

A Management Plan for
Florida Keys
Wildlife and Environmental Area
2016 - 2026



Monroe County, Florida

Florida Fish and Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, Florida 32399-1600



Florida Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Jonathan P. Steverson
Secretary

February 23, 2016

Mr. Gary Cochran
Florida Fish and Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, FL 32399-1600

RE: Florida Keys Wildlife and Environmental Area – Lease #4153

Dear Mr. Cochran:

On **February 19, 2016**, the Acquisition and Restoration Council recommended approval of the **Florida Keys Wildlife and Environmental Area** management plan. Therefore, the Division of State Lands, Office of Environmental Services, acting as agent for the Board of Trustees of the Internal Improvement Trust Fund, hereby approves the **Florida Keys Wildlife and Environmental Area** management plan. The next management plan update is due February 19, 2026.

Approval of this land management plan does not waive the authority or jurisdiction of any governmental entity that may have an interest in this project. Implementation of any upland activities proposed by this management plan may require a permit or other authorization from federal and state agencies having regulatory jurisdiction over those particular activities. Pursuant to the conditions of your lease, please forward copies of all permits to this office upon issuance.

Sincerely,

A handwritten signature in cursive script that reads "Paula L. Allen".

Paula L. Allen
Office of Environmental Services
Division of State Lands

**A Management Plan
for
Florida Keys Wildlife and Environmental Area**

Monroe County, Florida

Owned by the Board of Trustees of the Internal Improvement Trust Fund
Managed by the Florida Fish and Wildlife Conservation Commission



October 2015

Approved *Thomas H. Eason*
Thomas Eason
Director, Division of Habitat and Species Conservation

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LAND MANAGEMENT PLAN EXECUTIVE SUMMARY

Lead Agency: Florida Fish and Wildlife Conservation Commission (FWC)
 Common Name of Property: Florida Keys Wildlife and Environmental Area
 Location: Monroe County, Florida
 Acreage Total: 4,250 acres
 Acreage Breakdown:

<u>Land Cover Classification</u>	<u>Acres</u>	<u>Percent of Total Area</u>
Coastal berm	36.73	0.70%
Coastal rock barren/Keys tidal rock barren	1,206.61	23.13%
Estuarine	67.76	1.30%
Mangrove swamp	2,558.27	49.04%
Marine	39.87	0.76%
Rockland hammock	1,025.67	19.66%
Ruderal - unclassified	38.97	0.75%
Ruderal - abandoned field	1.82	0.03%
Ruderal - canal	6.00	0.11%
Ruderal - clearing	13.44	0.26%
Ruderal - exotic monoculture	0.45	0.01%
Ruderal - impoundment/artificial lake	26.26	0.50%
Ruderal - road	0.15	0.00%
Ruderal - spoil area	4.16	0.08%
Salt marsh	1.25	0.02%
Tidal flat	3.48	0.07%
Unconsolidated substrate	185.39	3.55%

*GIS-calculated acreage for land cover classification varies from actual total acreage.

Lease/Management Agreement No.: 4153 (Appendix 13.1)

Use: Single _____ Management Responsibilities:
 Multiple X Agency FWC Responsibilities
LEAD, SUBLESSEE (Wildlife and Environmental Area, resource protection, law enforcement)

Designated Land Use: Wildlife and Environmental Area

Sublease (s): None

Encumbrances: List: No known encumbrances.

Type Acquisition: CARL, P2000, and Florida Forever

Unique Features: Natural: Tropical hardwood hammocks, rare and unique natural communities.

Archaeological/Historical: Fifteen documented within FKWEA.

Management Needs: Habitat restoration and improvement; public access and recreational opportunities; hydrological preservation and restoration; exotic and invasive species maintenance and control; imperiled species habitat maintenance, enhancement, and restoration.

Acquisition Needs/Acreage: 92 acres FWC Additions and Inholdings list; 6,392 acres remaining in the Florida Keys Ecosystem Florida Forever Project (Figures 29-31).

Surplus Lands/Acreage: None

Public Involvement: Management Advisory Group consensus building meeting and Public Hearing (Appendix 13.3)

DO NOT WRITE BELOW THIS LINE (FOR DIVISION OF STATE LANDS USE ONLY)

ARC Approval Date _____ BTIITF Approval Date: _____

Comments: _____

Land Management Plan Compliance Checklist

Required for State-owned conservation lands over 160 acres

Section A: Acquisition Information Items

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
1	The common name of the property.	18-2.018 & 18-2.021	1
2	The land acquisition program, if any, under which the property was acquired.	18-2.018 & 18-2.021	11
3	Degree of title interest held by the Board, including reservations and encumbrances such as leases.	18-2.021	12
4	The legal description and acreage of the property.	18-2.018 & 18-2.021	1, Appendix 3.1
5	A map showing the approximate location and boundaries of the property, and the location of any structures or improvements to the property.	18-2.018 & 18-2.021	4-10, 103
6	An assessment as to whether the property, or any portion, should be declared surplus. <i>Provide information regarding assessment and analysis in the plan, and provide corresponding map.</i>	18-2.021	82
7	Identification of other parcels of land within or immediately adjacent to the property that should be purchased because they are essential to management of the property. <i>Please clearly indicate parcels on a map.</i>	18-2.021	105-109
8	Identification of adjacent land uses that conflict with the planned use of the property, if any.	18-2.021	16-18
9	A statement of the purpose for which the lands were acquired, the projected use or uses as defined in 253.034 and the statutory authority for such use or uses.	259.032(10)	11-12
10	Proximity of property to other significant State, local or federal land or water resources.	18-2.021	12-16

Section B: Use Items

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
11	The designated single use or multiple use management for the property, including use by other managing entities.	18-2.018 & 18-2.021	80-81
12	A description of past and existing uses, including any unauthorized uses of the property.	18-2.018 & 18-2.021	78-79
13	A description of alternative or multiple uses of the property considered by the lessee and a statement detailing why such uses were not adopted.	18-2.018	80-81
14	A description of the management responsibilities of each entity involved in the property's management and how such responsibilities will be coordinated.	18-2.018	12, 110
15	Include a provision that requires that the managing agency consult with the Division of Historical Resources, Department of State before taking actions that may adversely affect archeological or historical resources.	18-2.021	77, 101-102, 127

16	Analysis/description of other managing agencies and private land managers, if any, which could facilitate the restoration or management of the land.	18-2.021	110
17	A determination of the public uses and public access that would be consistent with the purposes for which the lands were acquired.	259.032(10)	97-100
18	A finding regarding whether each planned use complies with the 1981 State Lands Management Plan, particularly whether such uses represent “balanced public utilization,” specific agency statutory authority and any other legislative or executive directives that constrain the use of such property.	18-2.021	80-81
19	Letter of compliance from the local government stating that the LMP is in compliance with the Local Government Comprehensive Plan.	BOT requirement	Appendix 13.14
20	An assessment of the impact of planned uses on the renewable and non-renewable resources of the property, including soil and water resources, and a detailed description of the specific actions that will be taken to protect, enhance and conserve these resources and to compensate/mitigate damage caused by such uses, including a description of how the manager plans to control and prevent soil erosion and soil or water contamination.	18-2.018 & 18-2.021	100-101, 113
21	*For managed areas larger than 1,000 acres, an analysis of the multiple-use potential of the property which shall include the potential of the property to generate revenues to enhance the management of the property provided that no lease, easement, or license for such revenue-generating use shall be entered into if the granting of such lease, easement or license would adversely affect the tax exemption of the interest on any revenue bonds issued to fund the acquisition of the affected lands from gross income for federal income tax purposes, pursuant to Internal Revenue Service regulations.	18-2.021 & 253.036	79-80
22	If the lead managing agency determines that timber resource management is not in conflict with the primary management objectives of the managed area, a component or section, prepared by a qualified professional forester, that assesses the feasibility of managing timber resources pursuant to section 253.036, F.S.	18-021	101
23	A statement regarding incompatible use in reference to Ch. 253.034(10).	253.034(10)	81

*The following taken from 253.034(10) is not a land management plan requirement; however, it should be considered when developing a land management plan: The following additional uses of conservation lands acquired pursuant to the Florida Forever program and other state-funded conservation land purchase programs shall be authorized, upon a finding by the Board of Trustees, if they meet the criteria specified in paragraphs (a)-(e): water resource development projects, water supply development projects, storm-water management projects, linear facilities and sustainable agriculture and forestry. Such additional uses are authorized where: (a) Not inconsistent with the management plan for such lands; (b) Compatible with the natural ecosystem and resource values of such lands; (c) The proposed use is appropriately located on such lands and where due consideration is given to the use of other available lands; (d) The using entity reasonably compensates the titleholder for such use based upon an appropriate measure of value; and (e) The use is consistent with the public interest.

Section C: Public Involvement Items

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
24	A statement concerning the extent of public involvement and local government participation in the development of the plan, if any.	18-2.021	18
25	The management prospectus required pursuant to paragraph (9)(d) shall be available to the public for a period of 30 days prior to the public hearing.	259.032(10)	Appendix 13.3.4
26	LMPs and LMP updates for parcels over 160 acres shall be developed with input from an advisory group who must conduct at least one public hearing within the county in which the parcel or project is located. <i>Include the advisory group members and their affiliations, as well as the date and location of the advisory group meeting.</i>	259.032(10)	Appendix 13.3.1, 13.3.2, & 13.3.3
27	Summary of comments and concerns expressed by the advisory group for parcels over 160 acres	18-2.021	Appendix 13.3.1
28	During plan development, at least one public hearing shall be held in each affected county. Notice of such public hearing shall be posted on the parcel or project designated for management, advertised in a paper of general circulation, and announced at a scheduled meeting of the local governing body before the actual public hearing. <i>Include a copy of each County's advertisements and announcements (meeting minutes will suffice to indicate an announcement) in the management plan.</i>	253.034(5) & 259.032(10)	Appendix 13.3.2 & 13.3.3
29	The manager shall consider the findings and recommendations of the land management review team in finalizing the required 10-year update of its management plan. <i>Include manager's replies to the team's findings and recommendations.</i>	259.036	88, Appendix 13.4
30	Summary of comments and concerns expressed by the management review team, if required by Section 259.036, F.S.	18-2.021	Appendix 13.4
31	If manager is not in agreement with the management review team's findings and recommendations in finalizing the required 10-year update of its management plan, the managing agency should explain why they disagree with the findings or recommendations.	259.036	Appendix 13.4

Section D: Natural Resources

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
32	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding soil types. <i>Use brief descriptions and include USDA maps when available.</i>	18-2.021	19-26, Appendix 13.5
33	Insert FNAI based natural community maps when available.	ARC consensus	27-32
34	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding outstanding native landscapes containing relatively unaltered flora, fauna and geological conditions.	18-2.021	19, 75

35	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding unique natural features and/or resources including but not limited to virgin timber stands, scenic vistas, natural rivers and streams, coral reefs, natural springs, caverns and large sinkholes.	18-2.018 & 18-2.021	75-77
36	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding beaches and dunes.	18-2.021	76
37	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding mineral resources, such as oil, gas and phosphate, etc.	18-2.018 & 18-2.021	76
38	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding fish and wildlife, both game and non-game, and their habitat.	18-2.018 & 18-2.021	52-74
39	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding State and Federally listed endangered or threatened species and their habitat.	18-2.021	66-74
40	The identification or resources on the property that are listed in the Natural Areas Inventory. <i>Include letter from FNAI or consultant where appropriate.</i>	18-2.021	27-32, Appendix 13.6
41	Specific description of how the managing agency plans to identify, locate, protect and preserve or otherwise use fragile, nonrenewable natural and cultural resources.	259.032(10)	87-148
42	Habitat Restoration and Improvement	259.032(10) & 253.034(5)	
42-A.	Describe management needs, problems and a desired outcome and the key management activities necessary to achieve the enhancement, protection and preservation of restored habitats and enhance the natural, historical and archeological resources and their values for which the lands were acquired.	↓	87-148
42-B.	Provide a detailed description of both short (2-year planning period) and long-term (10-year planning period) management goals, and a priority schedule based on the purposes for which the lands were acquired and include a timeline for completion.		117-143
42-C.	The associated measurable objectives to achieve the goals.		117-131
42-D.	The related activities that are to be performed to meet the land management objectives and their associated measures. <i>Include fire management plans - they can be in plan body or an appendix.</i>		87-148
42-E.	A detailed expense and manpower budget in order to provide a management tool that facilitates development of performance measures, including recommendations for cost-effective methods of accomplishing those activities.		146-148, Appendix 13.12
43	***Quantitative data description of the land regarding an inventory of forest and other natural resources and associated acreage. <i>See footnote.</i>	253.034(5)	28
44	Sustainable Forest Management, including implementation of prescribed fire management	18-2.021, 253.034(5) & 259.032(10) ↓	
44-A.	Management needs, problems and a desired outcome (see requirement for # 42-A).		87-148

44-B.	Detailed description of both short and long-term management goals (see requirement for # 42-B).		117-143
44-C.	Measurable objectives (see requirement for #42-C).		117-131
44-D.	Related activities (see requirement for #42-D).		87-148
44-E.	Budgets (see requirement for #42-E).		146-148, Appendix 13.12
45	Imperiled species, habitat maintenance, enhancement, restoration or population restoration		259.032(10) & 253.034(5)
45-A.	Management needs, problems and a desired outcome (see requirement for # 42-A).	↓	87-148
45-B.	Detailed description of both short and long-term management goals (see requirement for # 42-B).		117-143
45-C.	Measurable objectives (see requirement for #42-C).		117-131
45-D.	Related activities (see requirement for #42-D).		87-148
45-E.	Budgets (see requirement for #42-E).		146-148, Appendix 13.12
46	***Quantitative data description of the land regarding an inventory of exotic and invasive plants and associated acreage. <i>See footnote.</i>		253.034(5)
47	Place the Arthropod Control Plan in an appendix. If one does not exist, provide a statement as to what arrangement exists between the local mosquito control district and the management unit.	BOT requirement via lease language	Appendix 13.13
48	Exotic and invasive species maintenance and control	259.032(10) & 253.034(5)	
48-A.	Management needs, problems and a desired outcome (see requirement for # 42-A).	↓	87-148
48-B.	Detailed description of both short and long-term management goals (see requirement for # 42-B).		117-143
48-C.	Measurable objectives (see requirement for #42-C).		117-131
48-D.	Related activities (see requirement for #42-D).		87-148
48-E.	Budgets (see requirement for #42-E).		146-148, Appendix 13.12

Section E: Water Resources

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
49	A statement as to whether the property is within and/or adjacent to an aquatic preserve or a designated area of critical state concern or an area under study for such designation. <i>If yes, provide a list of the appropriate managing agencies that have been notified of the proposed plan.</i>	18-2.018 & 18-2.021	1-2, 12-18, 110

50	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding water resources, including water classification for each water body and the identification of any such water body that is designated as an Outstanding Florida Water under Rule 62-302.700, F.A.C.	18-2.021	28-32, 47-51, 75-76
51	Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding swamps, marshes and other wetlands.	18-2.021	28-32, 47-51, 75-76
52	***Quantitative description of the land regarding an inventory of hydrological features and associated acreage. <i>See footnote.</i>	253.034(5)	28-32
53	Hydrological Preservation and Restoration	259.032(10) & 253.034(5)	
53-A.	Management needs, problems and a desired outcome (see requirement for # 42-A).	↓	87-148
53-B.	Detailed description of both short and long-term management goals (see requirement for # 42-B).		117-143
53-C.	Measurable objectives (see requirement for #42-C).		117-131
53-D.	Related activities (see requirement for #42-D).		87-148
53-E.	Budgets (see requirement for #42-E).		146-148, Appendix 13.12

Section F: Historical, Archeological and Cultural Resources

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
54	**Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding archeological and historical resources. <i>Include maps of all cultural resources except Native American sites, unless such sites are major points of interest that are open to public visitation.</i>	18-2.018, 18-2.021 & per DHR's request	77, 101-102, Appendix 13.9.1
55	***Quantitative data description of the land regarding an inventory of significant land, cultural or historical features and associated acreage.	253.034(5)	77, 101-102, Appendix 13.9.1
56	A description of actions the agency plans to take to locate and identify unknown resources such as surveys of unknown archeological and historical resources.	18-2.021	101-102, 127
57	Cultural and Historical Resources	259.032(10) & 253.034(5)	
57-A.	Management needs, problems and a desired outcome (see requirement for # 42-A).	↓	87-148
57-B.	Detailed description of both short and long-term management goals (see requirement for # 42-B).		117-143
57-C.	Measurable objectives (see requirement for #42-C).		117-131
57-D.	Related activities (see requirement for #42-D).		87-148
57-E.	Budgets (see requirement for #42-E).		146-148, Appendix 13.12

**While maps of Native American sites should not be included in the body of the management plan, the DSL urges each managing agency to provide such information to the Division of Historical Resources for inclusion in their proprietary database. This information should be available for access to new managers to assist them in developing, implementing and coordinating their management activities.

Section G: Facilities (Infrastructure, Access, Recreation)

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
58	***Quantitative data description of the land regarding an inventory of infrastructure and associated acreage. <i>See footnote.</i>	253.034(5)	102-103
59	Capital Facilities and Infrastructure	259.032(10) & 253.034(5)	
59-A.	Management needs, problems and a desired outcome (see requirement for # 42-A).	↓	87-148
59-B.	Detailed description of both short and long-term management goals (see requirement for # 42-B).		117-143
59-C.	Measurable objectives (see requirement for #42-C).		117-131
59-D.	Related activities (see requirement for #42-D).		87-148
59-E.	Budgets (see requirement for #42-E).		146-148, Appendix 13.12
60	*** Quantitative data description of the land regarding an inventory of recreational facilities and associated acreage.	253.034(5)	97-100, 102-103
61	Public Access and Recreational Opportunities	259.032(10) & 253.034(5)	
61-A.	Management needs, problems and a desired outcome (see requirement for # 42-A).	↓	87-148
61-B.	Detailed description of both short and long-term management goals (see requirement for # 42-B).		117-143
61-C.	Measurable objectives (see requirement for #42-C).		117-131
61-D.	Related activities (see requirement for #42-D).		87-148
61-E.	Budgets (see requirement for #42-E).		146-148, Appendix 13.12

Section H: Other/ Managing Agency Tools

Item #	Requirement	Statute/Rule	Page Numbers and/or Appendix
62	Place this LMP Compliance Checklist at the front of the plan.	ARC and managing agency consensus	v-xii
63	Place the Executive Summary at the front of the LMP. Include a physical description of the land.	ARC and 253.034(5)	iii-iv
64	If this LMP is a 10-year update, note the accomplishments since the drafting of the last LMP set forth in an organized (categories or bullets) format.	ARC consensus	82-87
65	Key management activities necessary to achieve the desired outcomes regarding other appropriate resource management.	259.032(10)	87-148

66	Summary budget for the scheduled land management activities of the LMP including any potential fees anticipated from public or private entities for projects to offset adverse impacts to imperiled species or such habitat, which fees shall be used to restore, manage, enhance, repopulate, or acquire imperiled species habitat for lands that have or are anticipated to have imperiled species or such habitat onsite. The summary budget shall be prepared in such a manner that it facilitates computing an aggregate of land management costs for all state-managed lands using the categories described in s. 259.037(3) which are resource management, administration, support, capital improvements, recreation visitor services, law enforcement activities.	253.034(5)	146-148, Appendix 13.12
67	Cost estimate for conducting other management activities which would enhance the natural resource value or public recreation value for which the lands were acquired, include recommendations for cost-effective methods in accomplishing those activities.	259.032(10)	146-148, Appendix 13.12
68	A statement of gross income generated, net income and expenses.	18-2.018	79-80, 146-148, Appendix 13.12

*** = The referenced inventories shall be of such detail that objective measures and benchmarks can be established for each tract of land and monitored during the lifetime of the plan. All quantitative data collected shall be aggregated, standardized, collected, and presented in an electronic format to allow for uniform management reporting and analysis. The information collected by the DEP pursuant to s. 253.0325(2) shall be available to the land manager and his or her assignee.

