	USGS FWC (FL GAP) FWMD's Tom Hoctor	National Hydrography dataset (NHDRCH.shp) fl_veg03 Florida Land Use, Land Cover Classification System Hybrid landuse dataset (hybridlanduse)	Derived from Tom Hoctor's hybrid land use data set and National Hydrography Dataset lakes and ponds. Hoctor's land use dataset is a combination of FWC's 2003 Vegetation classification and the WMD Florida Land Use, Land Cover Classification System (FLUCCS) dat a.	Statewide	natural lakes.shp
Reservoir/ Managed Lake	Polygon	USGS FWC (FL GAP) FWMD's Tom Hoctor	National Hydrography dataset (NHDRCH.shp) fl_veg03 Florida Land Use, Land Cover Classification System Hybrid landuse dataset (hybridlanduse)	Derived from Tom Hoctor's hybrid land use data set and National Hydrography Dataset reservoirs. Hoctor's land use dataset is a combination of FWC's 2003 Vegetation classification and the WMD Florida Land Use, Land Cover Classification System (FLUCCS) dat a	Statewide	reservoirs2.shp

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Seepage/ Steephead Stream	Line	FNAI USGS	Element Occurrence National Hydrography dataset (NHDRCH.shp)	Derived by identifying all known FNAI plant and animal element occurrences tightly associated with seepage/steephead systems, buffering around this point data and then looking for intersections of the buffer with NHD stream reaches.	Statewide	nhd_seep.shp
Softwater Stream	Line	USGS Florida Geological Survey FDEP	National Hydrography dataset (NHDRCH.shp) Surficial Geology (SURGEO.shp) Major Rivers (MJRIVL.shp)	Essentially all the NHD stream reaches that were not already one of the other freshwater habitats. Added Blackwater River segment from Major Rivers. Based on expert input, added Yellow, Shoal, Sopchoppy, portion of Waccasassa. Removed portion of Ocklawaha.	Statewide	nhd_blakwat2.shp
Spring and Spring Run	Line/ Point	USGS FDEP	National Hydrography dataset (NHDRCH.shp) Springs (Spring.shp)	Derived by buffering around known spring locations and selecting low-order NHD stream segments that intersect those buffers. Also includes Floridian springs - derived from Florida Department of Environmental Protection (FDEP) springs database by deleting surficial aquifer springs (more closely associated with seepage stream/steephead habitat). Resulting shape file includes all springs originating from Floridian Aquifer.	Statewide	nhd_sprrun.shp floridan_spr2.shp
Estimates of existing conserv'n. or managed areas	Vector digital data	FNAI	flma_200409	This data was used to develop the acreage in the status section of the habitat chapters	Statewide	flma_200409

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Estimates of Florida Forever projects	Vector digital data	FNAI	ffbot_200409	This data was used to develop the acreage in the status section of the habitat chapters	Statewide	ffbot_200409
Estimates of SHCA-designated lands	Grid	FWC	GFCSHA.VAT	This data was used to develop the acreage in the status section of the habitat chapters Cox, J. A., R. S. Kautz, M. MacLaughlin and T. Gilbert. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Office of Environmental Services, Florida Game and Fresh Water Fish Commission. Tallahassee, Florida, USA.	Statewide	GFCSHA.VAT
Terrestrial Cave	Point	FNAI	fleo_caves.shp	Derived from all Florida Natural Areas Inventory (FNAI) elem ent occurrences for "terrestrial caves."	Statewide	fleo_caves.shp
Bay Swamp Beach/Surf Zone Bottomland Hardwood Forest Coastal Strand Cypress Swamp Disturbed/ Transitional Dry Prairie Freshwater Marsh and Wet Prairie	Polygon	FWC- 2003 land cover	fl_veg03	Used as is from: Florida Vegetation and Land Cover Data (Stys, B., R. Kautz, D. Reed, M. Kertis, and R. Kawula. 2004. Florida Vegetation and Land Cover Data Derived from 2003 Landsat ETM+ Imagery. Florida Fish and Wildlife Conservation Commission, Tallahassee.)	Statewide	fl_veg03