Management Plan Compliance Checklist - Conservation Lands.xlsx

Table of Contents

1	Introduction and General Information	1
1.1	Management Plan Purpose	2
1.1.1	FWC Planning Philosophy	2
1.2	Location	3
1.3	Acquisition.....	11
1.3.1	Purpose for Acquisition of the Property.....	11
1.3.2	Acquisition History.....	11
1.4	Management Authority	12
1.5	Management Directives	12
1.6	Title Interest and Encumbrances	12
1.7	Proximity to Other Public Conservation Lands	12
1.8	Adjacent Land Uses.....	16
1.8.1	Florida Keys Area of Critical State Concern	17
1.9	Public Involvement.....	18
2	Natural and Historical Resources	18
2.1	Physiography.....	18
2.1.1	Climate	19
2.1.2	Topography	19
2.1.3	Soils	19
2.1.4	Geologic Conditions.....	19
2.2	Vegetation.....	27
2.2.1	FNAI Natural Community Descriptions	47
2.2.2	Forest Resources	52
2.3	Fish and Wildlife Resources.....	52
2.3.1	Integrated Wildlife Habitat Ranking System.....	62
2.3.2	Imperiled Species	66
2.3.3	FWC Wildlife Observations and FNAI Element Occurrences	68
2.3.4	United States Fish and Wildlife Service Critical Habitat.....	69
2.4	Native Landscapes	75
2.5	Water Resources.....	75

2.6	Beaches and Dunes	76
2.7	Mineral Resources	76
2.8	Historical Resources	77
2.9	Scenic Resources.....	77
3	Uses of the Property	78
3.1	Previous Use and Development	78
3.2	Current Use of the Property.....	79
3.2.1	Visitation and Economic Benefits	79
3.3	Single- or Multiple-use Management	80
3.3.1	Analysis of Multiple-use Potential.....	80
3.3.2	Incompatible Uses and Linear Facilities	81
3.3.3	Assessment of Impact of Planned Uses of the Property	82
3.4	Acreage Recommended for Potential Surplus Review.....	82
4	Accomplished Objectives from the FKWEA Management Plan 2004 – 2014	82
5	Management Activities and Intent	87
5.1	Land Management Review.....	88
5.2	Adaptive Management	88
5.2.1	Monitoring	88
5.2.2	Performance Measures.....	89
5.2.3	Implementation	89
5.3	Habitat Restoration and Improvement.....	89
5.3.1	Objective-Based Vegetation Management.....	90
5.3.2	Prescribed Fire and Fire Management.....	91
5.3.3	Habitat Restoration.....	92
5.4	Fish and Wildlife Management, Imperiled and Focal Species Habitat Maintenance, Enhancement, Restoration, or Population Restoration	92
5.4.1	Fish and Wildlife	92
5.4.2	Imperiled and Focal Species: Wildlife Conservation Prioritization and Recovery.....	93
5.5	Exotic and Invasive Species Maintenance and Control	95
5.6	Public Access and Recreational Opportunities	97

5.7	Hydrological Preservation and Restoration.....	100
5.7.1	Hydrological Assessment	100
5.7.2	Water Resource Monitoring	101
5.8	Forest Resource Management.....	101
5.9	Historical Resources	101
5.10	Capital Facilities and Infrastructure.....	102
5.11	Land Conservation and Stewardship Partnerships	105
5.11.1	Optimal Resource Boundary	105
5.11.2	Optimal Conservation Planning Boundary	105
5.11.3	Conservation Action Strategy	105
5.11.4	FWC Florida Forever Additions and Inholdings Acquisition List	106
5.12	Research Opportunities.....	110
5.13	Cooperative Management and Special Uses.....	110
5.13.1	Cooperative Management	110
5.13.2	First Responder and Military Training	110
5.13.3	Apiaries.....	111
5.14	Climate Change.....	111
5.15	Soil and Water Conservation	113
6	Resource Management Goals and Objectives	117
6.1	Habitat Restoration and Improvement.....	117
6.2	Imperiled and Focal Species Habitat Maintenance, Enhancement, Restoration, or Population Restoration	118
6.3	Other Wildlife (Game and Nongame) Habitat Maintenance, Enhancement, Restoration, or Population Restoration.....	120
6.4	Exotic and Invasive Species Maintenance and Control	121
6.5	Public Access and Recreational Opportunities	122
6.6	Hydrological Preservation and Restoration.....	123
6.7	Forest Resource Management.....	124
6.8	Historical Resources	127
6.9	Capital Facilities and Infrastructure.....	128
6.10	Land Conservation and Stewardship Partnerships	128

6.11	Cooperative Management and Special Uses.....	130
6.12	Climate Change.....	131
6.13	Research Opportunities.....	131
7	Schedule: Timelines for Completion of Resource Management Goals and Objectives	131
8	Resource Management Challenges and Strategies	144
9	Cost Estimates and Funding Sources	146
10	Analysis of Potential for Contracting Private Vendors for Restoration and Management Activities.....	149
11	Compliance with Federal, State, and Local Governmental Requirements	150
12	Endnotes	150
13	Appendix	153

Table of Figures

Figure 1. FKWEA Location	4
Figure 2. FKWEA – Upper Keys Aerial Imagery	5
Figure 3. FKWEA – Middle Keys Aerial Imagery	6
Figure 4. FKWEA – Lower Keys Aerial Imagery	7
Figure 5. FKWEA Section, Township, and Range – Upper Keys.....	8
Figure 6. FKWEA Section, Township, and Range – Middle Keys.....	9
Figure 7. FKWEA Section, Township, and Range – Lower Keys.....	10
Figure 8. Nearby Conservation Lands and Florida Forever Projects	13
Figure 9. FKWEA Soil Type – Upper Keys.....	20
Figure 10. FKWEA Soil Type – Middle Keys.....	21
Figure 11. FKWEA Soil Type – Lower Keys NE	22
Figure 12. FKWEA Soil Type – Lower Keys SW	23
Figure 13. FKWEA Soil Depth to Water Table – Upper Keys	24
Figure 14. FKWEA Soil Depth to Water Table – Middle Keys	25
Figure 15. FKWEA Soil Depth to Water Table – Lower Keys	26
Figure 16. FKWEA Natural Communities – Upper Keys	29
Figure 17. FKWEA Natural Communities – Middle Keys	30
Figure 18. FKWEA Natural Communities – Lower Keys NE.....	31
Figure 19. FKWEA Natural Communities – Lower Keys SW	32
Figure 20. FWC IWHRs 2009 – FKWEA Upper Keys	63
Figure 21. FWC IWHRs 2009 – FKWEA Middle Keys	64
Figure 22. FWC IWHRs 2009 – FKWEA Lower Keys	65
Figure 23. FWC Wildlife Observations & FNAI Element Occurrences–Upper Keys.....	70
Figure 24. FWC Wildlife Observations & FNAI Element Occurrences–Middle Keys.....	71
Figure 25. FWC Wildlife Observations & FNAI Element Occurrences–Lower Keys NE.....	72
Figure 26. FWC Wildlife Observations & FNAI Element Occurrences–Lower Keys SW.....	73
Figure 27. FKWEA – USFWS Critical Habitat.....	74
Figure 28. FKWEA Capital Facilities and Infrastructure	103
Figure 29. FKWEA Optimal Conservation Planning Boundary – Upper Keys.....	107
Figure 30. FKWEA Optimal Conservation Planning Boundary – Middle Keys.....	108

Figure 31. FKWEA Optimal Conservation Planning Boundary – Lower Keys	109
Figure 32. Sea Level Rise Potential Inundation – Upper Keys.....	114
Figure 33. Sea Level Rise Potential Inundation – Middle Keys	115
Figure 34. Sea Level Rise Potential Inundation – Lower Keys.....	116
Figure 35. FKWEA Project Locations	125

Table of Tables

Table 1. Conservation Lands within 20 Miles of FKWEA.....	15
Table 2. Florida Forever Projects within 20 Miles of FKWEA.....	16
Table 3. FKWEA FNAI Natural and Anthropogenic Communities.....	28
Table 4. Native Plant Species Known to Occur on the FKWEA	33
Table 5. Rare and Imperiled Plants Known to Occur on the FKWEA	41
Table 6. Exotic Plant Species Known to Occur on the FKWEA	43
Table 7. Mammal Species Occurring on or near FKWEA	52
Table 8. Bird Species Occurring on or near FKWEA.....	53
Table 9. Reptile and Amphibian Species Occurring on or near FKWEA.....	56
Table 10. Fish Species Occurring on or near FKWEA.....	57
Table 11. Butterfly Species Occurring on or near FKWEA.....	58
Table 12. Mollusks Species Occurring on or near FKWEA	61
Table 13. Exotic Species Occurring on or Near FKWEA.....	62
Table 14. Rare and Imperiled Species Occuring on or near FKWEA.....	66
Table 15. Focal Species Occurring on or Near the FKWEA.....	95

1 Introduction and General Information

The imperiled tropical hammocks and other vegetative communities within the Florida Keys contain populations of exceptionally rare and unique wildlife and plants that occur nowhere else in the world. Tropical hardwood hammocks are the only tropical hardwood forests in the continental United States and are among the most imperiled plant communities in the world. Many of the tropical hardwood hammocks on the south Florida mainland and in the Keys have been lost to development because they occupy higher, drier land suitable for human habitation. The Florida Keys Wildlife and Environmental Area (FKWEA) was acquired to protect and to restore the imperiled, rare, and more common native plants and animals in these communities and others that are present on the area, many of which are found nowhere else in the continental United States and some of which are found nowhere else in the world.

Managed by the Florida Fish and Wildlife Conservation Commission (FWC), the FKWEA is an archipelago of small sites totaling 4,250 acres and stretching 80 miles from Key Largo to Sugarloaf and Saddlebunch Keys lying immediately northeast of Key West. These sites contain some of the best examples of undisturbed tropical hardwood hammocks remaining in Florida. The FKWEA's hammocks are



critical feeding and resting areas for scores of migratory bird species on their way between the eastern half of North America, Latin America, and the Caribbean. Among the many unique imperiled and rare wildlife and plant species that occur here are the Key deer, American crocodile, Lower Keys marsh rabbit, silver rice rat, wood stork, tree cactus, Garber's spurge, and four species of imperiled marine turtles, the green sea turtle, Hawksbill sea turtle, Kemp's ridley sea turtle, and loggerhead sea turtle.

Accordingly, the entirety of the islands that compose the Florida Keys, extending more than 100 miles from Key Largo to Key West, has been designated by the State of Florida as an Area of Critical State Concern for the unique and fragile significance of the natural resources found within Florida's tropical island chain.

Given its unique combination of tropical endemic rare and imperiled species and habitats, the conservation of the critical remaining natural lands within the Florida Keys has long been a commitment of the State of Florida, the federal government, the South Florida Water Management District (SFWMD), Monroe County, The Audubon Society, The Nature Conservancy, and many other private conservation organizations. Conserving these unparalleled natural resources also helps to protect the Outstanding Florida Waters (OFW)

of the Keys, its recreational and commercial fisheries, and its reefs and islands, while providing Florida's citizens and visitors more opportunities to enjoy their rare scenic beauty along with fish and wildlife-based public outdoor recreation.

The FWC has lead management authority for all of the resources within the established boundary of the FKWEA. The area is managed by the FWC to conserve the important natural communities on site that provide habitat for a wide range of imperiled and more common wildlife species, to conserve and restore natural wildlife habitat, and to provide high-quality opportunities for fishing and other fish and wildlife-based public outdoor recreation opportunities including hiking, snorkeling, and paddling.

1.1 Management Plan Purpose

This Management Plan serves as the basic statement of policy and direction for the management of the FKWEA. It provides information including the past usage, conservation acquisition history, and descriptions of the natural and historical resources found on the FKWEA. Furthermore, it identifies FWC's future management intent, goals and associated short and long-term objectives, as well as identifying challenges and solutions. This Management Plan has been developed to guide each aspect of the FKWEA's management for the next ten years.

This Management Plan is submitted for review to the Acquisition and Restoration Council (ARC) acting on behalf of the Board of Trustees of the Internal Improvement Trust Fund (Board of Trustees) of the State of Florida through the Florida Department of Environmental Protection's (DEP) Division of State Lands (DSL), in compliance with paragraph seven of Lease No. 4153 (Appendix 13.1.1) and pursuant to Chapters 253 and 259, Florida Statutes (FS), and Chapters 18-2 and 18-4, Florida Administrative Code (FAC). Format and content were drafted in accordance with the ARC requirements for management plans and the model plan outline provided by the staff of the DSL. Terms (Appendix 13.2) used in this Management Plan describing management activities and associated measurable goals and objectives conform to those developed for the Land Management Uniform Accounting Council Biennial Land Management Operational Report.

1.1.1 FWC Planning Philosophy

The FWC's planning philosophy includes emphasizing management recommendation consensus-building among stakeholders and input from user groups and the general public at the beginning of the planning process. The FWC engages stakeholders by convening a Management Advisory Group (MAG) and solicits additional input from user groups and the general public at a public hearing (Appendix 13.3). The FWC also engages area, district, and regional agency staff, as well as other FWC staff expertise, in developing this Management Plan, thereby facilitating area biologist and manager "ownership" of the Management Plan, and thus the development of meaningful management intent language, goals with associated measurable objectives, timelines for completion, and the identification

of challenges and solution strategies for inclusion in the FKWEA Management Plan (Sections 5 – 8).

Further management planning input is received through Land Management Reviews (LMR) conducted every five years, which includes a review of the previous Management Plan, as well as a field review of the FKWEA. The LMR report (Section 5.1, Appendix 13.4) provides FWC staff with important information and guidance provided by a diverse team of land management auditors, and communicates the recommendations of the LMR team to the FWC so they may be adequately addressed in this Management Plan, and thus guide the implementation of the LMR team recommendations on the FKWEA.

Furthermore, the FWC maintains transparency and accountability throughout the development and implementation of this Management Plan. A “living document” concept, linking this updated Management Plan to the previous one, is accomplished by reporting on the objectives, management activities, and projects accomplished over the last planning timeframe (previous ten years; see Section 4), thereby ensuring agency accountability through time. Also, in an effort to remain adaptive for the duration of this Management Plan, continuous input and feedback will be collected from FWC staff, stakeholders, user groups, and other interested parties and individuals. As needed, amendments to this Management Plan will be presented to the DSL and the ARC for review and consideration.

1.2 Location

The FKWEA is located in south Florida in Monroe County. The Florida Keys are the chain of islands located on the most southern portion of the state of Florida. Key Largo, the northernmost key, is approximately 60 miles from Miami. U.S. Highway 1 runs through the Florida Keys, connecting the different Keys to the mainland.

The FKWEA is composed of 4,250 noncontiguous acres spread through the Florida Keys in Monroe County, Florida, 52 miles south of Miami and 15 miles east of Key West. The FKWEA tracts are located in, around or near several urban centers over an 80-mile linear stretch from Key Largo almost to Key West. Consisting almost entirely of non-contiguous tracts that range in size from over 2,000 acres to 20 acres, the FKWEA tracts are spread throughout the Upper Keys, Middle Keys, and Lower Keys (Figures 1-7).

The Upper Keys include the Dove Creek Hammock, Tavernier Creek, Lake San Pedro, and Snake Creek Hammock Tracts of the FKWEA. Portions of the FKWEA located in the Middle Keys include Vaca Cut Hammock, Blue Heron Hammock, and Stirrup Key Hammock Tracts. The Lower Keys include the Torch Keys, Ramrod Key, Knockemdown Keys, Spoonbill Sound, Loggerhead Key, and Sugarloaf/Saddlebunch Keys Tracts of the FKWEA. Like most of these listed areas, the Sugarloaf/Saddlebunch Keys Tracts encompass several tracts of the FKWEA, including Sammy Creek Landing and the newly-acquired Johnson Tract.

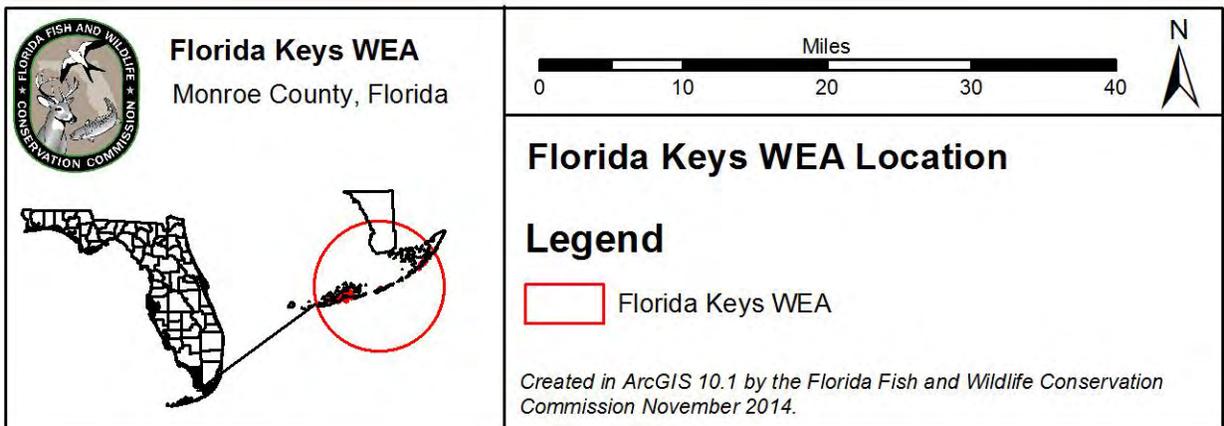
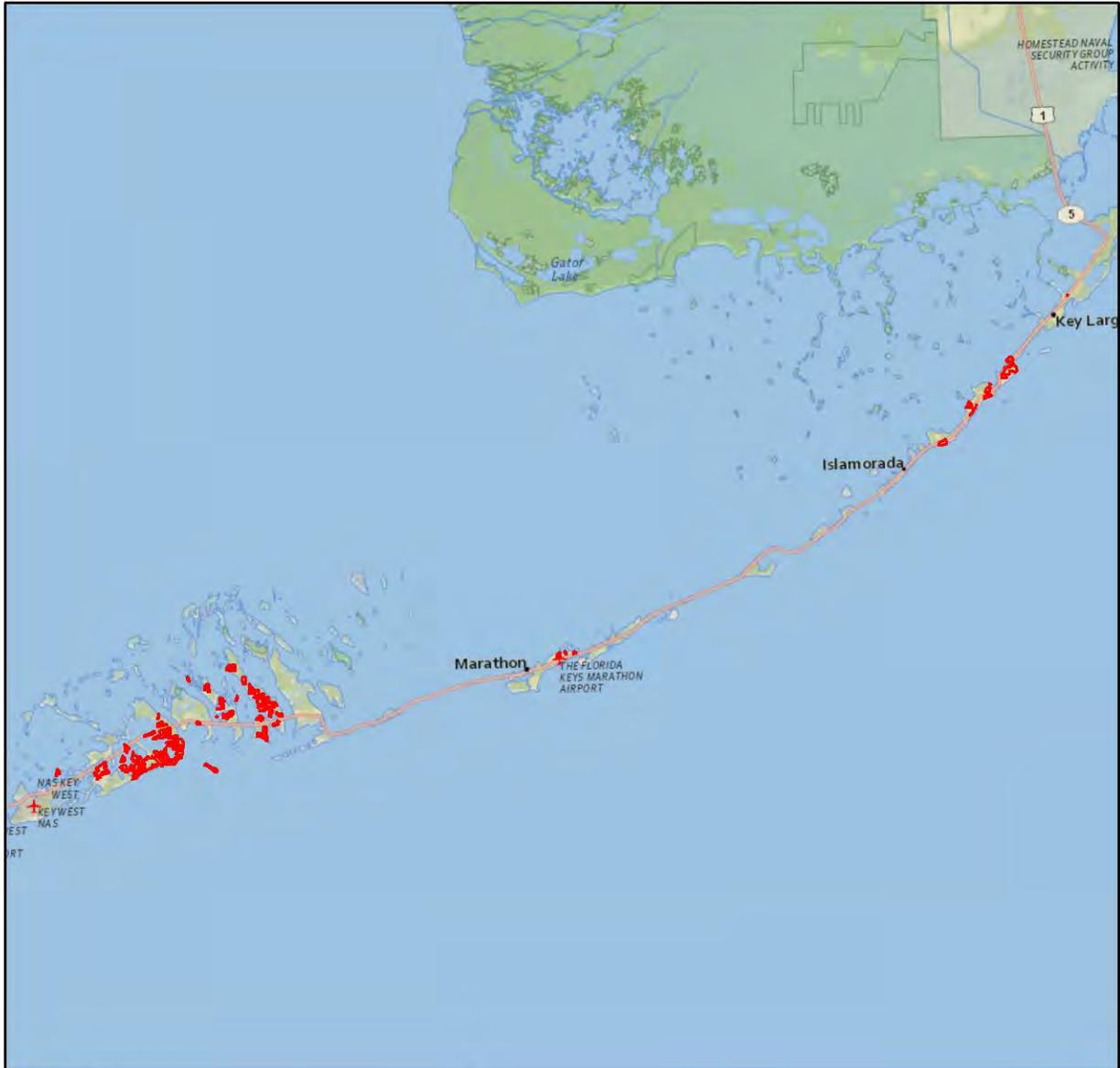


Figure 1. FKWEA Location

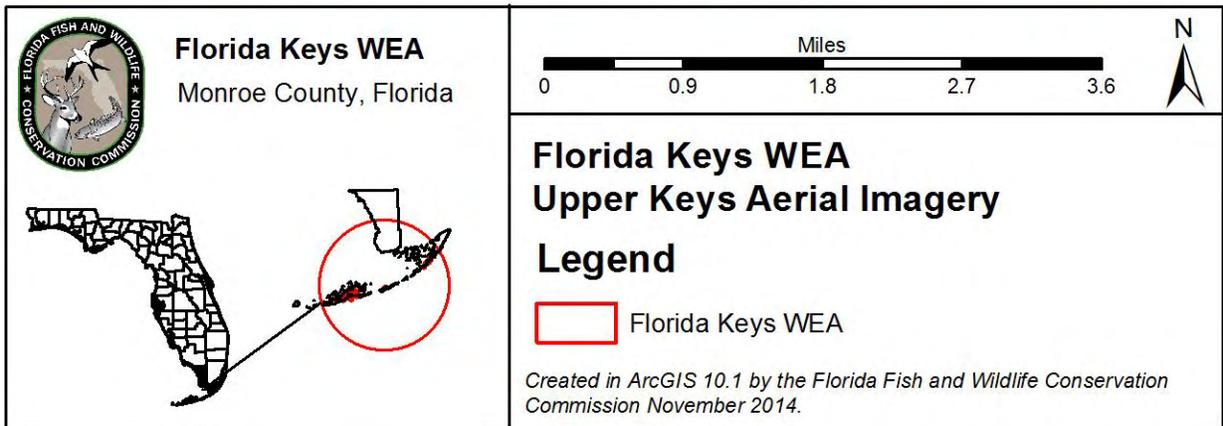


Figure 2. FKWEA – Upper Keys Aerial Imagery

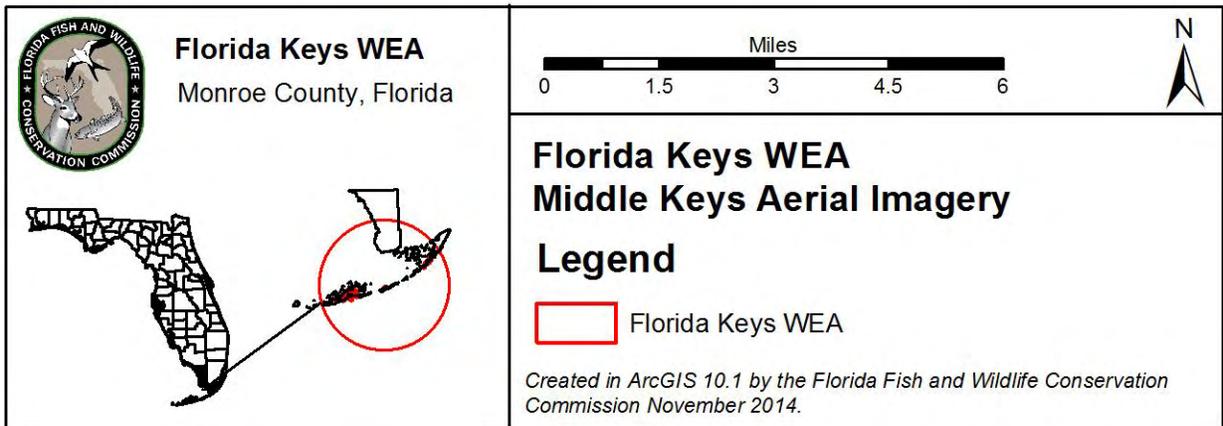


Figure 3. FKWEA – Middle Keys Aerial Imagery

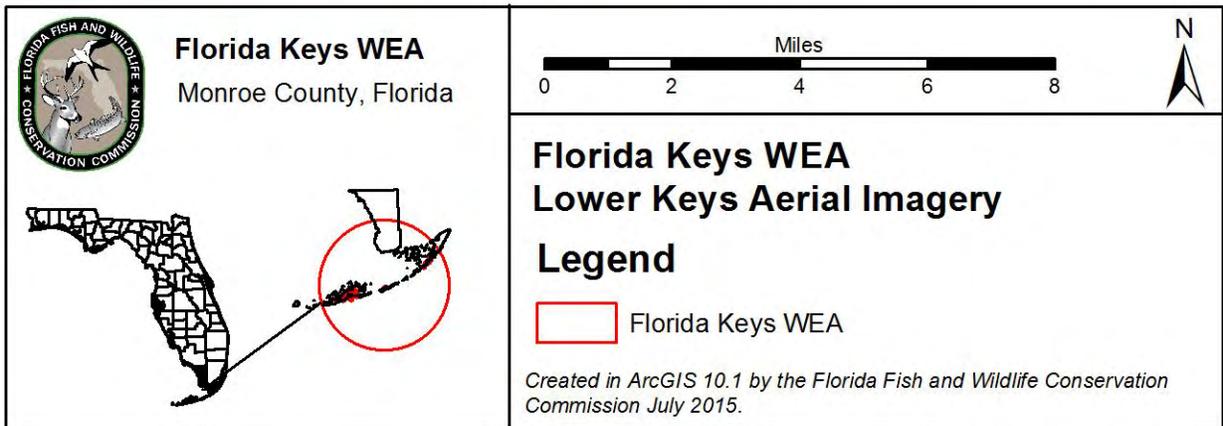
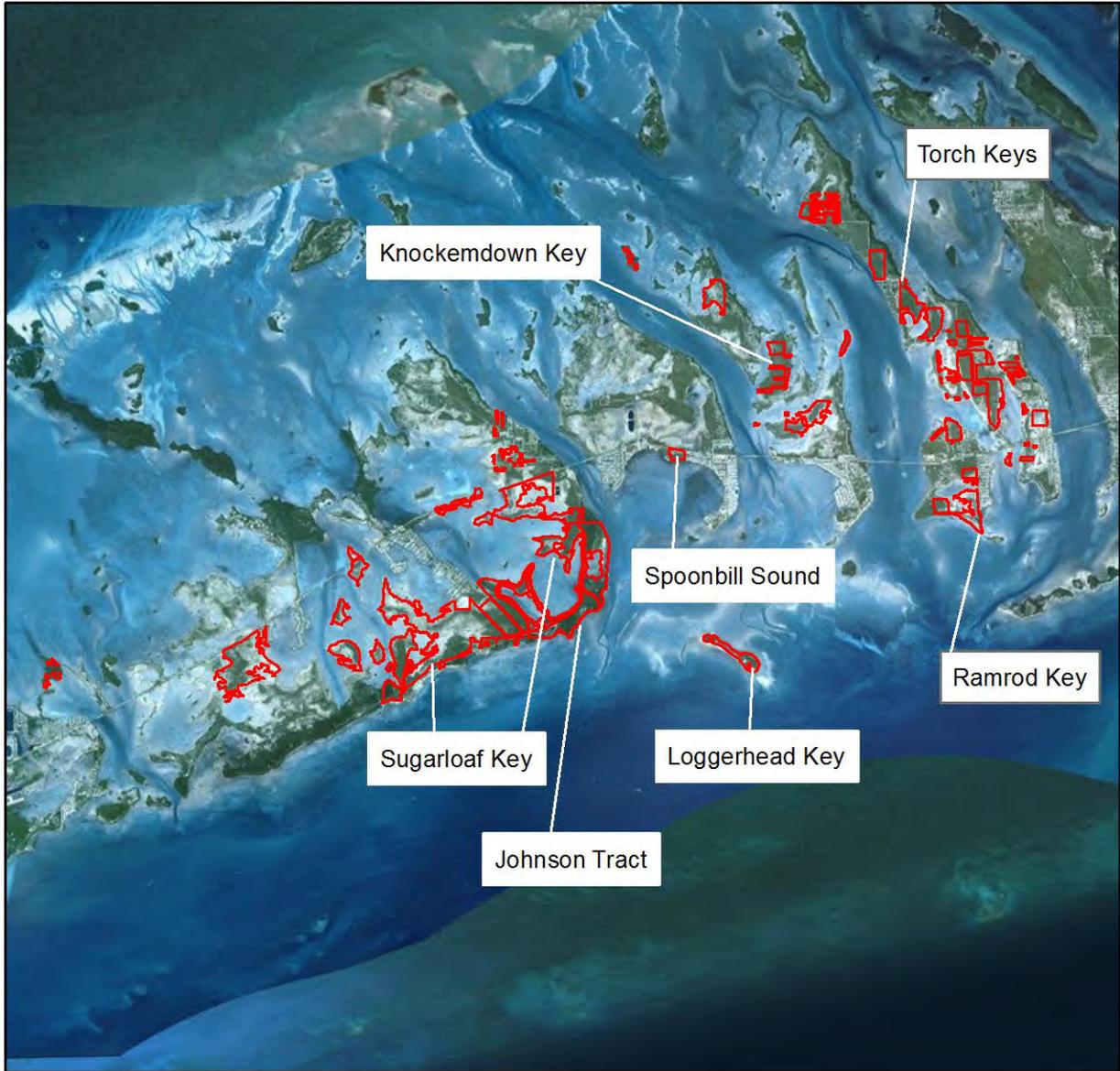


Figure 4. FKWEA – Lower Keys Aerial Imagery

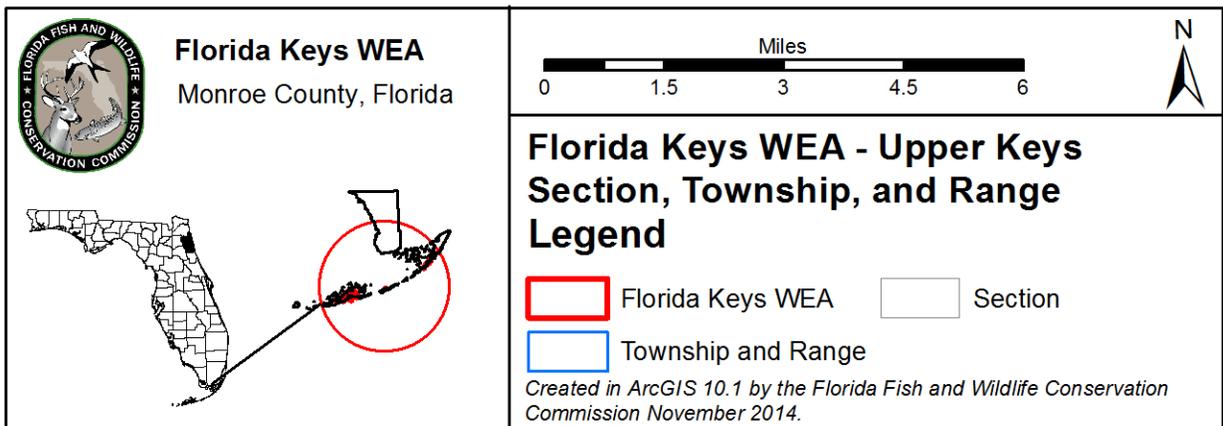
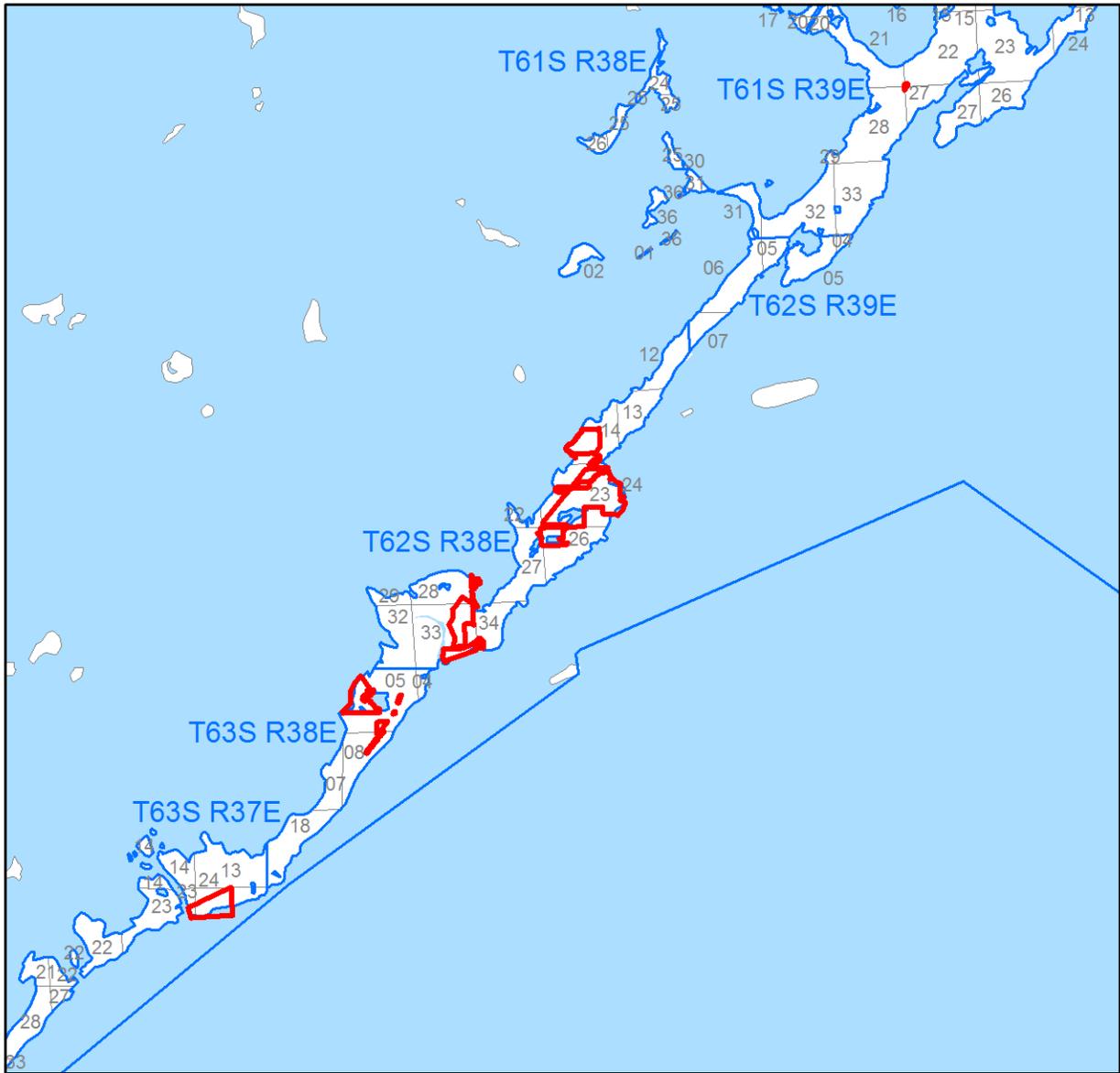


Figure 5. FKWEA Section, Township, and Range – Upper Keys

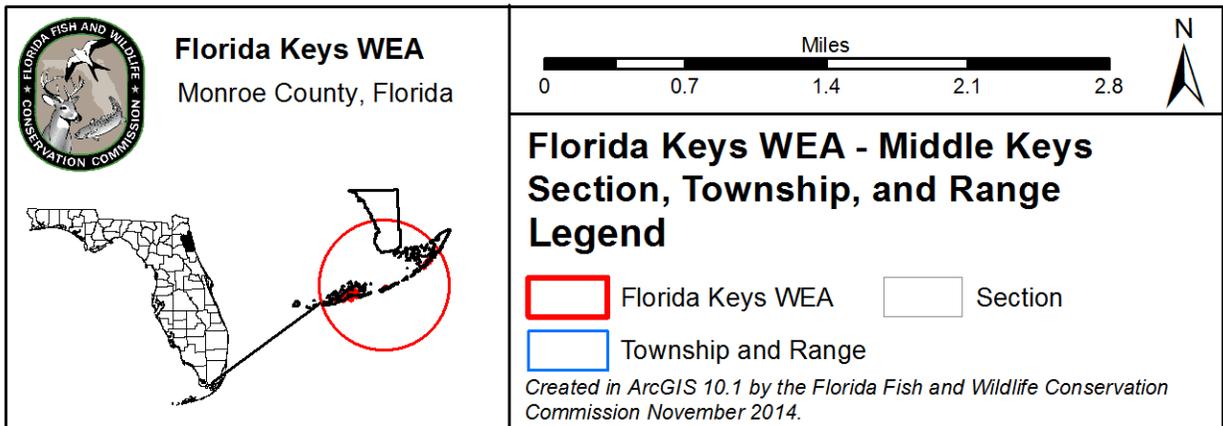
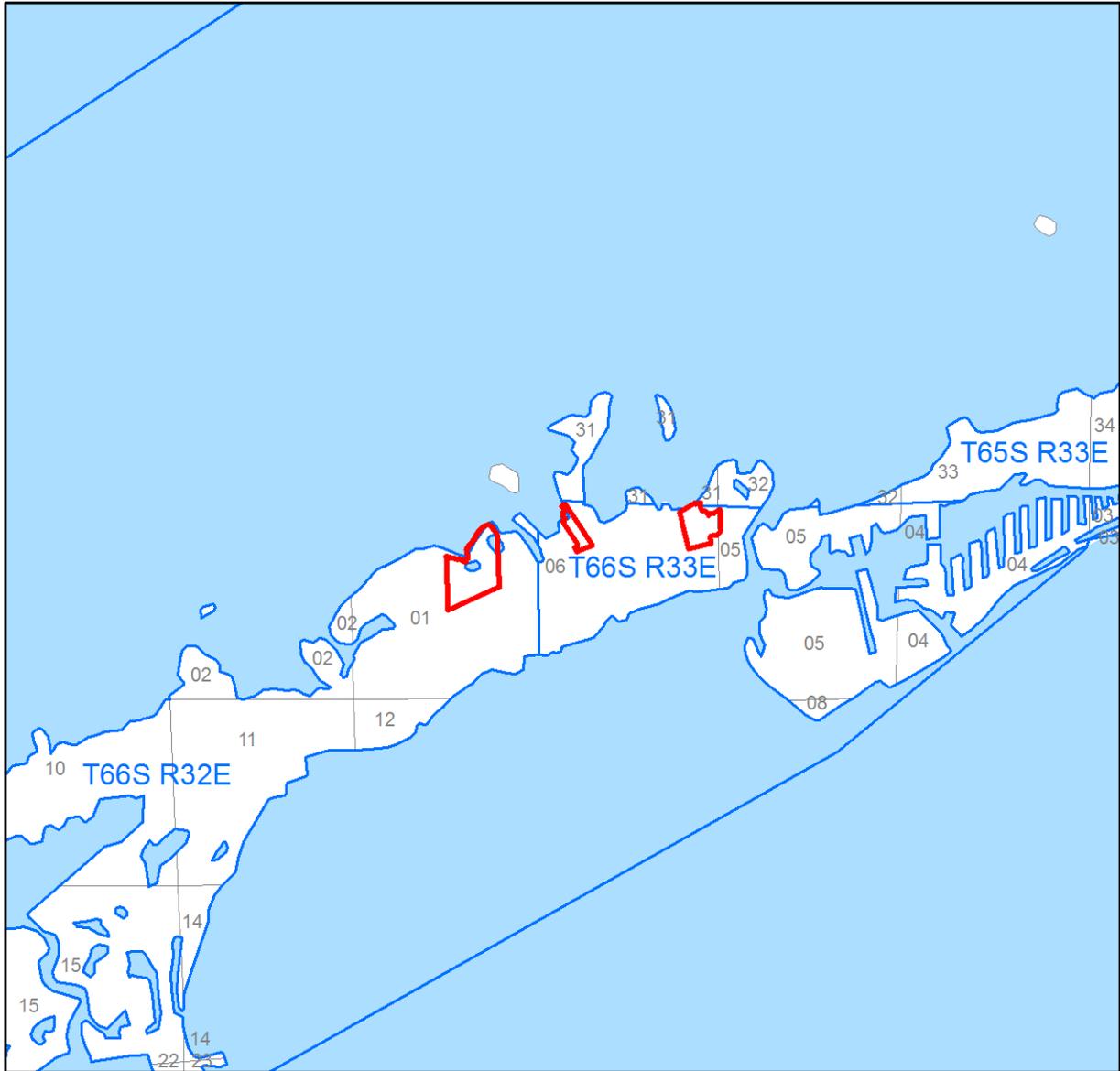


Figure 6. FKWEA Section, Township, and Range – Middle Keys

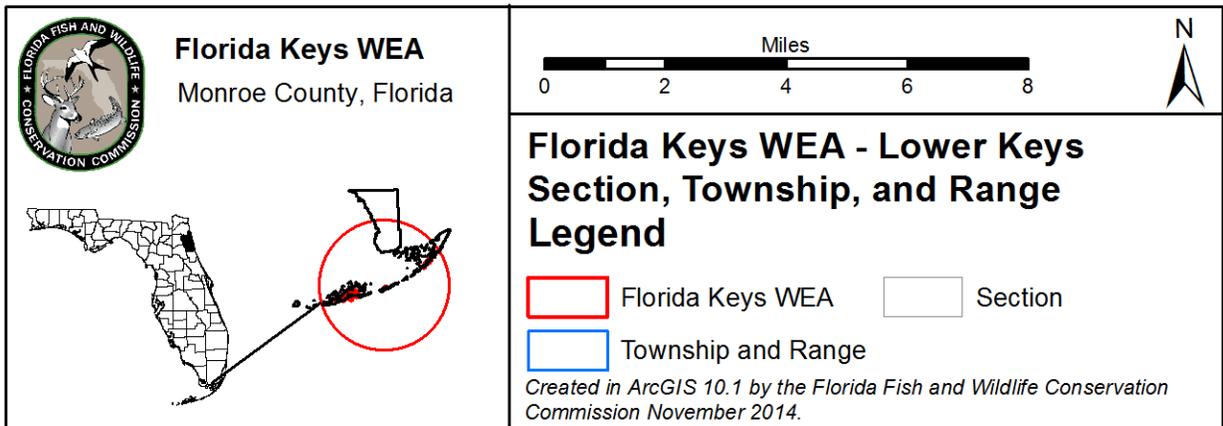
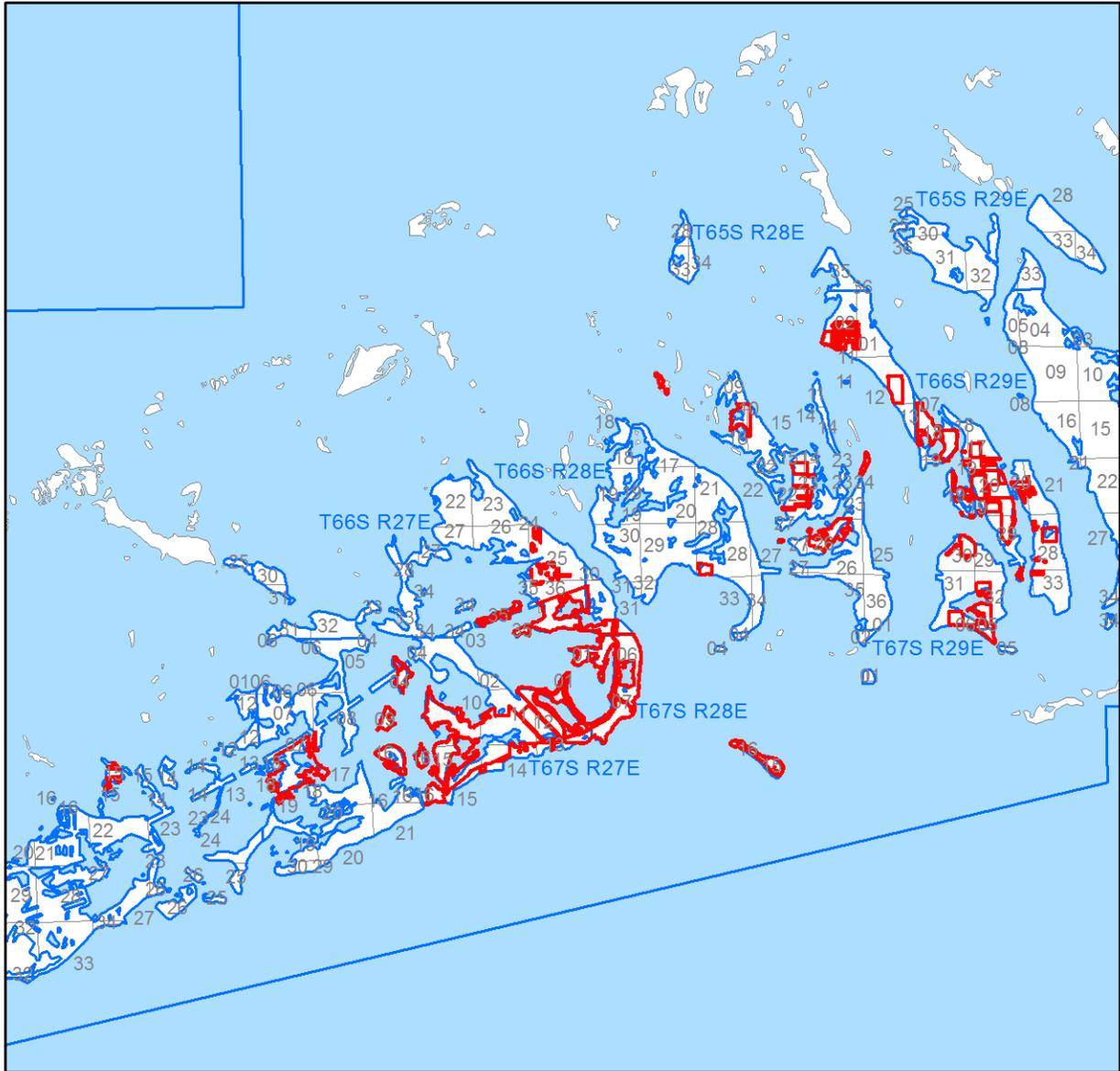


Figure 7. FKWEA Section, Township, and Range – Lower Keys

1.3 Acquisition

1.3.1 Purpose for Acquisition of the Property

The Florida Forever Annual Report states that the primary objective for acquisition of the Florida Keys Ecosystem Florida Forever Project (FKEFFP) is to protect all of the significant unprotected tropical hardwood hammocks remaining in the Keys as well as many imperiled and rare plants and animals found in the Keys, including the Lower Keys marsh rabbit and Key deer. The project was also approved to protect the OFW of the Keys, the recreational and commercial fisheries, and the reefs around the islands, and also to give residents and visitors more area for enjoying the natural beauty of the Keys.

The FWC manages the FKWEA in conformance with the purposes of acquisition through the establishment and management of a Wildlife and Environmental Area, providing for ecological diversity, managing habitat for both common and imperiled wildlife, and for providing the public with fish and wildlife-based outdoor recreational opportunities.

1.3.2 Acquisition History

The first 344 acres of the FKWEA were acquired on July 7, 1997, under the Conservation and Recreational Lands (CARL) program and the Preservation 2000 (P2000) program. Since that time, additional parcels have been added to the project under the CARL, P2000 and Florida Forever environmental land acquisition programs. Title to the lands within the FKWEA is held by the Board of Trustees.

Addition of the FKEFFP to the CARL Acquisition List was approved by the CARL committee in 1995 by combining two existing CARL projects, the Tropical Flyways and Hammocks of the Lower Keys Projects to create the FKEFFP. The CARL Trust Fund was approved in 1979 and relies on funds generated principally from the documentary stamp tax and severance taxes on phosphate rock. The CARL program was established for the purpose of purchasing environmentally endangered lands and other lands such as those which have potential for public recreation.

The CARL program was succeeded by the P2000 program, which was established by the Florida Legislature in 1990. The P2000 program was then succeeded by the Florida Forever program, established by the Florida Legislature in 2000. Funding for both of these programs emanated from the sale of tax-exempt bonds that relied on documentary stamp tax to pay the interest on those bonds. The FKEFFP was successively approved for inclusion on the acquisition lists of both the P2000 and Florida Forever programs.