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Grassland/ Improved Pasture Hardwood Hammock Forest Hardwood Swamp/ Mixed Wetland Forest	Polygon	FWC- 2003 land cover	fl_veg03	Used as is from: Florida Vegetation and Land Cover Data (Stys, B., R. Kautz, D. Reed, M. Kertis, and R. Kawula. 2004. Florida Vegetation and Land Cover Data Derived from 2003 Landsat ETM+ Imagery. Florida Fish and Wildlife Conservation Commission, Tallahassee.)	Statewide	fl_veg03
Hydric Hammock Industrial/ Commercial Pineland Mixed Hardwood-Pine Forest	Polygon	FWC- 2003 land cover	fl_veg03	Used as is from: Florida Vegetation and Land Cover Data (Stys, B., R. Kautz, D. Reed, M. Kertis, and R. Kawula. 2004. Florida Vegetation and Land Cover Data Derived from 2003 Landsat ETM+ Imagery. Florida Fish and Wildlife Conservation Commission, Tallahassee.)	Statewide	fl_veg03
Natural Pineland Pine Rockland Salt Marsh Sandhill	Polygon	FWC- 2003 land cover	fl_veg03	Used as is from: Florida Vegetation and Land Cover Data (Stys, B., R. Kautz, D. Reed, M. Kertis, and R. Kawula. 2004. Florida Vegetation and Land Cover Data Derived from 2003 Landsat ETM+ Imagery. Florida Fish and Wildlife Conservation Commission, Tallahassee.)	Statewide	fl_veg03

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Scrub Shrub Swamp Tidal Flat Tropical Hardwood Hammock Urban/ Developed	Polygon	FWC- 2003 land cover	fl_veg03	Used as is from: Florida Vegetation and Land Cover Data (Stys, B., R. Kautz, D. Reed, M. Kertis, and R. Kawula. 2004. Florida Vegetation and Land Cover Data Derived from 2003 Landsat ETM+ Imagery. Florida Fish and Wildlife Conservation Commission, Tallahassee.)	Statewide	fl_veg03
Annelid Worm Reef [1] (Sabellariid-ae)	Polygon	D. McCarthy D. Kirtley & W. Tanner D. Stauble & D. McNeill	N/A	Created shapefile using graphics and text descriptions with reference points; in some cases located reefs mentioned in text above using FGDL – Digital Orthophoto Quarter Quad 3 Meter aerial images; some coordinates also used	Southeast & East Central Florida	wormreefs.shp
Artificial Structure	Point	FWC-FWRI FWC-FWRI	artificialreef_fl_point.shp solid_man-made_structures_ESI.shp	Used as is; Isolated solid man-made structures attribute in Environmental Sensitivity Index shapefile.	Statewide Statewide	artificialreef_fl_point.shp solidstr.shp
Beach/Surf Zone	Polygon	FWC (FL GAP) SFWMD	beach_surf_zone.shp beaches_wmd.shp	Used as is (missing SE Florida beaches) Used as is. These 2 datasets complement each other to fill gaps in each.	Statewide, incomplete; Statewide, incomplete	beach_surf_zone.shp; beaches_wmd.shp
Benthic Complexity[2]	Polygon	National Geophysical Data Center	90 meter bathymetry data	Model derived by Duke University Marine Geospatial Ecology Laboratory (DUGAP 2005); Gulf Coast dataset produced by G. Cumming	Statewide with some gaps	bc2-poly.shp