FKWEA lands are leased to the FWC under Board of Trustees Lease No. 4153. To date, there are 30 additional amendments to Lease No. 4153, with each lease amendment adding parcels of varying sizes to the boundary of the FKWEA (Appendix 13.1). In March 2015, the Board of Trustees acquired the Johnson Tract, a 928-acre parcel on Sugarloaf Key, which is to be managed by the FWC as part of the FKWEA. This addition will be added to

the FKWEA through an amendment to Lease No. 4153, bringing the total size of the FKWEA to approximately 4,250 acres.

1.4 Management Authority

The FWC is the designated lead managing agency for the FKWEA under the authority granted by Lease No. 4153 from the Board of Trustees agent, the DSL. Further management authority derives from Article IV, Section 9 of the Florida Constitution as well as the guidance and directives of Chapters 253, 259, 327, 370, 373, 375, 378, 379, 403, 487, 870, and 597, FS. These constitutional provisions and laws provide the FWC the authority to protect, conserve, and manage the State’s fish and wildlife resources.

1.5 Management Directives

The 50-year Board of Trustees Lease Agreement Number 4153 with the FWC directs the FWC to “manage the leased premises only for the conservation and protection of natural and historical resources and resource-based, public outdoor recreation which is compatible with the conservation and protection of these public lands, as set forth in subsection 253.023(11), FS...” The lease agreement further directs the FWC to "implement applicable Best Management Practices for all activities under this lease in compliance with paragraph 18-2.018(2)(h), FAC, which have been selected, developed, or approved by lessor, lessee, or other land managing agencies for the protection and enhancement of the leased premises.”

1.6 Title Interest and Encumbrances

As State-owned lands, title to the FKWEA is vested in the Board of Trustees. On July 7, 1997, DSL, as staff to the Board of Trustees, entered into Lease Agreement Number 4153, a 50 year lease agreement, granting the FWC management authority for the FKWEA. There are no known encumbrances to the property.

1.7 Proximity to Other Public Conservation Lands

The FKWEA is near or adjacent to a large number of government-managed areas or facilities. The waters that surround all tracts of the FKWEA fall within the Florida Keys National Marine Sanctuary, a cooperative designation of the National Oceanic and Atmospheric Administration (NOAA) and the DEP. Additionally, the FKWEA, and most of the conservation lands listed below, fall within the Florida Keys Area of Critical State Concern.

Tables 1 and 2 list the conservation lands and Florida Forever projects within a 20-mile radius of FKWEA, including lands that are managed by public and private organizations, that conserve historical and natural resources within this region of Florida. These nearby conservation lands and Florida Forever projects are also displayed in Figure 8.

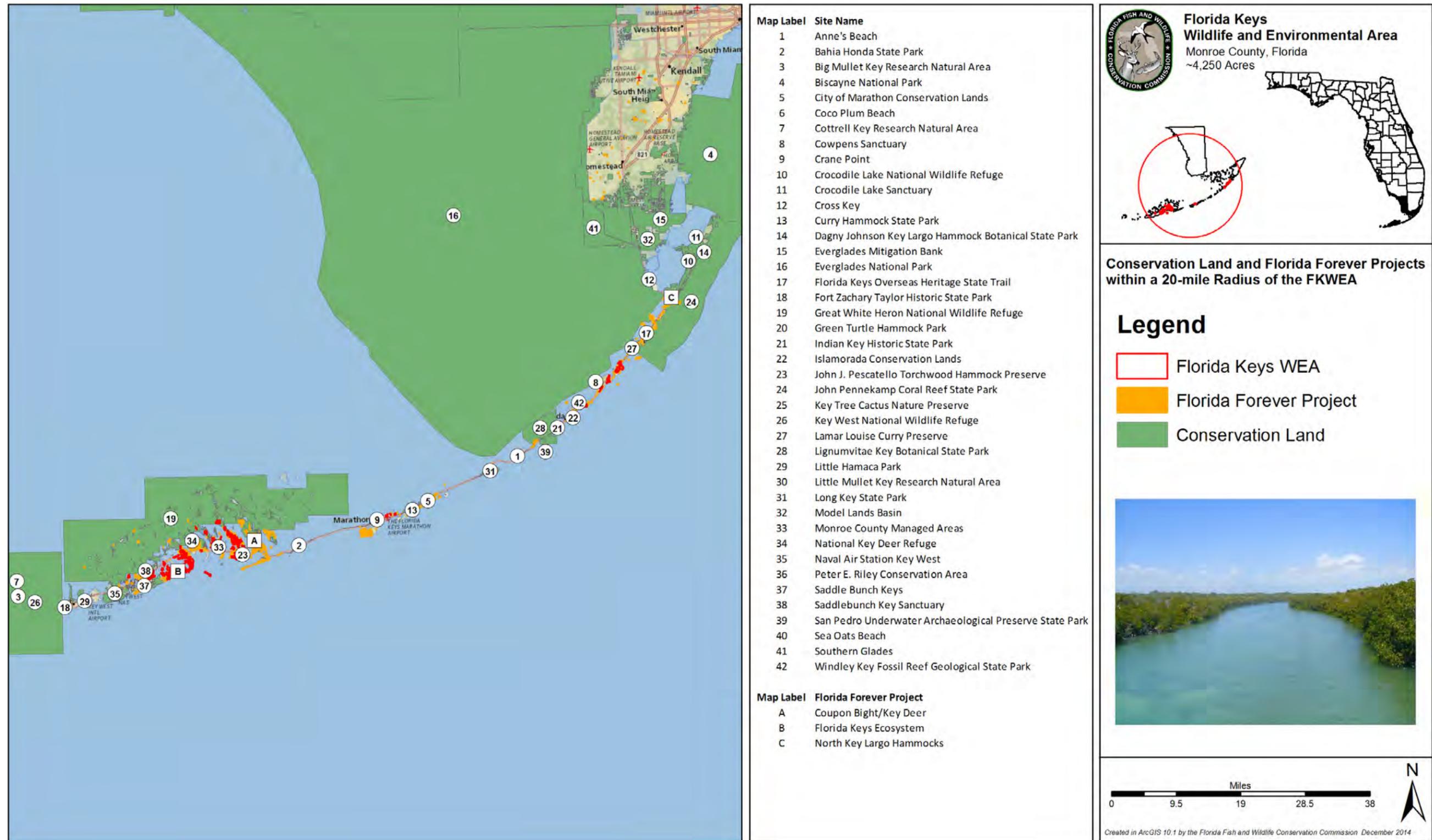


Figure 8. Conservation Lands and Florida Forever Projects within a 20-mile Radius of the FKWEA

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Table 1. Conservation Lands within 20 Miles of FKWEA

Federal Government	Managing Agency
Biscayne National Park	DOI - NPS
Crocodile Lake National Wildlife Refuge	DOI - USFWS
Everglades National Park	DOI - NPS
Great White Heron National Wildlife Refuge	DOI - USFWS
Key West National Wildlife Refuge	DOI - USFWS
Big Mullet Key Research Natural Area	DOI - USFWS
Cottrell Key Research Natural Area	DOI - USFWS
Little Mullet Key Research Natural Area	DOI - USFWS
National Key Deer Refuge	DOI - USFWS
Naval Air Station Key West	DOD - Navy
State of Florida	Managing Agency
Bahia Honda State Park	DEP-DRP
Curry Hammock State Park	DEP-DRP
Dagny Johnson Key Largo Hammock Botanical State Park	DEP-DRP
Florida Keys Overseas Heritage State Trail	DEP-DRP
Fort Zachary Taylor Historic State Park	DEP-DRP
Indian Key Historic State Park	DEP-DRP
John Pennekamp Coral Reef State Park	DEP-DRP
Lignumvitae Key Botanical State Park	DEP-DRP
Long Key State Park	DEP-DRP
San Pedro Underwater Archaeological Preserve State Park	DEP-DRP
Windley Key Fossil Reef Geological State Park	DEP-DRP
Local Government	Managing Agency
Anne's Beach	Islamorada, Village of Islands
City of Marathon Conservation Lands	City of Marathon
Coco Plum Beach	City of Marathon
Green Turtle Hammock Park	Islamorada, Village of Islands
Islamorada Conservation Lands	Islamorada, Village of Islands
Key Tree Cactus Nature Preserve	Islamorada, Village of Islands
Little Hamaca Park	City of Key West
Monroe County Managed Areas	Monroe County
Peter E. Riley Conservation Area	City of Layton
Sea Oats Beach	Islamorada, Village of Islands
Water Management District	Managing Agency
Model Lands Basin	SFWMD

Table 1. Conservation Lands within 20 Miles of FKWEA

Southern Glades	SFWMD
Private	Managing Entity
Cowpens Sanctuary	National Audubon Society, Inc.
Crane Point	Florida Keys Land and Sea Trust
Crocodile Lake Sanctuary	Florida Audubon Society, Inc.
Cross Key	The Nature Conservancy
Everglades Mitigation Bank	FPL Everglades Mitigation Bank
John J. Pescatello Torchwood Hammock Preserve	The Nature Conservancy
Lamar Louise Curry Preserve	The Nature Conservancy
Saddle Bunch Keys	The Nature Conservancy
Saddlebunch Key Sanctuary	Florida Audubon Society, Inc.

Acronym	Agency
DEP-DRP	Florida Department of Environmental Protection – Department of Recreation and Parks
DOD-Navy	Department of Defense – Navy
DOI-NPS	Department of the Interior – National Parks Service
DOI-USFWS	Department of the Interior – U.S. Fish and Wildlife Service
SFWMD	South Florida Water Management District

Table 2. Florida Forever Projects within 20 Miles of FKWEA

Project Name	GIS Acres
Coupon Bight/Key Deer Florida Forever BOT Project	3,102
Florida Keys Ecosystem Florida Forever BOT Project	13,581
North Key Largo Hammocks Florida Forever BOT Project	4,907

1.8 Adjacent Land Uses

As mentioned above, the FKWEA is located in Monroe County in the southernmost region of Florida. The 2013 U.S. Census estimates that Monroe County has a population of 76,351. The Bureau of Economic and Business Research (BEBR) at the University of Florida predicts, with its medium-range projection, that the population of Monroe County will decline to 72,200 in 2025. According to BEBR’s medium-range population projections, the two counties surrounding Monroe County, which are Miami-Dade County and Collier County, will have a population of 2,932,400 and 243,200, respectively, in the year 2025.

The current zoning designation for the FKWEA is conservation lands. Monroe County's Comprehensive Plan states the following usages allowed on land zoned as conservation: passive recreational uses, collocations on existing antenna-supporting structures, and satellite earth stations less than two meters in diameter. According to Monroe County's Comprehensive Plan's future land use map, the FKWEA will remain zoned conservation lands.

The current land use designations for areas in the vicinity of the FKWEA are conservation lands, mixed use district, industrial, and airport district. Permitted uses on land zoned industrial include: restaurant and offices of less than 5,000 square feet of floor area, manufacturing, assembly and storage of goods and materials, commercial apartments or employee housing involving less than six dwelling units, commercial fishing, and institutional uses. Land zoned mixed use district permits the following usages: detached residential dwellings, commercial retail, office uses, institutional residential, commercial apartments, commercial recreational uses, commercial fishing, manufacture, assembly, repair, maintenance and storage of traps, nets and other fishing equipment, institutional uses, public buildings and uses, home occupations, community parks, accessory uses, and vacation rental use.

The many parcels that make up the FKWEA are surrounded by residences, commercial buildings, offices, and airports. The Florida Keys are made up of islands with limited space, so challenges may arise for the FKWEA if more development occurs adjacent to the area. However, as detailed above, the BEBR's population projections do not currently project an increase in population for the Florida Keys through 2025.

1.8.1 Florida Keys Area of Critical State Concern

The Areas of Critical State Concern Program is authorized under Section 380.05, FS, and allows the Governor and Cabinet to designate certain geographic areas as Areas of Critical State Concern in order to protect resources and public facilities of major statewide significance from uncontrolled development that would cause substantial deterioration of such resources. The Florida Department of Economic Opportunity (DEO) administers the Areas of Critical State Concern Program.

As noted above, the Florida Keys have been designated by the State of Florida as an Area of Critical State Concern in order to preserve the natural environment and unique community of the Florida Keys. The Florida Keys Area of Critical State Concern includes the municipalities of



Islamorada, Marathon, Layton and Key Colony Beach, and unincorporated Monroe County. The City of Key West constitutes its own Area of Critical State Concern. As a result of this designation, the DEO reviews all local development projects within the Florida Keys Area of Critical State Concern to ensure consistency with the purposes for the designation and is responsible for reviewing and approving amendments to local comprehensive plans and land development regulations in the area.

1.9 Public Involvement

The FWC conducted a MAG meeting in Key West, Florida on December 3, 2014, to obtain input from both public and private stakeholders regarding management of the FKWEA.



Results of this meeting were used by the FWC to develop management goals and objectives and to identify opportunities and strategies for inclusion in this Management Plan. A summary of issues and opportunities raised by the MAG, as well as a listing of participants, is included as Appendix 13.3.1. Further, a public hearing, as required by Chapter 259.032(10), FS, was held in Key West, Florida, on January 27, 2015, to obtain public input on this Management Plan. The report of that hearing is also contained in Appendix 13.3.3. A

website is also maintained for receipt of public input at <http://myfwc.com/conservation/terrestrial/management-plans/develop-mps/>. Further testimony and input is received at a public hearing held by the ARC. Input received from all public involvement efforts has been considered in the development of this Management Plan.

2 Natural and Historical Resources

2.1 Physiography

The physiography of the Florida Keys is distinct from that of mainland Florida. The Keys are divided into three physiographic provinces; the High Coral Keys in the Upper Keys, the Low Coral Keys in the Middle Keys, and the Oolite Keys in the Lower Keys. The High Coral Keys generally contains areas of higher elevation than both the Low Coral Keys and Oolite Keys. The High Coral Keys and Low Coral Keys are limestone remnants of a coral reef and are buttressed on either end by the oolite shoal formations of the Oolite Keys and the Miami Ridge. All three of the physiographic provinces that make up the Florida Keys were formed during a period of high sea levels during the Pleistocene Epoch.

2.1.1 Climate

The climate of the Florida Keys is subtropical maritime with a moderately warm dry season (October - May) and a hot, humid wet season (June - September). Rainfall in the Keys is the lowest reported for Florida, averaging approximately 35 to 45 inches per year with most of the rain occurring from June to October. In general, annual rainfall decreases from the Upper Keys to the Lower Keys, with Tavernier averaging nearly 46 inches of annual rainfall while Key West averages just under 40 inches. Throughout the Keys the average maximum temperature is 83 degrees Fahrenheit and the average minimum temperature is between 70 and 73 degrees Fahrenheit. The warmest months are July and August and the coolest months are January and February. Droughts and hurricanes are additional climatic features of the area, while frosts are very rare.

2.1.2 Topography

Topographic features across the entirety of the dispersed tracts comprising the FKWEA are very slight and are similar among the different tracts. Most of the elevation and relief occurs gradually from the salt marsh and/or the mangroves, which begin at sea level, to the tropical hammocks, which can be as much as 15 feet above Mean Sea Level (MSL). As mentioned above, the elevation of the FKWEA tends to decline slightly as it progress from the Upper Keys to the Lower Keys. Numerous solution-hole depressions occur throughout the tropical hammocks.

2.1.3 Soils

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) data were used to identify the FKWEA's soil series and soil depth to water table (Figures 9-15). Twelves soil map units described in the soil survey of the FKWEA are distributed as shown in Figures 9-12. Analyses of depth to water table for map units occurring within the FKWEA are also provided in Figures 13-15. The NRCS defines a soil map unit as: "a collection of soil areas or non-soil areas (miscellaneous areas) delineated in a soil survey." Soil map units may contain multiple soil components, which are given names that are unique identifiers. Figures 9-12 provide aggregation data for the FKWEA soil map units. Soils series descriptions may be found in Appendix 13.5.

2.1.4 Geologic Conditions

Pleistocene limestone underlies the entirety of the Florida Keys. This limestone is exposed at the surface in some areas, but it is often covered by a thin layer of sediment. The Upper and Middle Keys from Soldier Key to just above Big Pine Key, in the High Coral Keys and Low Coral Keys physiographic provinces, are composed of Key Largo limestone. Key Largo limestone is a coralline limestone that is very porous and is part of the Biscayne Aquifer of the surficial aquifer system. The Lower Keys, in the Oolite Keys physiographic province from Big Pine Key to Key Largo, are composed of Miami limestone. Miami limestone is composed of oolitic limestone that is very porous and also is part of the Biscayne Aquifer of the surficial aquifer system.

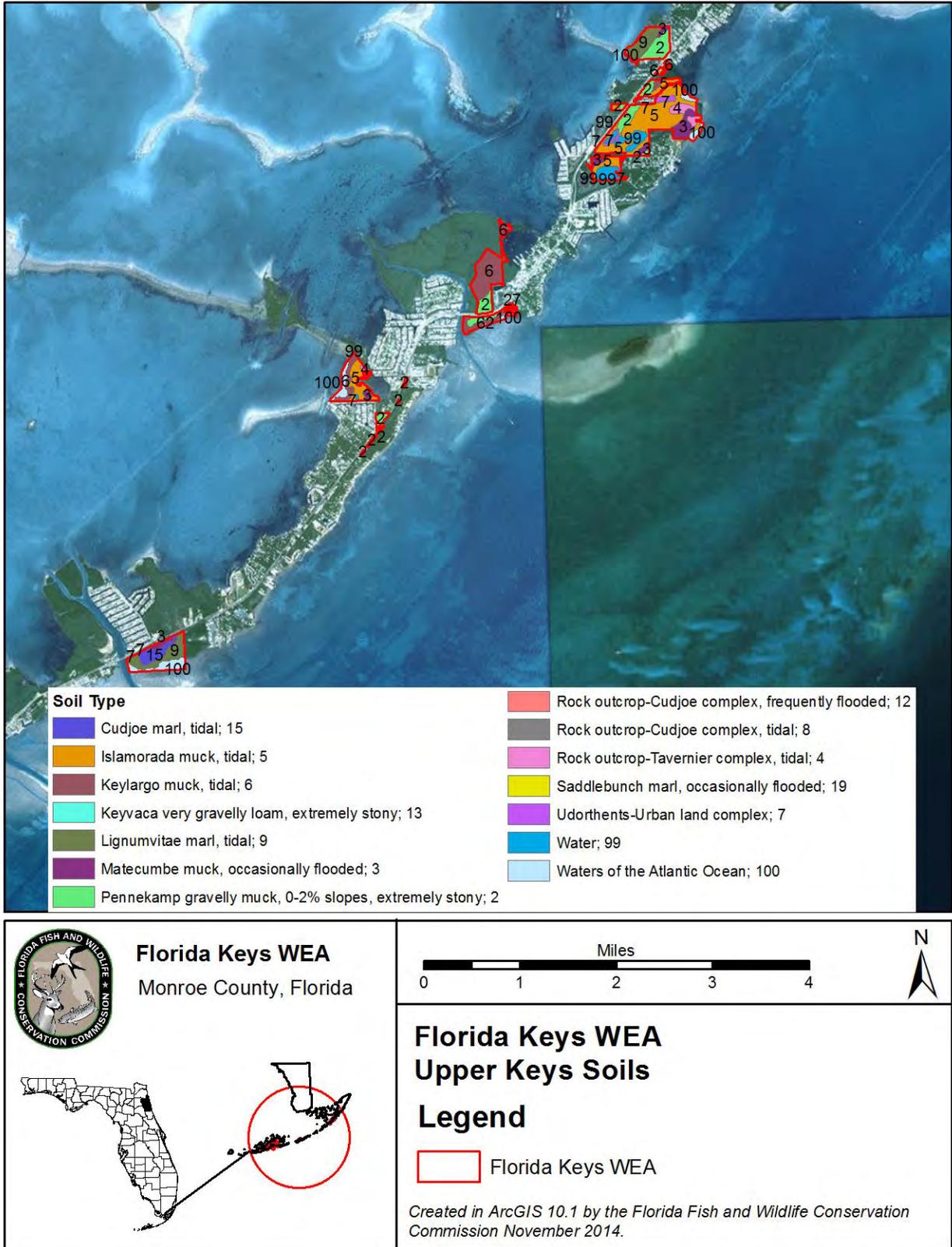


Figure 9. FKWEA Soil Type – Upper Keys

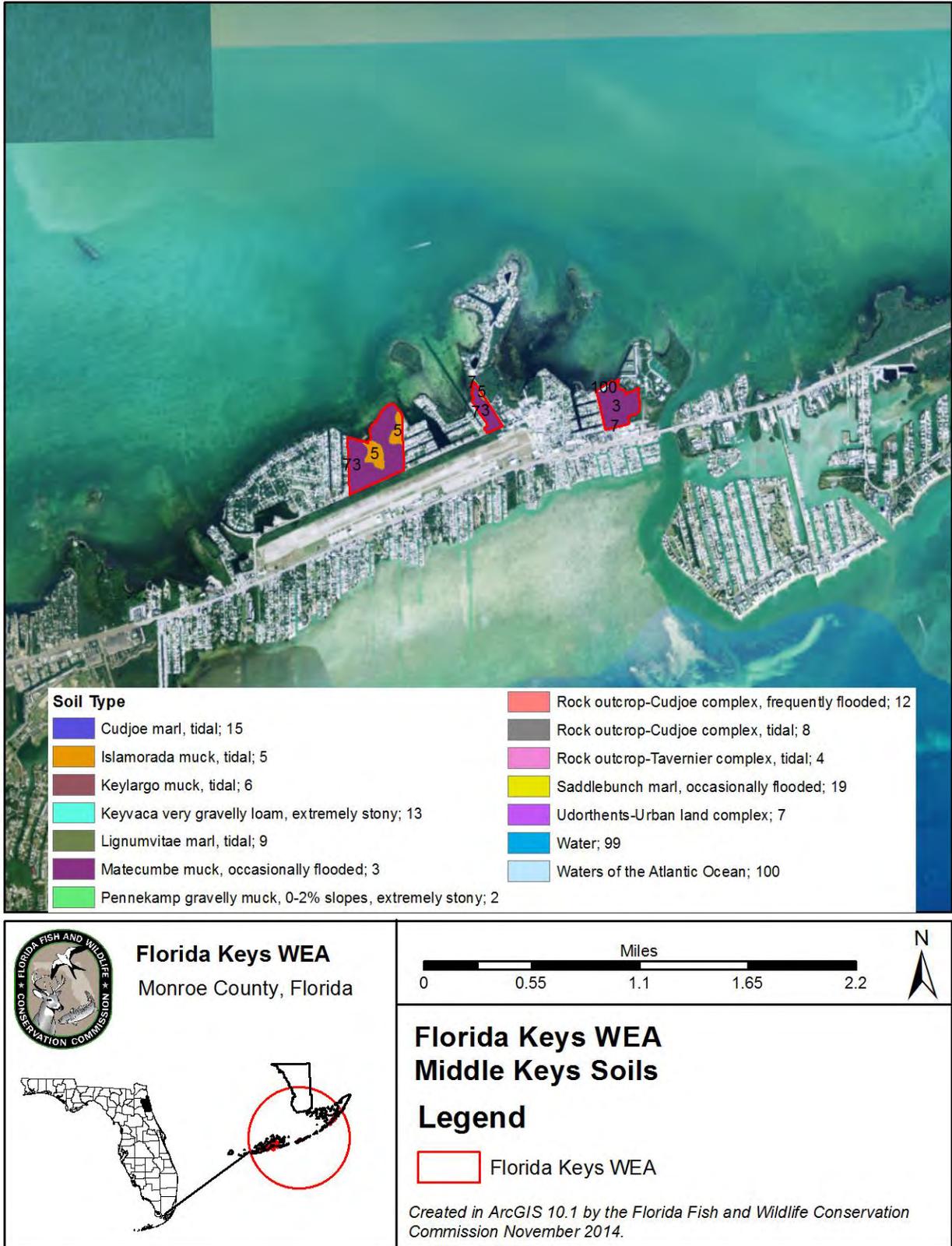


Figure 10. FKWEA Soil Type – Middle Keys

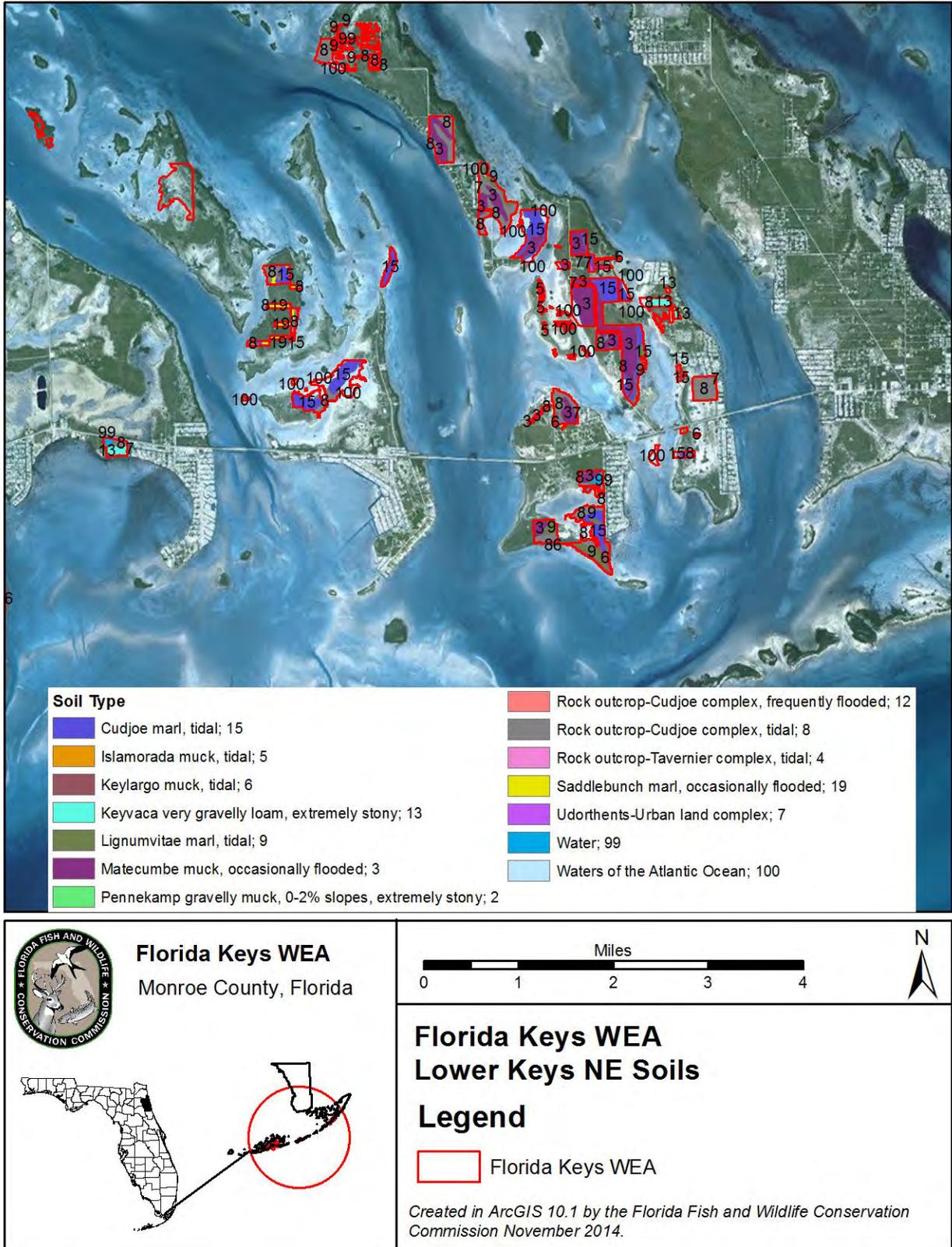


Figure 11. FKWEA Soil Type – Lower Keys NE

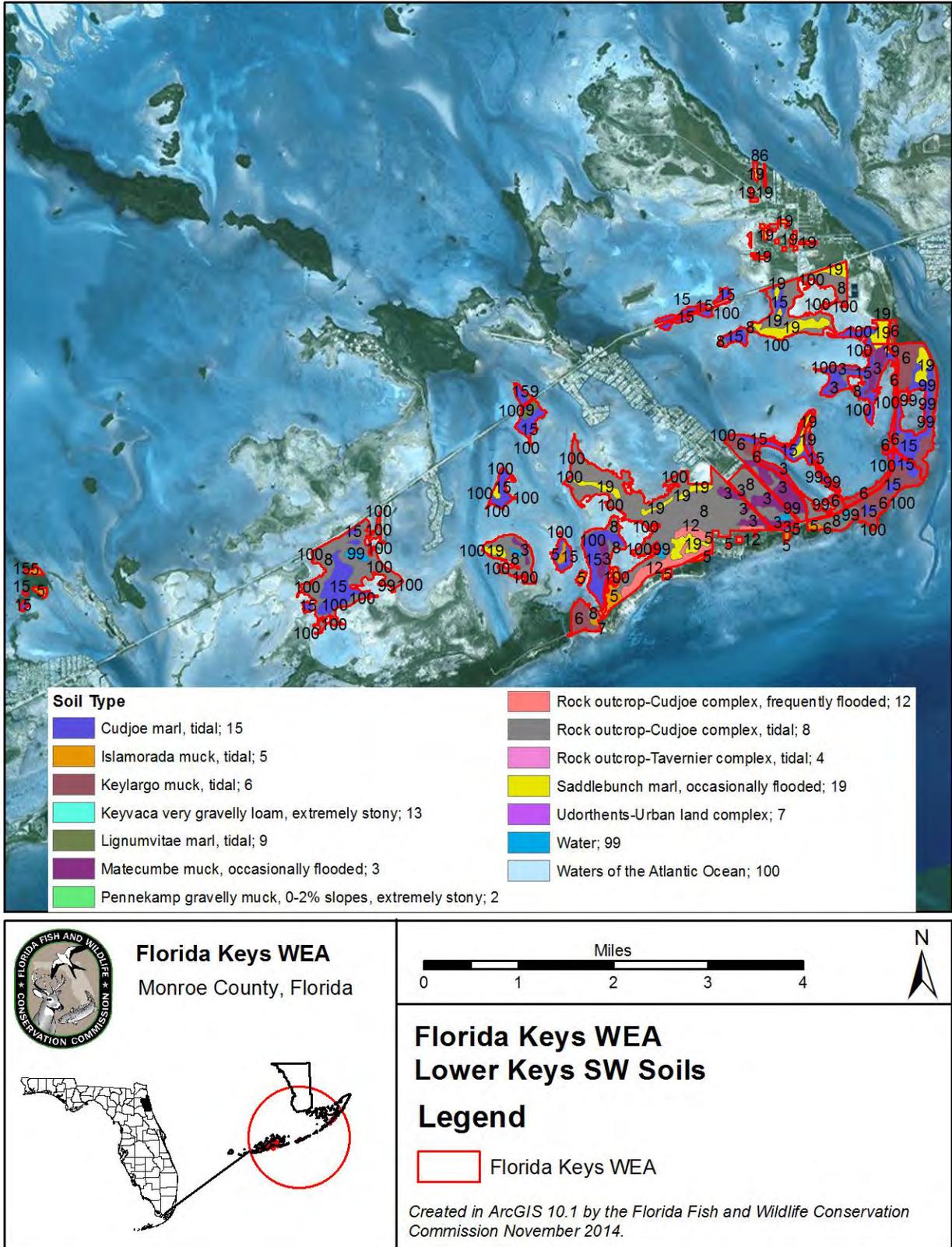


Figure 12. FKWEA Soil Type – Lower Keys SW

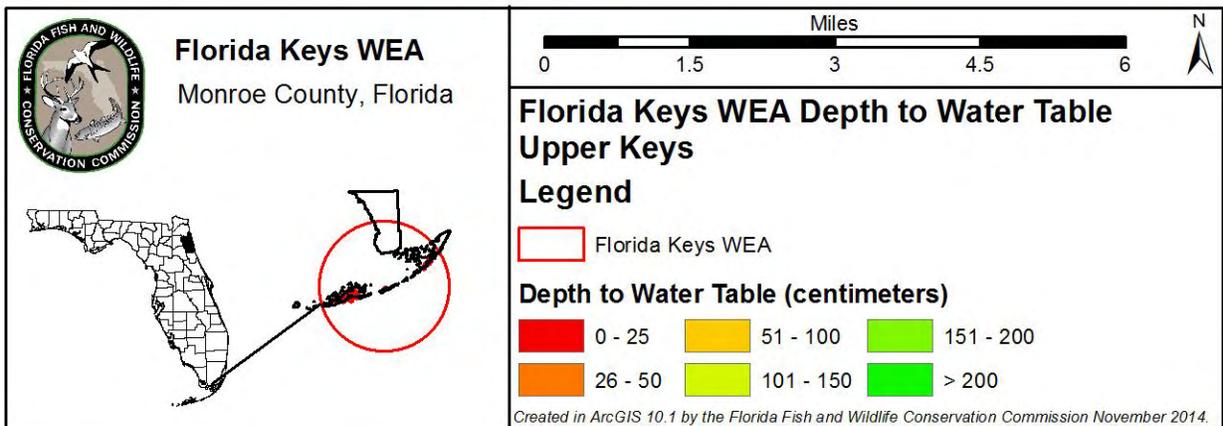


Figure 13. FKWEA Soil Depth to Water Table – Upper Keys

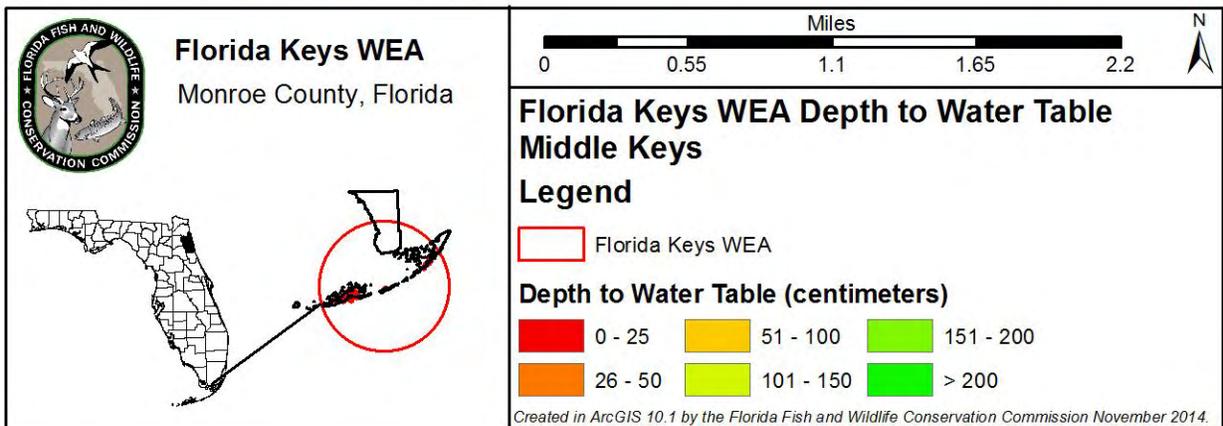


Figure 14. FKWEA Soil Depth to Water Table – Middle Keys

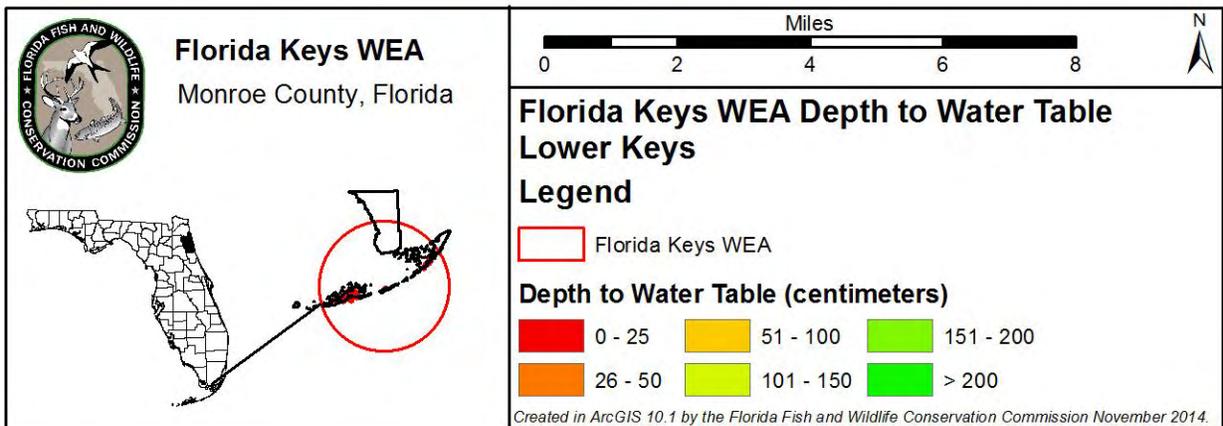
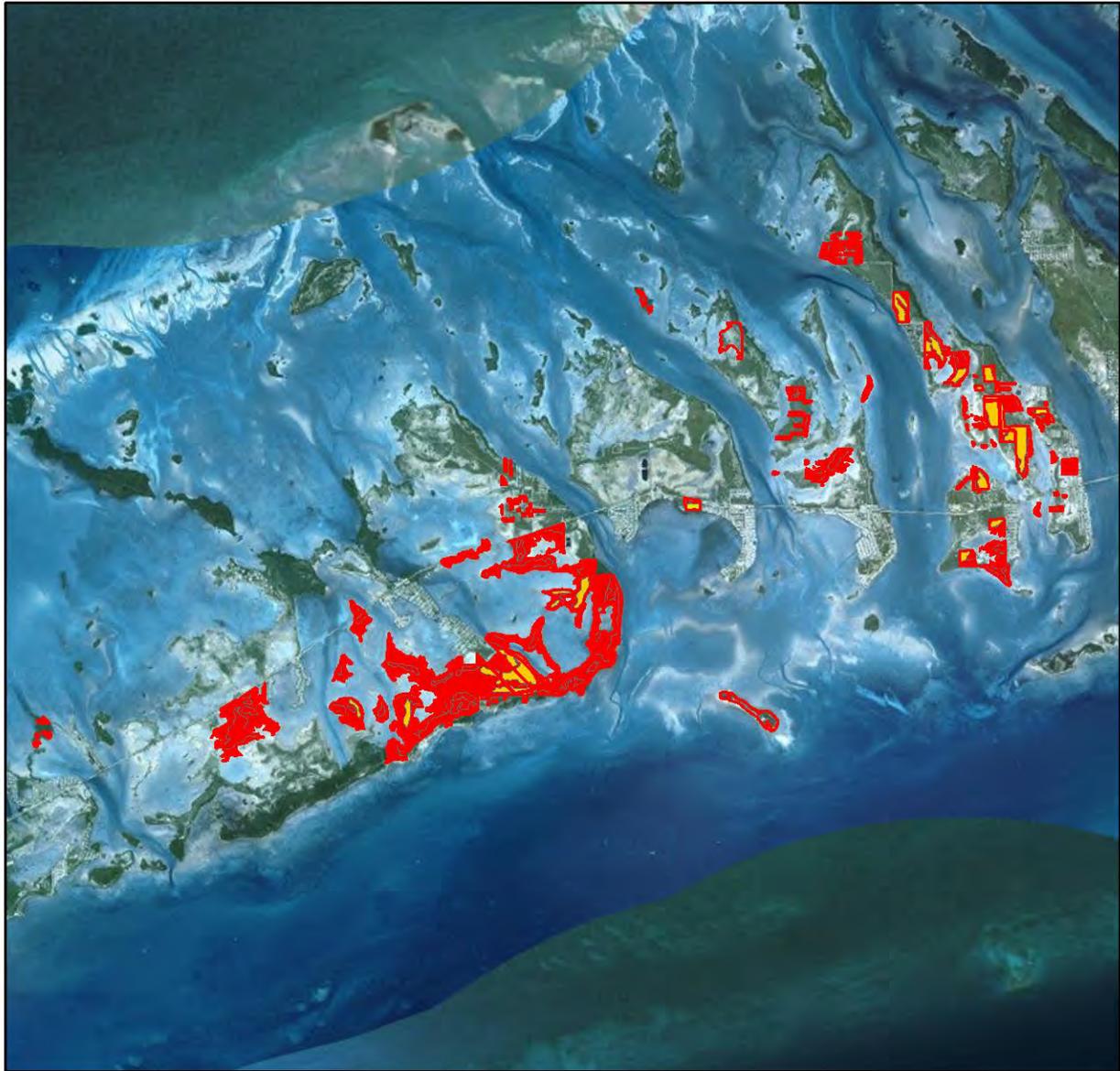


Figure 15. FKWEA Soil Depth to Water Table – Lower Keys

2.2 Vegetation

As described above, the Florida Keys consist of small islands of limestone rock formed from ancient coral reefs rising a few meters above the sea. The tropical climate and the Gulf Stream have brought both tropical West Indian and temperate North American plants and animals to these islands. Plant surveys conducted on the FKWEA properties have



identified a large number of rare plant species, many of which are listed as threatened or endangered and generally referred to as imperiled species.

The major natural communities on the area are mangrove swamp, coastal rock barren, and rockland hammock. In the Florida Keys, freshwater resources are found only in the

Lower Keys where small ponds and marshes are scattered amidst the hammocks where depressions in the underlying rock occur. Although these freshwater resources do not account for a large portion of the habitat, they are critical to wildlife.

In 2005, the FWC, through the services of the Florida Natural Areas Inventory (FNAI), mapped the natural and anthropogenic communities of the FWKEA. Since that original natural community mapping effort was completed, substantial additional acreage has been acquired and incorporated into the FKWEA. Natural community delineations and associated natural community descriptions have yet to be developed for those new additions to the area. For that reason, data from the Cooperative Land Cover Map version 2.3 were used to map and describe the natural communities on lands that were added to the area since 2005 in order to supplement the original natural community map produced by the FNAI for the FKWEA lands that were within the area at that time.

The Cooperative Land Cover Map is a project that was developed cooperatively by the FNAI and the FWC to develop an improved statewide land cover map depicting vegetative or habitat types across the entirety of Florida. The Cooperative Land Cover Map utilizes similar



nomenclature and methods to the usual FNAI natural community mapping efforts and is therefore useful to delineate and describe natural communities on the FKWEA that have

not yet been mapped by the FNAI. The combination of the Cooperative Land Cover data and the original FNAI mapping of the FKWEA identifies nine natural communities and eight anthropogenic ruderal communities as being present on the FKWEA (Table 3, Figures 16-19). The FWC has scheduled with the FNAI to complete updated natural community mapping of the entire FKWEA in 2016.

Additionally, FWC biologists, along with contracted surveys through FNAI and others, have documented the native plant species (Table 4), imperiled and rare plant species (Table 5), and exotic and invasive plant species (Table 6) that are known to occur on the FKWEA.

Table 3. FKWEA FNAI Natural and Anthropogenic Communities

Community Type	Acres*	Percent
Coastal berm	36.73	0.70%
Coastal rock barren/Keys tidal rock barren	1,206.61	23.13%
Estuarine	67.76	1.30%
Mangrove swamp	2,558.27	49.04%
Marine	39.87	0.76%
Rockland hammock	1,025.67	19.66%
Ruderal - unclassified	38.97	0.75%
Ruderal - abandoned field	1.82	0.03%
Ruderal - canal	6.00	0.11%
Ruderal - clearing	13.44	0.26%
Ruderal - exotic monoculture	0.45	0.01%
Ruderal - impoundment/artificial lake	26.26	0.50%
Ruderal - road	0.15	0.00%
Ruderal - spoil area	4.16	0.08%
Salt marsh	1.25	0.02%
Tidal flat	3.48	0.07%
Unconsolidated substrate	185.39	3.55%