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Bivalve Reef (Oyster)	Polygon	Grizzel et al. 2002	Canaveral_Seashore_allreef-final.shp	Used as is;	East-Central Florida	Canaveral_Seashore_allreef-final.shp
		USFWS	national_wtlds_inventory_areas.shp	Isolated intertidal mollusk reef in NWI;	Statewide	nwi_est_intrtdl_moll_reefs.shp
		ANERR	Oyster_Bars_ANERR.shp	Used as is;	Apalachicola NERR	Oyster_Bars_ANERR.shp
		A. Volety	Oysters bar aerials, SW FL	Created shapefile from aerial images for SW FL;	SW Florida	oysterssw.shp
		SFWMD	SLO2003beds.shp	Used as is;	St. Lucie Estuary	SLO2003beds.shp
		SRWMD	oyster_bigbend.shp	Used as is;	Big Bend	oyster_bigbend.shp
		SRWMD/ USGS-NWRC	oyster_nw_92.shp	Used as is.	Panhandle	oyster_nw_92.shp
Coastal Tidal River or Stream	Line	FWC-FWRI	Florida coastline and tidal rivers	Derived by overlaying "Florida coastline and tidal rivers" layer with NHD stream reaches. Presumably rivers and streams are included in the FWRI data up to head of tide. Note that this includes the St. Johns River up to about Sanford.	Statewide	coastal_rivers2d.shp
		USGS	National Hydrography Dataset (NHD)			

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Coral Reef (Oculina)	Polygon	FWC-FWRI Palm Beach County Miami Dade County Broward County NURC/UNCW	benthic_south_fl_poly.shp palm beach 2003_reef_OFFSHORE.shp and LADS data LADS data broward reefs.shp oculina.shp	Isolated patch & platform margin reefs attributes; Used as is; Created reef shapefile from LADs data; Created reef shapefile from LADs data; Used as is. ---------- For all coral reef datasets, we identified patch (discrete reef patches, mostly shallow at 0-15 meters deep), shallow bank (0-10 meters deep), deep bank (10-30 meters deep), and deep reef resources (30-200 meters deep).	SE Florida & Florida Keys	sf_benthic_97.shp palm beach 2003_reef_OFFSHORE.shp palm beach reefs.shp miami dade reefs.shp broward reefs.shp oculina.shp
Mangrove Swamp	Polygon	FWC (FL GAP)	fl_veg03	Isolated mangrove swamp & scrub mangrove attributes; Converted raster data to shapefile.	Statewide	fl_veg03_mangroves.shp
Hard Bottom	Polygon	FWC-FWRI (SEAMAP-SA 2001) FWC-FWRI (Middle Grounds Data 1979)	seamap.shp middleground_data 1979 reef.shp	Selected hardbottom and potential hardbottom attributes. Selected reef attributes	Florida Atlantic Coast with some gaps Partial coverage of Gulf of Mexico	HardbottomC.shp reef.shp
Inlet	Polygon	Univ. of FL Geoplan Center & USGS	Aerial photos (digital orthoquads, DOQQs)	Used Geoplan & USGS county aerials to ID locations; Solicited expert input re: polygon size.	Statewide	inlets_poly_statewideWkeys.shp
Salt Marsh	Polygon	FWC (FL GAP)	fl_veg03	Isolated salt marsh attribute; Created shapefile from raster data.	Statewide	flveg03saltmarsh
Submerged Aquatic Vegetation	Polygon	FWC-FWRI	seagrass_fl_1987to1999_poly.shp	Used as is.	Statewide	seagrass_fl_1987to1999_poly.shp

TARGET	DATA TYPE	DATA SOURCE(s)	SOURCE DATASET(s)	PROJECT DATA PROCESSING	DATASET EXTENT	PROJECT DATASET NAME(s)
Tidal Flat	Polygon	FWC (FL GAP) FWC-FWRI	fl_veg03 tidalflats_fl_nwi_poly.shp	Isolated tide flats attribute in fl_veg03 and combined with FWRI's tide flats layer.	Statewide	fl_veg03_and_FWRI_tidalflats.shp

[1]*Survey information for sabellarid worm reefs in Florida was only available for the sabellarid, Phragmatopoma lapidosa, which occurs in east-central and southeast Florida coastal areas.*
[2] *Benthic Complexity is not a CWCS habitat category. This data was used in site prioritization analyses presented in TNC's Final Report (Gordon et al., 2005)*