*GIS-calculated acreage differs from the actual total acreage of the FKWEA

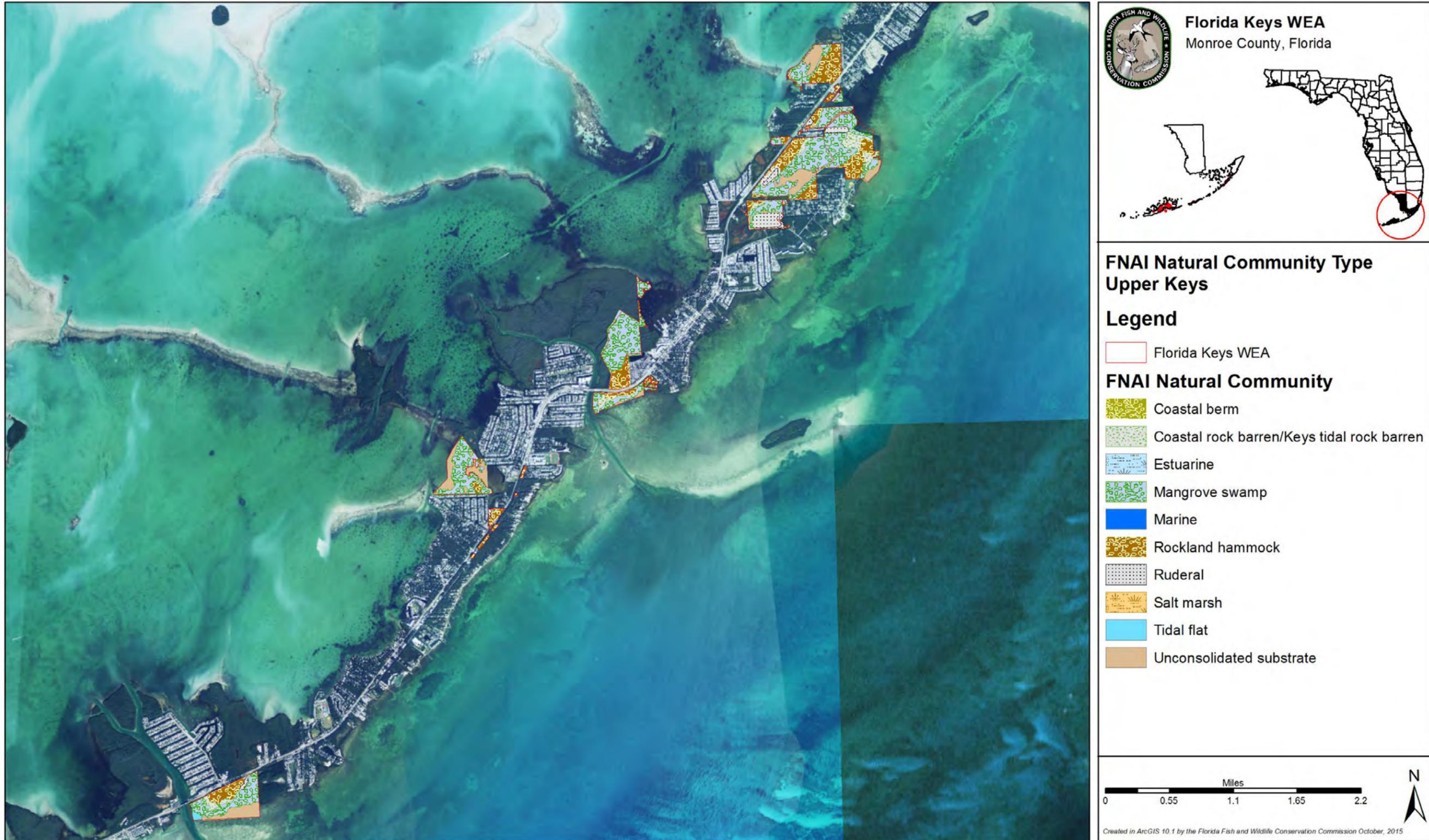


Figure 16. FKWEA Natural Communities – Upper Keys

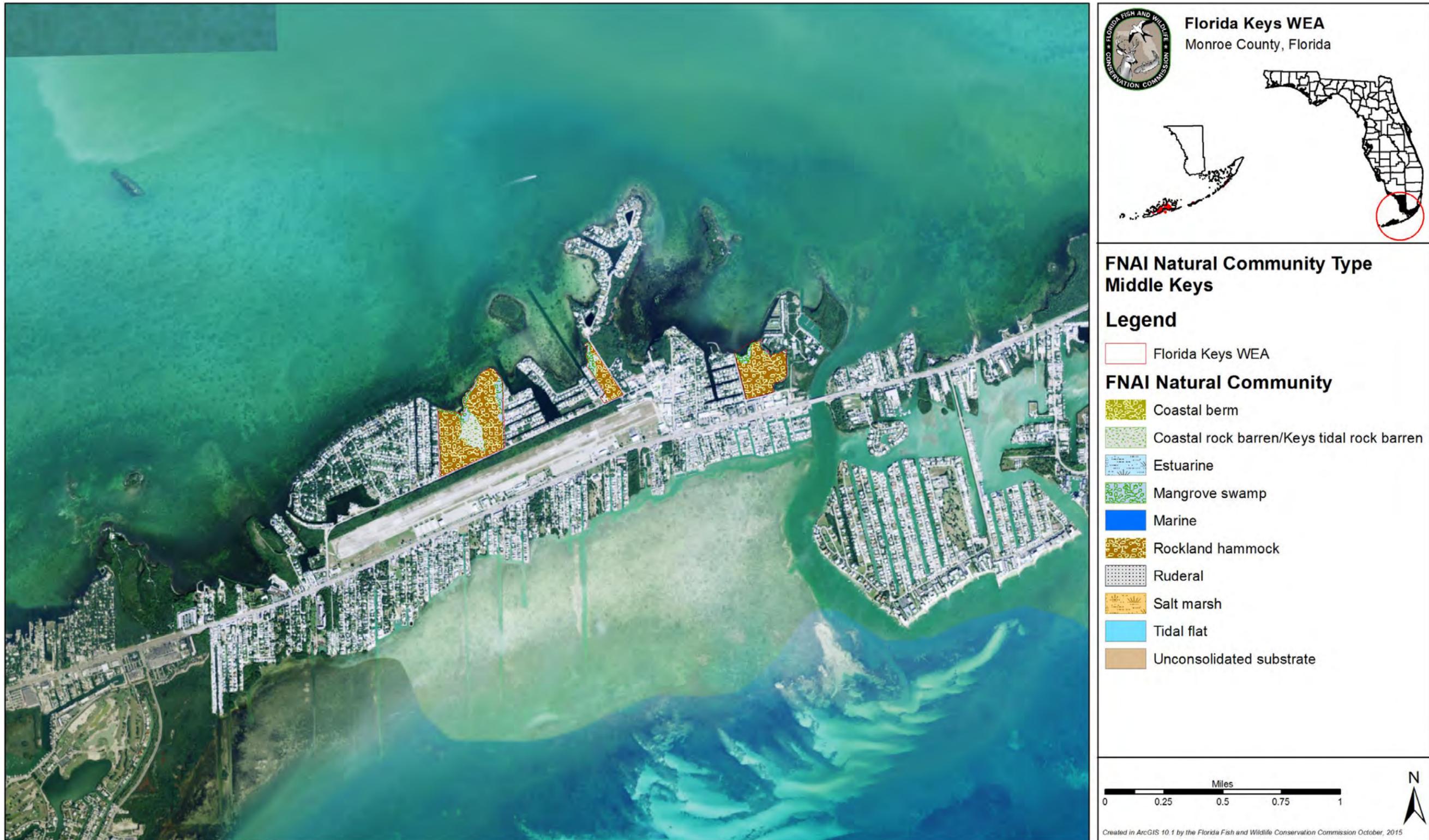


Figure 17. FKWEA Natural Communities – Middle Keys

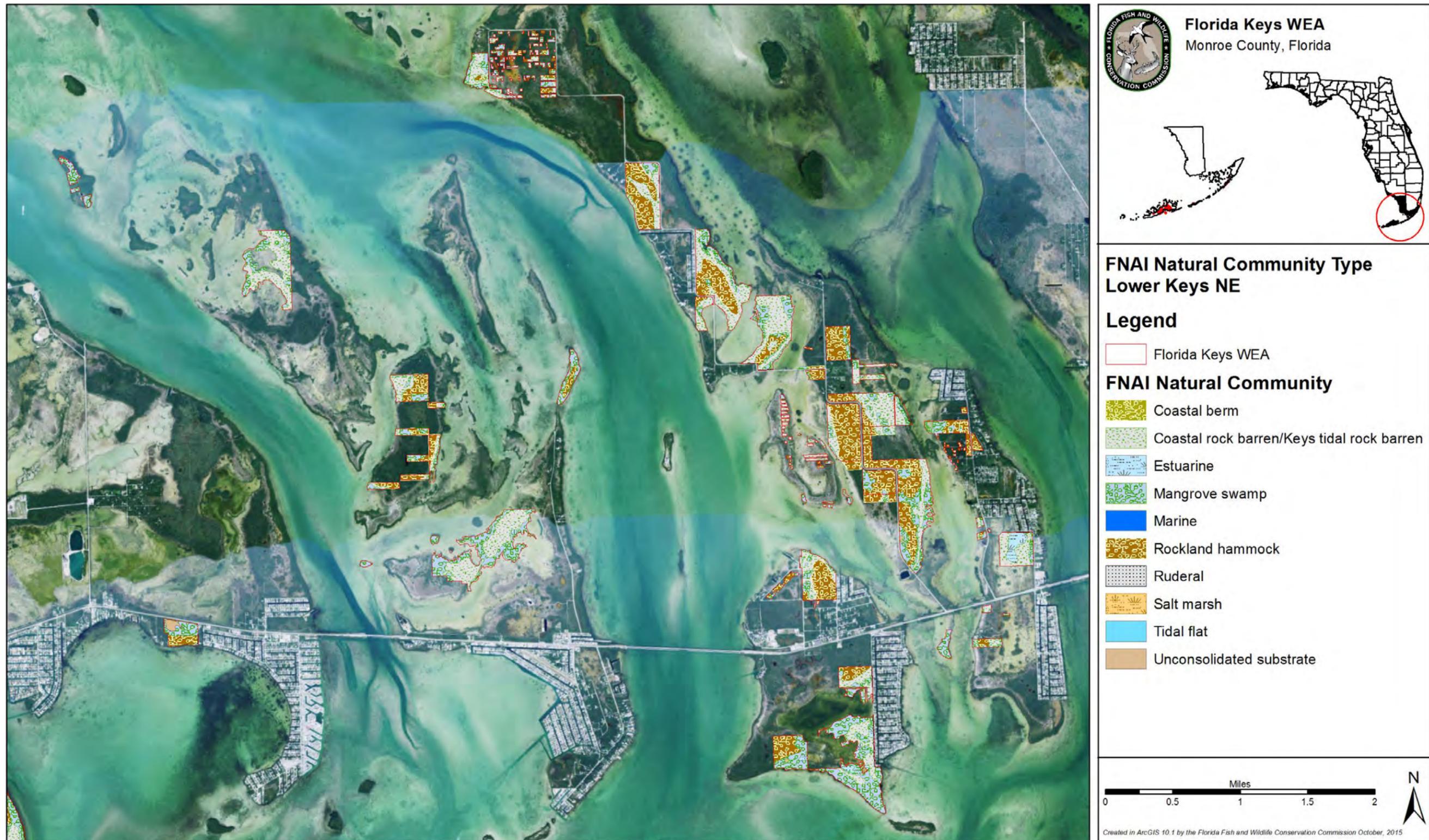


Figure 18. FKWEA Natural Communities – Lower Keys NE

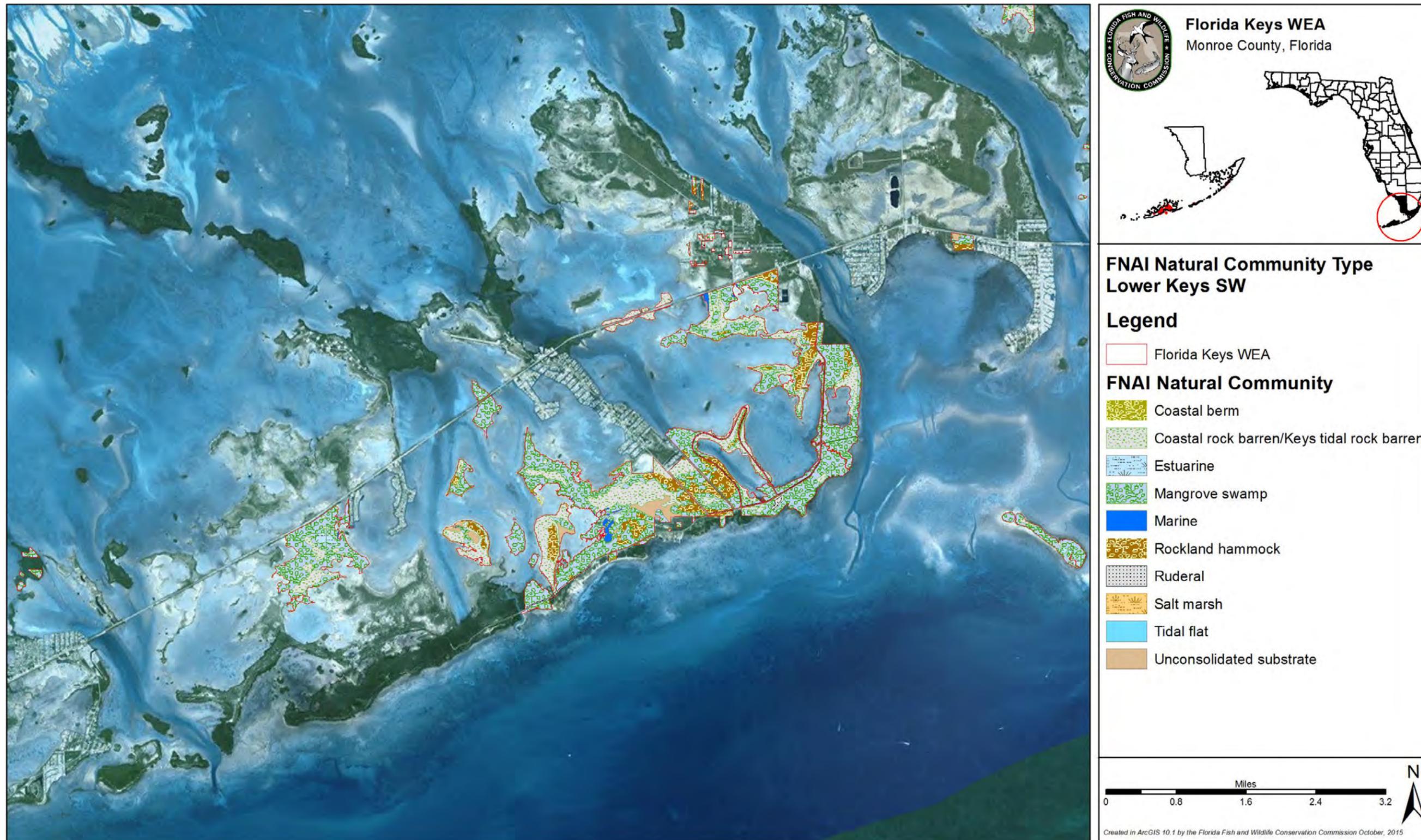


Figure 19. FKWEA Natural Communities – Lower Keys SW

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Aloe yucca	<i>Yucca aloifolia</i>
American bluehearts	<i>Buchnera americana</i>
Annual glasswort	<i>Salicornia bigelovii</i>
Arrowfeather threeawn	<i>Aristida purpurascens</i>
Bahama ladder brake	<i>Pteris bahamensis</i>
Bahama maidenbush	<i>Savia bahamensis</i>
Bahama nightshade	<i>Solanum bahamense</i>
Baldwin's flatedge	<i>Cyperus croceus</i>
Ball-moss	<i>Tillandsia recurvata</i>
Barbwire cactus	<i>Acanthocereus tetragonus</i>
Baybean	<i>Canavalia rosea</i>
Bay cedar	<i>Suriana maritima</i>
Bayhops	<i>Ipomoea pes-caprae</i> ssp. <i>brasiliensis</i>
Bayleaf capertree	<i>Capparis flexuosa</i>
Beach false foxglove	<i>Agalinis fasciculata</i>
Beach morning-glory	<i>Ipomoea imperati</i>
Beach orach	<i>Atriplex pentandra</i>
Beach-creeper	<i>Ernodea littoralis</i>
Bitter panicgrass	<i>Panicum amarum</i>
Black ironwood	<i>Krugiodendron ferreum</i>
Black mangrove	<i>Avicennia germinans</i>
Blacktorch	<i>Erithalis fruticosa</i>
Bladdermallow	<i>Herissantia crispa</i>
Blodgett's silverbrush	<i>Argythamnia blodgettii</i>
Blolly	<i>Guapira discolor</i>
Blue crowngrass	<i>Paspalum caespitosum</i>
Blue porterweed	<i>Stachytarpheta jamaicensis</i>
Boykin's milkwort	<i>Polygala boykinii</i>
Brace's aster	<i>Aster bracei</i>
Bracken fern	<i>Pteridium aquilinum</i>
Brittle thatch palm	<i>Thrinax morrisii</i>
Bushy seaside oxeye	<i>Borrichia frutescens</i>
Buttonsage	<i>Lantana involucrata</i>
Buttonwood	<i>Conocarpus erectus</i>
Cabbage palm	<i>Sabal palmetto</i>
Camphor daisy	<i>Rayjacksonia phyllocephala</i>
Canada spikerush	<i>Eleocharis geniculata</i>
Cape sable whiteweed	<i>Ageratum littorale</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Cardinal airplant	<i>Tillandsia fasciculata</i>
Caribbean princewood	<i>Exostema caribaeum</i>
Carolina sealavender	<i>Limonium carolinianum</i>
Catclaw blackbead	<i>Pithecellobium unguis-cati</i>
Catstongue	<i>Priva lappulacea</i>
Chapman's wild sensitive plant	<i>Senna mexicana var. chapmanii</i>
Cheesytoes	<i>Stylosanthes hamata</i>
Christmasberry	<i>Lycium carolinianum</i>
Cinnecord	<i>Vachellia choriophylla</i>
Climbing hempweed	<i>Mikania scandens</i>
Clustered yellowtops	<i>Flaveria trinervia</i>
Coastal indian mallow	<i>Abutilon permolle</i>
Coastal foxtail	<i>Setaria macrosperma</i>
Coastal groundcherry	<i>Physalis angustifolia</i>
Coastal morningglory	<i>Ipomoea violacea</i>
Cockspur	<i>Pisonia rotundata</i>
Coco plum	<i>Chrysobalanus icaco</i>
Coconut paspalum	<i>Paspalum laxum</i>
Colicwood	<i>Myrsine cubana</i>
Common bushy bluestem	<i>Andropogon glomeratus var. pumilus</i>
Common nightshade	<i>Solanum americanum</i>
Common ragweed	<i>Ambrosia artemisiifolia</i>
Common snowberry	<i>Chiococca alba</i>
Common torchwood	<i>Amyris elemifera</i>
Common wireweed	<i>Sida acuta</i>
Common yellow woodsorrel	<i>Oxalis corniculata</i>
Coral dropseed	<i>Sporobolus domingensis</i>
Coral panicum	<i>Paspalidium chapmanii</i>
Coral paspalum	<i>Paspalum blodgettii</i>
Corkystem passionflower	<i>Passiflora suberosa</i>
Costal sandbur	<i>Cenchrus incertus</i>
Crabwood	<i>Gymnanthes lucida</i>
Creeping-cucumber	<i>Melothria pendula</i>
Crimson bluestem	<i>Schizachyrium sanguineum</i>
Cuban jute	<i>Sida rhombifolia</i>
Cupania	<i>Cupania glabra</i>
Curacao bush	<i>Cordia globosa</i>
Cure-for-all	<i>Pluchea carolinensis</i>
Danglepod	<i>Sesbania herbacea</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Darlingplum	<i>Reynosa septentrionalis</i>
Desert horsepurslane	<i>Trianthema portulacastrum</i>
Devil's claws	<i>Pisonia aculeata</i>
Devil's-potato	<i>Echites umbellatus</i>
Dixie ticktrefoil	<i>Desmodium tortuosum</i>
Dog fennel	<i>Eupatorium capillifolium</i>
Dominican signalgrass	<i>Urochloa adspersa</i>
Downy milkpea	<i>Galactia volubilis</i>
Dwarf Canadian horseweed	<i>Conyza canadensis var. pusilla</i>
Earleaf greenbrier	<i>Smilax auriculata</i>
Eastern poison ivy	<i>Toxicodendron radicans</i>
Egyptian paspalidium	<i>Paspalidium geminatum</i>
Elliott's love grass	<i>Eragrostis elliottii</i>
Erect pricklypear	<i>Opuntia stricta</i>
Everglades greenbrier	<i>Smilax havanensis</i>
Eyebane	<i>Chamaesyce hypericifolia</i>
False mallow	<i>Malvastrum corchorifolium</i>
False mastic	<i>Sideroxylon foetidissimum</i>
False tamarind	<i>Lysiloma latisiliquum</i>
False-mint	<i>Dicliptera sexangularis</i>
False-sisal	<i>Agave decipiens</i>
Faux persil	<i>Cardiospermum corindum</i>
Fiddler's spurge	<i>Poinsettia heterophylla</i>
Firebush	<i>Hamelia patens</i>
Firewheel	<i>Gaillardia pulchella</i>
Flatleaf flatsedge	<i>Cyperus planifolius</i>
Flatspike sedge	<i>Abildgaardia ovata</i>
Florida boxwood	<i>Schaefferia frutescens</i>
Florida butterfly orchid	<i>Encyclia tampensis</i>
Florida hammock milkpea	<i>Galactia striata</i>
Florida hammock sandmat	<i>Chamaesyce ophthalmica</i>
Florida Keys blackbead	<i>Pithecellobium keyense</i>
Florida Keys indigo	<i>Indigofera mucronata var. keyensis</i>
Florida mayten	<i>Maytenus phyllanthoides</i>
Florida silver palm	<i>Coccothrinax argentata</i>
Florida swampprivet	<i>Forestiera segregata</i>
Florida thatch palm	<i>Thrinax radiata</i>
Florida whitetop	<i>Rhynchospora floridensis</i>
Fragrant swallowwort	<i>Cynanchum northropiae</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Fringed fanpetals	<i>Sida ciliaris</i>
Galphimia	<i>Galphimia gracilis</i>
Garber's spurge	<i>Chamaesyce garberi</i>
Giant airplant	<i>Tillandsia utriculata</i>
Giant leather fern	<i>Acrostichum danaeifolium</i>
Glasswort	<i>Salicornia virginica</i>
Goatweed	<i>Capraria biflora</i>
Golden polypody	<i>Phlebodium aureum</i>
Gray nicker-bean	<i>Caesalpinia bonduc</i>
Green sprangletop	<i>Leptochloa dubia</i>
Greenheart	<i>Colubrina arborescens</i>
Groundsel tree	<i>Baccharis halimifolia</i>
Guiana plum	<i>Drypetes lateriflora</i>
Gulf Coast spikerush	<i>Eleocharis cellulosa</i>
Gulf Coast swallowwort	<i>Cynanchum angustifolium</i>
Gulf cordgrass	<i>Spartina spartinae</i>
Gumbo-limbo	<i>Bursera simaruba</i>
Hairy bluestem	<i>Andropogon longiberbis</i>
Hairy pod cowpea	<i>Vigna luteola</i>
Hammock velvetseed	<i>Guettarda elliptica</i>
Herb-of-grace	<i>Bacopa monnieri</i>
Hog-plum	<i>Ximenia americana</i>
Hollywood lignumvitae	<i>Guaiacum sanctum</i>
Hurricane grass	<i>Fimbristylis cymosa</i>
Hyssopleaf sandmat	<i>Chamaesyce hyssopifolia</i>
Inkwood	<i>Exothea paniculata</i>
Jack-in-the-brush	<i>Chromolaena odorata</i>
Jacob's ladder	<i>Pedilanthus tithymaloides ssp. smallii</i>
Jamaica caper-tree	<i>Capparis cynophallophora</i>
Jamaican dogwood	<i>Piscidia piscipula</i>
Jimsonweed	<i>Datura stramonium</i>
Joewood	<i>Jacquinia keyensis</i>
Juba's bush	<i>Iresine diffusa</i>
Keygrass	<i>Monanthochloe littoralis</i>
Knot grass	<i>Paspalum distichum</i>
Lancewood	<i>Ocotea coriacea</i>
Leafless swallowwort	<i>Cynanchum scoparium</i>
Least snoutbean	<i>Rhynchosia minima</i>
Limestone flatedge	<i>Cyperus fuliginous</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Limestone sandmat	<i>Chamaesyce blodgettii</i>
Locustberry	<i>Byrsonima lucida</i>
Lopsided indiagrass	<i>Sorghastrum secundum</i>
Love-in-a-puff	<i>Cardiospermum halicacabum</i>
Lovevine	<i>Cassytha filiformis</i>
Maidenberry	<i>Crossopetalum rhacoma</i>
Maidenhair pineland fern	<i>Anemia adiantifolia</i>
Manateeegrass	<i>Syringodium filiforme</i>
Manchineel	<i>Hippomane mancinella</i>
Mangrove berry	<i>Psidium longipes</i>
Mangrove spiderlily	<i>Hymenocallis latifolia</i>
Manyspike flatedge	<i>Cyperus polystachyos</i>
Marlberry	<i>Ardisia escallonioides</i>
Marsh fimbry	<i>Fimbristylis spadicea</i>
Marshgentian	<i>Eustoma exaltatum</i>
Marshhay cordgrass	<i>Spartina patens</i>
Mendez's sandmat	<i>Chamaesyce mendezii</i>
Mexican pricklypoppy	<i>Argemone mexicana</i>
Michaux's cupgrass	<i>Eriochloa michauxii</i>
Milkbark	<i>Drypetes diversifolia</i>
Monk orchid	<i>Oeceoclades maculata</i>
Moonflowers	<i>Ipomoea alba</i>
Muhlygrass	<i>Muhlenbergia capillaris</i>
Mullein nightshade	<i>Solanum donianum</i>
Muscadine	<i>Vitis rotundifolia</i>
Myrtle-of-the-river	<i>Calyptrothrix zuzygium</i>
Narrowleaf yellowtops	<i>Flaveria linearis</i>
Nettletree	<i>Trema micrantha</i>
Noyau vine	<i>Merremia dissecta</i>
Ocean-blue morningglory	<i>Ipomoea indica var. acuminata</i>
Paintedleaf	<i>Poinsettia cyathophora</i>
Pale lidflower	<i>Calyptrothrix pallens</i>
Paradisetree	<i>Simarouba glauca</i>
Parasitic ghostplant	<i>Leiphaimos parasitica</i>
Perennial glasswort	<i>Sarcocornia perennis</i>
Pigeonplum	<i>Coccoloba diversifolia</i>
Pillpod sandmat	<i>Chamaesyce hirta</i>
Pineland acacia	<i>Acacia pinetorum</i>
Pineland golden trumpet	<i>Angadenia berteroi</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Pineland snowberry	<i>Chiococca parvifolia</i>
Pinewoods fingergrass	<i>Eustachys petraea</i>
Pink purslane	<i>Portulaca pilosa</i>
Pinkpink	<i>Bletia purpurea</i>
Poeppig's rosemallow	<i>Hibiscus poeppigii</i>
Poisonwood	<i>Metopium toxiferum</i>
Porter's spurge	<i>Chamaesyce porteriana</i>
Potatotree	<i>Solanum erianthum</i>
Potbelly airplant	<i>Tillandsia paucifolia</i>
Pride-of-Big-Pine	<i>Strumpfia maritima</i>
Privet wild sensitive plant	<i>Senna ligustrina</i>
Purslane	<i>Portulaca oleracea</i>
Red mangrove	<i>Rhizophora mangle</i>
Red spiderling	<i>Boerhavia diffusa</i>
Red stopper	<i>Eugenia rhombea</i>
Redgal	<i>Morinda royoc</i>
Redsteam purslane	<i>Portulaca rubricaulis</i>
Reflexed wild-pine	<i>Tillandsia balbisiana</i>
Resurrection fern	<i>Pleopeltis polypodioides var. michauxiana</i>
Rhacoma	<i>Crossopetalum rhacoma</i>
Rock Carolina leafflower	<i>Phyllanthus caroliniensis ssp. saxicola</i>
Rose-of-Plymouth	<i>Sabatia stellaris</i>
Rosy camphorweed	<i>Pluchea rosea</i>
Rougeplant	<i>Rivina humilis</i>
Rough velvetseed	<i>Guettarda scabra</i>
Royal flatedge	<i>Cyperus elegans</i>
Rubbervine	<i>Rhabdadenia biflora</i>
Rustweed	<i>Polypremum procumbens</i>
Saffron plum	<i>Sideroxylon celastrinum</i>
Saltgrass	<i>Distichlis spicata</i>
Saltmarsh false foxglove	<i>Agalinis maritima</i>
Saltwater falsewillow	<i>Baccharis angustifolia</i>
Saltwort	<i>Batis maritima</i>
Samphire	<i>Blutaparon vermiculare</i>
Sand flax	<i>Linum arenicola</i>
Sandune cinchweed	<i>Pectis glaucescens</i>
Santa Maria feverfew	<i>Parthenium hysterophorus</i>
Satinleaf	<i>Chrysophyllum oliviforme</i>
Saw grass	<i>Cladium jamaicense</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Saw palmetto	<i>Serenoa repens</i>
Scorpionstail	<i>Heliotropium angiospermum</i>
Sea lavender	<i>Argusia gnaphalodes</i>
Sea oxeye	<i>Pascaliala glauca</i>
Sea purslane	<i>Sesuvium maritimum</i>
Sea-blite	<i>Suaeda linearis</i>
Seagrape	<i>Coccoloba uvifera</i>
Seashore dropseed	<i>Sporobolus virginicus</i>
Seashore paspalum	<i>Paspalum vaginatum</i>
Seaside heliotrope	<i>Heliotropium curassavicum</i>
Seaside joyweed	<i>Alternanthera maritima</i>
Seaside spurge	<i>Chamaesyce mesembrianthemifolia</i>
Semaphore cactus	<i>Opuntia corallicola</i>
Sensitive pea	<i>Chamaecrista nictitans var. aspera</i>
Sevenyear apple	<i>Genipa clusiifolia</i>
Shiny-leaved wild-coffee	<i>Psychotria nervosa</i>
Shoreline seapurslane	<i>Sesuvium portulacastrum</i>
Showy milkwort	<i>Polygala grandiflora</i>
Shrub verbena	<i>Lantana sp.</i>
Simpson's prickly apple	<i>Harrisia simpsonii</i>
Skyblue clustervine	<i>Jacquemontia pentanthos</i>
Sleepy morning	<i>Waltheria indica</i>
Slender dwarf morningglory	<i>Evolvulus alsinoides</i>
Slim amaranth	<i>Amaranthus hybridus</i>
Slippery burr	<i>Corchorus siliquosus</i>
Smallcane	<i>Lasiacis divaricata</i>
Smallfruit varnishleaf	<i>Dodonaea elaeagnoides</i>
Smooth strongback	<i>Bouyeria succulenta</i>
Snow squarestem	<i>Melanthera nivea</i>
Soapberry	<i>Sapindus saponaria</i>
Soldierwood	<i>Colubrina elliptica</i>
Sorrelvine	<i>Cissus trifoliata</i>
South Florida slash pine	<i>Pinus elliottii var. densa</i>
Southern beeblossom	<i>Gaura angustifolia</i>
Southern cattail	<i>Typha domingensis</i>
Southern crabgrass	<i>Digitaria ciliaris</i>
Southern sandbur	<i>Cenchrus echinatus</i>
Spanish stopper	<i>Eugenia foetida</i>
Spanish-moss	<i>Tillandsia usneoides</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Spanish-needles	<i>Bidens alba var. radiata</i>
Spreading fanpetals	<i>Sida abutilifolia</i>
Spurred butterfly pea	<i>Centrosema virginianum</i>
Starrush whitetop	<i>Rhynchospora colorata</i>
Strangler fig	<i>Ficus aurea</i>
Swamp flatedge	<i>Cyperus ligularis</i>
Swartz's snoutbean	<i>Rhynchosia swartzii</i>
Sweet acacia	<i>Acacia farnesiana</i>
Sweetscent	<i>Pluchea odorata</i>
Switchgrass	<i>Panicum virgatum</i>
Sword fern	<i>Nephrolepis exaltata</i>
Tearshrub	<i>Vallesia antillana</i>
Thin paspalum	<i>Paspalum setaceum</i>
Tree seaside oxeye	<i>Borrichia arborescens</i>
Tropical puff	<i>Neptunia pubescens</i>
Turkey tangle fogfruit	<i>Phyla nodiflora</i>
Turtle grass	<i>Thalassia testudinum</i>
Twining soldierbush	<i>Tournefortia volubilis</i>
Twisted airplant	<i>Tillandsia flexuosa</i>
Varnishleaf	<i>Dodonaea viscosa</i>
Virginia pepperweed	<i>Lepidium virginicum</i>
Water pimpernel	<i>Samolus ebracteatus</i>
Wax myrtle	<i>Myrica cerifera</i>
West Indian false boxwood	<i>Gyminda latifolia</i>
West Indian mahogany	<i>Swietenia mahagoni</i>
West Indian pinkroot	<i>Spigelia anthelmia</i>
White indigoberry	<i>Randia aculeata</i>
White mangrove	<i>Laguncularia racemosa</i>
White stopper	<i>Eugenia axillaris</i>
Whiteflower passionflower	<i>Passiflora multiflora</i>
White ironwood	<i>Hypelate trifoliata</i>
Whitemouth dayflower	<i>Commelina erecta</i>
Whiteroot	<i>Gouania lupuloides</i>
Whitevine	<i>Sarcostemma clausum</i>
Whorled dropseed	<i>Sporobolus pyramidatus</i>
Wigeongrass	<i>Ruppia maritima</i>
Wild allamanda	<i>Pentalinon luteum</i>
Wild banyan tree	<i>Ficus citrifolia</i>
Wild cinnamon	<i>Canella winterana</i>

Table 4. Native Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Wild cotton	<i>Gossypium hirsutum</i>
Wild dilly	<i>Manilkara jaimiqui</i>
Wild tantan	<i>Desmanthus virgatus</i>
Wild-lime	<i>Zanthoxylum fagara</i>
Willow-bustic	<i>Sideroxylon salicifolium</i>
Wire bluestem	<i>Schizachyrium gracile</i>
Woodland false buttonweed	<i>Spermacoce assurgens</i>
Wormvine orchid	<i>Vanilla barbellata</i>
Yellow alder	<i>Turnera ulmifolia</i>
Yellow bristlegrass	<i>Setaria parviflora</i>
Yellow joyweed	<i>Alternanthera flavescens</i>
Yellow necklacepod	<i>Sophora tomentosa</i>
Yellow nicker-bean	<i>Caesalpinia major</i>
Zarabacoa comun	<i>Desmodium incanum</i>

Table 5. Rare and Imperiled Plants Known to Occur on the FKWEA

Common Name	Scientific Name	Status
Bahama ladder brake	<i>Pteris bahamensis</i>	ST
Bahama maidenbush	<i>Savia bahamensis</i>	SE
Barbwire cactus	<i>Acanthocereus tetragonus</i>	ST
Blacktorch	<i>Erithalis fruticosa</i>	ST
Blodgett's silverbrush	<i>Argythamnia blodgettii</i>	SE
Brittle thatch palm	<i>Thrinax morrisii</i>	ST
Cape sable whiteweed	<i>Ageratum littorale</i>	SE
Cardinal airplant	<i>Tillandsia fasciculata var. densispica</i>	SE
Caribbean princewood	<i>Exostema caribaeum</i>	SE
Cinnecord	<i>Vachellia choriophylla</i>	SE
Chapman's wild sensitive plant	<i>Senna mexicana var. chapmanii</i>	ST
Coral panicum	<i>Paspalidium chapmanii</i>	SE
Curacao bush	<i>Cordia globosa</i>	SE
Darlingplum	<i>Reynosia septentrionalis</i>	ST
Devil's smooth-claw	<i>Pisonia rotundata</i>	SE
Erect pricklypear	<i>Opuntia stricta</i>	ST
Everglades greenbrier	<i>Smilax havanensis</i>	ST
Florida boxwood	<i>Schaefferia frutescens</i>	SE
Florida Keys blackbead	<i>Pithecellobium keyense</i>	ST
Florida Keys indigo	<i>Indigofera mucronata var. keyensis</i>	SE
Florida mayten	<i>Maytenus phyllanthoides</i>	ST
Florida silver palm	<i>Coccothrinax argentata</i>	ST

Table 5. Rare and Imperiled Plants Known to Occur on the FKWEA

Common Name	Scientific Name	Status
Florida thatch palm	<i>Thrinax radiata</i>	SE
Garber's spurge	<i>Chamaesyce garberi</i>	ST, FT
Giant airplant	<i>Tillandsia utriculata</i>	SE
Greenheart	<i>Colubrina arborescens</i>	SE
Guiana plum	<i>Drypetes lateriflora</i>	ST
Hollywood lignumvitae	<i>Guaiacum sanctum</i>	SE
Joewood	<i>Jacquinia keyensis</i>	ST
Limestone flatedge	<i>Cyperus fuliginous</i>	SE
Locustberry	<i>Byrsonima lucida</i>	ST
Maidenberry	<i>Crossopetalum rhacoma</i>	ST
Manchineel	<i>Hippomane mancinella</i>	SE
Mangrove berry	<i>Psidium longipes</i>	ST
Milkbark	<i>Drypetes diversifolia</i>	SE
Mullein nightshade	<i>Solanum donianum</i>	ST
Myrtle-of-the-river	<i>Calypttranthes zuzygium</i>	SE
Pale lidflower	<i>Calypttranthes pallens</i>	ST
Parasitic ghostplant	<i>Leiphaimos parasitica</i>	SE
Pineland golden trumpet	<i>Angadenia berteroi</i>	ST
Pinkpink	<i>Bletia purpurea</i>	ST
Poeppig's rosemallow	<i>Hibiscus poeppigii</i>	SE
Porter's spurge	<i>Chamaesyce porteriana</i>	SE
Pride-of-Big-Pine	<i>Strumpfia maritima</i>	SE
Red stopper	<i>Eugenia rhombea</i>	SE
Reflexed wild-pine	<i>Tillandsia balbisiana</i>	ST
Sand flax	<i>Linum arenicola</i>	SE
Satinleaf	<i>Chrysophyllum oliviforme</i>	ST
Sea lavender	<i>Argusia gnaphalodes</i>	SE
Semaphore cactus	<i>Opuntia corallicola</i>	SE
Simpson's prickly apple	<i>Harrisia simpsonii</i>	SE, FE
Skyblue clustervine	<i>Jacquemontia pentantha</i>	SE
Smallfruit varnishleaf	<i>Dodonaea elaeagnoides</i>	SE
Smooth strongback	<i>Bourreria succulenta</i>	SE
Soldierwood	<i>Colubrina elliptica</i>	SE
Swartz's snoutbean	<i>Rhynchosia swartzii</i>	SE
Tearshrub	<i>Vallesia antillana</i>	SE
Twisted airplant	<i>Tillandsia flexuosa</i>	ST
West Indian false boxwood	<i>Gyminda latifolia</i>	SE
West Indian mahogany	<i>Swietenia mahagoni</i>	ST
White ironwood	<i>Hypelate trifoliata</i>	SE

Table 5. Rare and Imperiled Plants Known to Occur on the FKWEA

Common Name	Scientific Name	Status
Whiteflower passionflower	<i>Passiflora multiflora</i>	SE
Wild cinnamon	<i>Canella winterana</i>	SE
Wild cotton	<i>Gossypium hirsutum</i>	SE
Wild dilly	<i>Manilkara jaimiqui</i>	ST
Wormvine orchid	<i>Vanilla barbellata</i>	SE
Yellow nicker-bean	<i>Caesalpinia major</i>	SE

Acronym	Status
FE	Federally-designated Endangered
FT	Federally-designated Threatened
SE	State-designated Endangered
ST	State-designated Threatened

Table 6. Exotic Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Achicoria azul	<i>Launaea intybacea</i>
African ground orchid	<i>Oeceoclades maculata</i>
African spear	<i>Sansevieria cylindrica</i>
African tuliptree	<i>Spathodea campanulata</i>
Air-potato	<i>Dioscorea bulbifera</i>
Aloe	<i>Aloe vera</i>
American evergreen	<i>Syngonium podophyllum</i>
Asian sword fern	<i>Nephrolepis multiflora</i>
Australian pine	<i>Casuarina spp.</i>
Australian umbrellatree	<i>Schefflera actinophylla</i>
Bahiagrass	<i>Paspalum notatum</i>
Bamboo palm	<i>Chamaedorea seifrizii</i>
Beach napuka	<i>Scaevola sericea</i>
Bermudagrass	<i>Cynodon dactylon</i>
Bottlebrush	<i>Melaleuca viminalis</i>
Bowstring-hemp	<i>Sansevieria hyacinthoides</i>
Brazilian pepper	<i>Schinus terebinthifolius</i>
Brittleweed	<i>Tridax procumbens</i>
Broomcorn	<i>Sorghum arundinaceum</i>
Browne's blechum	<i>Blechnum pyramidatum</i>
Cape leadwort	<i>Plumbago auriculata</i>
Caribbean trumpetree	<i>Tabebuia aurea</i>
Castorbean	<i>Ricinus communis</i>

Table 6. Exotic Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Cathedral bell	<i>Kalanchoe pinnata</i>
Centipedegrass	<i>Eremochloa ophiuroides</i>
Century plant	<i>Agave americana</i>
Chandelier plant	<i>Kalanchoe tubiflora</i>
Chinese fan palm	<i>Livistona chinensis</i>
Christmas palm	<i>Veitchia merrillii</i>
Citron	<i>Citrus medica</i>
Climbing dayflower	<i>Commelina diffusa</i> var. <i>diffusa</i>
Cochineal cactus	<i>Opuntia cochenillifera</i>
Coconut palm	<i>Cocos nucifera</i>
Common banana	<i>Musa x paradisiaca</i>
Coral vine	<i>Antigonon leptopus</i>
Creeping oxeye	<i>Wedelia trilobata</i>
Crow's-foot grass	<i>Dactyloctenium aegyptium</i>
Cut-leaf philodendron	<i>Monstera deliciosa</i>
Date palm	<i>Phoenix dactylifera</i>
Devil's backbone	<i>Kalanchoe daigremontiana</i>
Dwarf schefflera	<i>Schefflera arboricola</i>
Earleaf acacia	<i>Acacia auriculiformis</i>
Elliptic yellowwood	<i>Ochrosia elliptica</i>
Feather lovegrass	<i>Eragrostis amabilis</i>
Fishtail sword fern	<i>Nephrolepis falcata</i>
Florida tasselflower	<i>Emilia fosbergii</i>
Frosted aralia	<i>Polyscias guilfoylei</i>
Gale-of-wind	<i>Phyllanthus amarus</i>
Garden rosemallow	<i>Hibiscus rosa-sinensis</i>
Golden pothos	<i>Epipremnum pinnatum</i>
Gophertail lovegrass	<i>Eragrostis ciliaris</i>
Governor's plum	<i>Flacourtia indica</i>
Grassleaf spurge	<i>Euphorbia graminea</i>
Gray sheoak	<i>Casuarina glauca</i>
Guineagrass	<i>Panicum maximum</i>
Horseflesh mahogany	<i>Lysiloma sabicu</i>
Inchplant	<i>Tradescantia zebrina</i>
Indian goosegrass	<i>Eleusine indica</i>
Indian tree spurg	<i>Euphorbia tirucalli</i>
Lantana	<i>Lantana camara</i>
Largeleaf geigertree	<i>Cordia sebestena</i>
Latherleaf	<i>Colubrina asiatica</i>

Table 6. Exotic Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Little ironweed	<i>Vernonia cinerea</i>
Littlebell	<i>Ipomoea triloba</i>
Madagascar periwinkle	<i>Catharanthus roseus</i>
Mango	<i>Mangifera indica</i>
Mascarene island leafflower	<i>Phyllanthus tenellus</i>
Mascarene templegrass	<i>Zoysia tenuifolia</i>
Mauritius-hemp	<i>Furcraea foetida</i>
Mexican flamewine	<i>Pseudogynoxys chenopodioides</i>
Mother-of-millions	<i>Kalanchoe x houghtonii</i>
Mottled spurge	<i>Euphorbia lactea</i>
Natal plum	<i>Carissa macrocarpa</i>
Nightblooming cereus	<i>Hylocereus undatus</i>
Norfolk island pine	<i>Araucaria heterophylla</i>
Nutgrass	<i>Cyperus rotundus</i>
Oxhorn bucida	<i>Bucida buceras</i>
Oysterplant	<i>Tradescantia spathacea</i>
Panama crowngrass	<i>Paspalum fimbriatum</i>
Papaya	<i>Carica papaya</i>
Paperflower	<i>Bougainvillea glabra</i>
Peruvian apple cactus	<i>Cereus repandus</i>
Pink trumpetvine	<i>Podranea ricasoliana</i>
Pitchapple	<i>Clusia rosea</i>
Pitted beardgrass	<i>Bothriochloa pertusa</i>
Portiatree	<i>Thespesia populnea</i>
Pride-of-barbados	<i>Caesalpinia pulcherrima</i>
Princess-of-the-night	<i>Selenicereus pteranthus</i>
Punktrees	<i>Melaleuca quinquenervia</i>
Queen palm	<i>Syagrus romanzoffiana</i>
Queenswreath	<i>Petrea volubilis</i>
River sheoak	<i>Casuarina cunninghamiana</i>
Roadside sandmat	<i>Chamaesyce lasiocarpa</i>
Rose natalgrass	<i>Rhynchelytrum repens</i>
Royal poinciana	<i>Delonix regia</i>
Rubber tree	<i>Ficus elastica</i>
Sapodilla	<i>Manilkara zapota</i>
Sea hibiscus	<i>Talipariti tiliaceum</i>
Senegal date palm	<i>Phoenix reclinata</i>
Shrubby false buttonweed	<i>Spermacoce verticillata</i>
Silky sesban	<i>Sesbania sericea</i>

Table 6. Exotic Plant Species Known to Occur on the FKWEA

Common Name	Scientific Name
Simpleleaf chastetree	<i>Vitex trifolia</i>
Sisal-hemp	<i>Agave sisalana</i>
Slender amaranth	<i>Amaranthus viridis</i>
Smooth joyweed	<i>Alternanthera paronichyoides</i>
Smutgrass	<i>Sporobolus indicus var. indicus</i>
Spanish lime	<i>Melicoccus bijugatus</i>
Spiny sowthistle	<i>Sonchus asper</i>
Sprenger's asparagus-fern	<i>Asparagus densiflorus</i>
St. Augustine grass	<i>Stenotaphrum secundatum</i>
Surinam cherry	<i>Eugenia uniflora</i>
Tamarind	<i>Tamarindus indica</i>
Torpedograss	<i>Panicum repens</i>
Trailing indigo	<i>Indigofera spicata</i>
Tropical paspalum	<i>Paspalum pleostachyum</i>
Tropical signalgrass	<i>Urochloa subquadripara</i>
True indigo	<i>Indigofera tinctoria</i>
Tuberous sword fern	<i>Nephrolepis cordifolia</i>
Tuna cactus	<i>Opuntia ficus-indica</i>
Umbrella plant	<i>Cyperus involucratus</i>
Valamuerto	<i>Senna pendula var. glabrata</i>
Washington fan palm	<i>Washingtonia robusta</i>
West Indian almond	<i>Terminalia catappa</i>
West Indian dropseed	<i>Sporobolus indicus var. pyramidalis</i>
White cedar	<i>Tabebuia heterophylla</i>
White leadtree	<i>Leucaena leucocephala</i>
White moneywort	<i>Alysicarpus vaginalis</i>
Whitelady	<i>Thunbergia fragrans</i>
Widow's thrill	<i>Kalanchoe sp.</i>
Wild bushbean	<i>Macroptilium lathyroides</i>
Women's tongue	<i>Albizia lebbek</i>
Yellow elder	<i>Tecoma stans</i>

2.2.1 FNAI Natural Community Descriptions

The following are descriptions of the natural and anthropogenic communities found on the FKWEA (Table 3). These community descriptions were prepared by the FNAI and edited by the FWC. Some of the natural community descriptions were adapted from the generic descriptions found in the Florida Land Cover Classification System Definitions for the Cooperative Land Cover Map v2.3, produced by the FNAI and the FWC and most recently updated in December 2012.

Coastal Berm

Coastal berm occurs on low ridges of storm-deposited sand, shell, and marine debris that form parallel to the shoreline on low energy coastlines. Coastal berm is typically bounded by mangrove swamp and coastal rock barren. Vegetation on coastal berm often includes dense thickets of shrubs and small trees.

On FKWEA, coastal berm occurs most frequently on low islands of the Sugarloaf Keys. These coastal berms consist of loosely deposited shell and marl sands forming small, low (1-



3 feet tall) ridges, which occur along outer edges of low mangrove swamp or coastal rock barren. Although extremely variable in their species composition, they generally support woody species such as buttonwood and black, red, and white mangroves, bay cedar, wild dilly, joewood, sea oxeye, and pride-of-Big-Pine. Coastal berm also may have a moderate to dense herbaceous layer consisting of shoreline seapurslane, keygrass, saltgrass, and dropseed.

The greatest threat to the coastal berm communities on FKWEA appears to be invasive exotic species. They are often colonized with scattered small to medium sized Australian pine.

Coastal Rock Barren/Keys Tidal Rock Barren

Coastal rock barren, which is referred to in the Cooperative Land Cover Map as Keys Tidal Rock Barren, is characterized as a coastal flatland with an exposed limestone substrate. The vegetation is a xeric mixture of halophytic herbs and grasses along with stunted shrubs. Coastal rock barren is usually located between mangrove swamp and coastal upland communities such as rockland hammock. Coastal rock barren is among the most endangered natural communities in Florida, occurring only along rocky coastlines in the

Florida Keys. A common disturbance seen in the coastal rock barrens of FKWEA is old mosquito ditches cut throughout large areas. These ditches are cut deep into the rock and cause altered hydrology in the barrens.

Vegetation varies in structure and composition from open rocky flats to dense shrub thickets. The short and tall shrub strata are typically dominated by buttonwood and black mangrove. Other shrub species include saltwort, tree seaside oxeye, bushy seaside oxeye,



Christmasberry, poisonwood, red mangrove, and saffron plum.

Herbaceous species may include saltgrass, marsh fimbry, keygrass, perennial glasswort, seashore dropseed, and gulf cordgrass. Joewood, wild dilly, Florida mayten, and twisted airplant are listed plant species often found in coastal rock barren.

In some areas, a layer of marl covers the rock substrate. This condition is noted in the attribute table comments field by the phrase “marl substrate, no exposed rock.” The vegetation is usually similar to the exposed rock sections and is dominated by keygrass, perennial glasswort, saltwort, bushy seaside oxeye, and seashore dropseed. Scattered buttonwood and black mangrove shrubs are usually present. The soft substrate is easily damaged by off-road vehicles.

Estuarine

Estuarine is a classification used in the Cooperative Land Cover Map to describe deepwater tidal habitats and adjacent tidal wetlands that are generally semi-enclosed by land but with open or partly obstructed access to the ocean.

Nearly 68 acres of the FKWEA are classified as estuarine on the Cooperative Land Cover Map. Most of these areas classified as estuarine are located along the outer boundaries of the FKWEA, adjacent to the ocean and often surrounded by mangrove swamp.

Mangrove Swamp

Mangrove swamp, formerly referred to as tidal swamp, is characterized as a dense forest occurring along relatively flat marine and estuarine shorelines of low wave energy. Zones of vegetation typically develop, depending on the extent of tidal influence, salinity, and substrate. Red mangrove dominates the lowest or deep-water zone, black mangrove the intermediate zone, and white mangrove and buttonwood the highest, least tidally

influenced zone. These zones are usually differentiated by separate polygons on the natural community map.

Mangrove swamps occur in flat coastal areas. The soils are generally saturated with brackish water at all times, and at high tides mangrove swamps are usually inundated with standing water. Mangroves can grow on a wide variety of soils ranging from sands to mud. In older mangrove swamps a layer of peat, which has built up from decaying plant material, usually covers the soil. A common disturbance seen in the mangrove swamps of the FKWEA is old mosquito ditches cut throughout large areas. These ditches are cut deep through the soil and into the rock and cause altered hydrology in the swamps.



Mangrove swamp covers large areas in the FKWEA. The density and height of the mangroves and the diversity of associated herbaceous species varies from site to site. The mangroves range from dwarfed shrubs to trees more than 50' tall. Shrubs other than mangroves include tree seaside oxeye and bushy seaside oxeye. The herbaceous species commonly found in mangrove swamp are saltwort, keygrass, and perennial glasswort.

Mangrove swamp within the FKWEA provides important habitat for several rare animal species such as white-crowned pigeon. Mangrove swamps also serve as important “nursery” grounds for a variety of fish species. Isolated mangrove islands also provide important nesting and roosting areas for many wading birds.

Marine

Marine is a classification used in the Cooperative Land Cover Map to describe open ocean overlying the continental shelf and coastline exposed to waves and currents of the open ocean shoreward to either the extreme high water of spring tides, the seaward limit of wetland emergent, trees, or shrubs, or the seaward limit of the estuarine system.

Cooperative Land Cover data indicates that nearly 40 acres of the FKWEA are classified as marine. These areas classified as marine are located entirely within the Lower Keys and are situated along the outer boundaries of the FKWEA along the ocean, abutting other natural community types such as mangrove swamp or rock barren.

Rockland Hammock

Rockland hammock is a hardwood forest on upland sites where limestone is very near or at the ground surface. Rockland hammock, also referred to as tropical hardwood hammock, is the climax community and the most tree rich community in the Florida Keys. Because of its limited range and high degree of fragmentation by development, rockland hammock is one of the rarest natural communities in Florida. It is also exemplary for its number of rare species. There is a substantial difference between the rockland hammocks north and south of Big Pine Key. This is at least partially due to differences in geology. The surface rock in the north portion from Soldier Key to Big Pine Key is Key Largo limestone while the south portion from Big Pine Key to Key West is Miami oolite.

On the FKWEA, this results in much taller, more developed tree canopies (up to 50 feet tall) in the northern section (on the FKWEA this includes Vaca Key and Key Largo), while the hammocks in the southern section are more scrubby and average less than 20 feet tall. Canopy species on the FKWEA include Jamaican dogwood, gumbo-limbo, poisonwood,



buttonwood, sea grape, blolly, pigeon plum, black ironwood, inkwood, willow busic, Spanish stopper, white stopper, darlingplum, brittle thatch palm, Florida thatch palm, wild dilly, black torch, Florida Keys blackbead, locustberry, rhacoma, and common torchwood. Additionally, false tamarind and West Indian mahogany are present in the hammocks of Key Largo.

Many of the above species also make up the continuous understory and shrub layers. Several species exist mostly as short shrubs or vines: white indigoberry, saffron plum, redgal, and common snowberry.

Many rare plants inhabit rockland hammock such as rhacoma, brittle thatch palm, Florida thatch palm, West Indian mahogany, locustberry, milkbark, red stopper, Florida silver palm, wild cinnamon, and wild dilly. Present threats to the rockland hammocks on FKWEA are trash dumping (including yard waste which can introduce exotic species) and the continuing spread of invasive exotic plants such as Brazilian pepper, lead tree, bowstring hemp, and sapodilla. Especially problematic along road edges are Brazilian pepper and lead tree.

Ruderal

Ruderal areas are anthropogenic, disturbed land usually having a high percentage of weedy species. The most common ruderal sites at FKWEA are artificial ponds from which soil

(limestone) was mined. These “borrow pits” are deep open water pools cut into the limestone with little vegetation in or around them. The surrounding disturbed sites commonly have a high percentage of exposed rock or soil and are colonized with many exotic invasive species such as Brazilian pepper, Australian pine, and lead tree. Ruderal sites on the FKWEA also include trash spoil areas and cleared areas, both of which have these same exotic species. Other ruderal types found on the FKWEA include six acres of canal and less than one acre of road.

Salt Marsh

Salt marsh, also known as saltwater marsh, is a classification used in the Cooperative Land Cover Map to describe estuarine wetland on muck, sand, or limestone substrate that are inundated with saltwater by daily tides. Salt marsh typically contains a dense herb layer with few shrubs. Common species include saltgrass, saltwort, perennial glasswort, bushy seaside oxeye, and tree seaside oxeye.

Though salt marsh occurs throughout the Florida Keys, Cooperative Land Cover data indicates that there is just over one acre of salt marsh on the FKWEA, all of which is located in the Upper Keys. These small patches of salt marsh are generally along the boundaries of parcels within the FKWEA and are primarily surrounded by rockland hammock or mangrove swamp.

Tidal Flat

Tidal flat is a classification used in the Cooperative Land Cover Map to describe a community of quiet waters with substrates composed of silt or sand that is rich in organic matter and poorly drained at low tide. This substrate may often be covered with algae.

Cooperate Land Cover data indicates that just over three acres of tidal flats are located in the Upper Keys parcels of the FKWEA. These areas of tidal flats are located along the boundaries of the FKWEA, usually seaward of other natural communities such as mangrove swamps and unconsolidated substrate.

Unconsolidated Substrate

Marine and estuarine unconsolidated substrate are mineral based natural communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Unconsolidated substrates are unconsolidated material and can include coralgall, marl, mud, mud/sand, sand, or shell. This community can support large populations of infaunal organisms as well as a variety of transient planktonic and pelagic organisms (e.g., tube worms, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs). The unconsolidated substrate at FKWEA is either “mud flats” or sandy bottom shoreline, both having open water and neither containing sessile plants.

2.2.2 Forest Resources

There are no timber resources on the FKWEA, with the exception of tropical hardwoods found throughout the hammocks on the area. As a result, the FWC and the Florida Forest Service (FFS) have determined that a professional timber assessment for the FKWEA is unnecessary. The FWC will cooperate with the FFS or a qualified professional forestry consultant regarding any forestry management activities on the FKWEA if they ever become necessary or appropriate.

Although the FKWEA has a low diversity of forest types, it contains some of the best examples of tropical hardwood hammocks in the Florida Keys. As described above, tropical hardwood hammocks are the only tropical hardwood forests in the continental United States and are among the most imperiled plant communities in the world and are therefore an exceptionally unique feature of the FKWEA.

2.3 Fish and Wildlife Resources

As previously described, the FKWEA contains a variety of unique natural communities that provide critical habitat for a wide array of imperiled and common wildlife species, some of which are found only in the Florida Keys. In addition to the 65 rare plant species noted in Table 5, there are 44 imperiled wildlife species documented as occurring on the FKWEA. Those rare and imperiled wildlife species are listed in Table 14.

The FWC maintains an inventory of fauna occurring on or near the FKWEA listed in the following tables, including mammals (Table 7), birds (Table 8), amphibians and reptiles (Table 9), fish (Table 10), butterflies (Table 11), and mollusks (Table 12). Additionally, Table 13 contains an inventory of the exotic invasive wildlife species that have been documented on or near the FKWEA. All of these species inventories will continue to be maintained and updated by FWC staff.

Table 7. Mammal Species Known to Occur on or near FWKEA

Common Name	Scientific Name
Eastern gray squirrel	<i>Sciurus carolinensis</i>
Key deer	<i>Odocoileus virginianus clavium</i>
Keys cotton rat	<i>Sigmodon hispidus exsputus</i>
Lower Keys marsh rabbit	<i>Sylvilagus palustris hefneri</i>
Opossum*	<i>Didelphis virginiana</i>
Raccoon	<i>Procyon lotor</i>
Silver rice rat	<i>Oryzomys palustris natator</i>
Spotted skunk	<i>Spilogale putorius</i>
Striped skunk	<i>Mephitis mephitis</i>
West Indian manatee	<i>Trichechus manatus</i>

*This species was introduced into the Lower Keys outside its historic range.

Table 8. Bird Species Known to Occur on or near FWKEA

Common Name	Scientific Name
American bittern	<i>Botaurus lentiginosus</i>
American coot	<i>Fulica americana</i>
American crow	<i>Corvus brachyrhynchos</i>
American goldfinch	<i>Spinus tristis</i>
American kestrel	<i>Falco sparverius</i>
American redstart	<i>Setophaga ruticilla</i>
American white pelican	<i>Pelecanus erythrorhynchos</i>
American woodcock	<i>Scolopax minor</i>
Anhinga	<i>Anhinga anhinga</i>
Antillean nighthawk	<i>Chordeiles gundlachii</i>
Bahama mockingbird	<i>Mimus gundlachii</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Belted kingfisher	<i>Megaceryle alcyon</i>
Black skimmer	<i>Rynchops niger</i>
Black vulture	<i>Coragyps atratus</i>
Black-and-white warbler	<i>Mniotilta varia</i>
Black-bellied plover	<i>Pluvialis squatarola</i>
Black-crowned night heron	<i>Nycticorax nycticorax</i>
Black-necked stilt	<i>Himantopus mexicanus</i>
Black-throated blue warbler	<i>Setophaga caerulescens</i>
Black-whiskered vireo	<i>Vireo altiloquus</i>
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>
Blue-winged teal	<i>Anas discors</i>
Bonaparte's gull	<i>Chroicocephalus philadelphia</i>
Broad-winged hawk	<i>Buteo platypterus</i>
Brown pelican	<i>Pelecanus occidentalis</i>
Brown thrasher	<i>Toxostoma rufum</i>
Burrowing owl	<i>Athene cunicularia</i>
Carolina chickadee	<i>Poecile carolinensis</i>
Carolina wren	<i>Thryothorus ludovicianus</i>
Caspian tern	<i>Hydroprogne caspia</i>
Cattle egret	<i>Bubulcus ibis</i>
Chipping sparrow	<i>Spizella passerina</i>
Chuck-will's widow	<i>Antrostomus carolinensis</i>
Clapper rail	<i>Rallus longirostris</i>
Common loon	<i>Gavia immer</i>
Common moorhen	<i>Gallinula chloropus</i>

Table 8. Bird Species Known to Occur on or near FWKEA

Common Name	Scientific Name
Common snipe	<i>Gallinago gallinago</i>
Common tern	<i>Sterna hirundo</i>
Common yellowthroat	<i>Geothlypis trichas</i>
Cooper's hawk	<i>Accipiter cooperii</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Downy woodpecker	<i>Picooides pubescens</i>
Dunlin	<i>Calidris alpina</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>
Eastern towhee	<i>Pipilo erythrophthalmus</i>
Fish crow	<i>Corvus ossifragus</i>
Florida prairie warbler	<i>Setophaga discolor paludicola</i>
Forster's tern	<i>Sterna forsteri</i>
Glossy ibis	<i>Plegadis falcinellus</i>
Gray catbird	<i>Dumetella carolinensis</i>
Gray kingbird	<i>Tyrannus dominicensis</i>
Great blue heron	<i>Ardea herodias</i>
Great egret	<i>Ardea alba</i>
Great white heron	<i>Ardea herodias occidentalis</i>
Great crested flycatcher	<i>Myiarchus crinitus</i>
Greater scaup	<i>Aythya marila</i>
Greater yellowlegs	<i>Tringa melanoleuca</i>
Green heron	<i>Butorides virescens</i>
Gull-billed tern	<i>Gelochelidon nilotica</i>
Herring gull	<i>Larus argentatus</i>
Hooded warbler	<i>Setophaga citrina</i>
Horned grebe	<i>Podiceps auritus</i>
Kentucky warbler	<i>Geothlypis formosa</i>
Killdeer	<i>Charadrius vociferus</i>
Laughing gull	<i>Leucophaeus atricilla</i>
Least bittern	<i>Ixobrychus exilis</i>
Least sandpiper	<i>Calidris minutilla</i>
Least tern	<i>Sternula antillarum</i>
Lesser scaup	<i>Aythya affinis</i>
Lesser yellowlegs	<i>Tringa flavipes</i>
Little blue heron	<i>Egretta caerulea</i>
Long-billed dowitcher	<i>Limnodromus scolopaceus</i>
Mangrove cuckoo	<i>Coccyzus minor</i>

Table 8. Bird Species Known to Occur on or near FWKEA

Common Name	Scientific Name
Marbled godwit	<i>Limosa fedoa</i>
Merlin	<i>Falco columbarius</i>
Mississippi kite	<i>Ictinia mississippiensis</i>
Mourning dove	<i>Zenaida macroura</i>
Northern cardinal	<i>Cardinalis cardinalis</i>
Northern flicker	<i>Colaptes auratus</i>
Northern harrier	<i>Circus cyaneus</i>
Northern mockingbird	<i>Mimus polyglottos</i>
Osprey	<i>Pandion haliaetus</i>
Palm warbler	<i>Setophaga palmarum</i>
Peregrine falcon	<i>Falco peregrinus</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>
Pine warbler	<i>Setophaga pinus</i>
Piping plover	<i>Charadrius melodus</i>
Prothonotary warbler	<i>Protonotaria citrea</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Red-bellied woodpecker	<i>Melanerpes carolinus</i>
Red-breasted merganser	<i>Mergus serrator</i>
Reddish egret	<i>Egretta rufescens</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Ring-billed gull	<i>Larus delawarensis</i>
Roseate spoonbill	<i>Platalea ajaja</i>
Roseate tern	<i>Sterna dougallii</i>
Royal tern	<i>Thalasseus maximus</i>
Ruddy turnstone	<i>Arenaria interpres</i>
Saltmarsh sparrow	<i>Ammodramus caudacutus</i>
Sandwich tern	<i>Thalasseus sandvicensis</i>
Savannah sparrow	<i>Passerculus sandwichensis</i>
Scarlet tanager	<i>Piranga olivacea</i>
Semipalmated plover	<i>Charadrius semipalmatus</i>
Semipalmated sandpiper	<i>Calidris pusilla</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Short-billed dowitcher	<i>Limnodromus griseus</i>
Snowy egret	<i>Egretta thula</i>
Song sparrow	<i>Melospiza melodia</i>
Summer tanager	<i>Piranga rubra</i>

Table 8. Bird Species Known to Occur on or near FWKEA

Common Name	Scientific Name
Swallow-tailed kite	<i>Elanoides forficatus</i>
Swamp sparrow	<i>Melospiza georgiana</i>
Tricolored heron	<i>Egretta tricolor</i>
Turkey vulture	<i>Cathartes aura</i>
Western sandpiper	<i>Calidris mauri</i>
White ibis	<i>Eudocimus albus</i>
White-crowned pigeon	<i>Patagioenas leucocephala</i>
Willet	<i>Tringa semipalmata</i>
Wilson's plover	<i>Charadrius wilsonia</i>
Wood stork	<i>Mycteria americana</i>
Worm-eating warbler	<i>Helmitheros vermivorum</i>
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>
Yellow-crowned night heron	<i>Nyctanassa violacea</i>
Yellow-rumped warbler	<i>Setophaga coronata</i>
Yellow-throated warbler	<i>Setophaga dominica</i>

Table 9. Reptile and Amphibian Species Known to Occur on or near FKWEA

Common Name	Scientific Name
American alligator	<i>Alligator mississippiensis</i>
American crocodile	<i>Crocodylus acutus</i>
Eastern corn snake	<i>Pantherophis guttatus</i>
Eastern diamondback rattlesnake	<i>Crotalus adamanteus</i>
Eastern glass lizard	<i>Ophisaurus ventralis</i>
Eastern indigo snake	<i>Drymarchon corais couperi</i>
Eastern spadefoot toad	<i>Scaphiopus holbrookii</i>
Florida box turtle	<i>Terrapene carolina bauri</i>
Florida brown snake	<i>Storeria victa</i>
Florida cooter	<i>Pseudemys concinna floridana</i>
Florida cottonmouth	<i>Agkistrodon piscivorus conanti</i>
Florida Keys mole skink	<i>Plestiodon egregius egregius</i>
Green anole	<i>Anolis carolinensis</i>
Green sea turtle	<i>Chelonia mydas</i>
Green treefrog	<i>Hyla cinerea</i>
Ground skink	<i>Scincella lateralis</i>
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>
Key ringneck snake	<i>Diadophis punctatus acricus</i>

Table 9. Reptile and Amphibian Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Loggerhead sea turtle	<i>Caretta caretta</i>
Mangrove diamondback terrapin	<i>Malaclemys terrapin rhizophorarum</i>
Mangrove salt marsh snake	<i>Nerodia clarkii compressicauda</i>
Narrow-mouthed toad	<i>Gastrophryne carolinensis</i>
Oak toad	<i>Anaxyrus quercicus</i>
Peninsula ribbon snake	<i>Thamnophis sauritus sackenii</i>
Red rat snake	<i>Elaphe guttata</i>
Reef gecko	<i>Sphaerodactylus notatus</i>
Rim rock crowned snake	<i>Tantilla oolitica</i>
Rough green snake	<i>Opheodrys aestivus</i>
Six-lined racerunner	<i>Aspidoscelis sexlineata</i>
Southeastern five-lined skink	<i>Plestiodon inexpectatus</i>
Southern black racer	<i>Coluber constrictor priapus</i>
Southern cricket frog	<i>Acris gryllus</i>
Southern leopard frog	<i>Lithobates spenocephalus</i>
Southern toad	<i>Anaxyrus terrestris</i>
Squirrel treefrog	<i>Hyla squirella</i>
Striped mud turtle	<i>Kinosternon baurii</i>

Table 10. Fish Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Barracuda	<i>Sphyraena barracuda</i>
Bigeye jacks	<i>Caranx spp.</i>
Bonfish	<i>Albula vulpes</i>
Bonnethead	<i>Sphyrna tiburo</i>
Cobia	<i>Rachycentron canadum</i>
Common anchovies	<i>Anchoa spp.</i>
Common snappers	<i>Lutjanus spp.</i>
Florida pompano	<i>Trachinotus carolinus</i>
Grunts	<i>Haemulon spp.</i>
Key silverside	<i>Menidia conchorum</i>
Ladyfish	<i>Elops saurus</i>
Mangrove gambusia	<i>Gambusia rhizophorae</i>
Naked gobies	<i>Gobiosoma spp.</i>
Permit	<i>Trachinotus falcatus</i>
Pinfish	<i>Lagodon rhomboides</i>
Red drum	<i>Sciaenops ocellatus</i>

Table 10. Fish Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Rivulus	<i>Rivulus marmoratus</i>
Sailfin molly	<i>Poecilia latipinna</i>
Sea catfish	<i>Arius felis</i>
Sheepshead	<i>Archosargus probatocephalus</i>
Sheepshead minnow	<i>Cyprinodon variegatus</i>
Silverstripe halfbeak	<i>Hyporhamphus unfasciatus</i>
Smalltooth sawfish	<i>Pristis pectinate</i>
Southern flounders	<i>Paralichthys spp.</i>
Southern stingray	<i>Dasyatis americana</i>
Spotted sea trout	<i>Cynoscion nebulosus</i>
Striped mullet	<i>Mugil cephalus</i>
Tarpon	<i>Megalops atlanticus</i>
Topminnows	<i>Fundulus spp.</i>
Western Atlantic seabream	<i>Archosargus rhomboidalis</i>

Table 11. Butterfly Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Aaron's skipper	<i>Poanes aaroni</i>
American lady	<i>Vanessa virginiensis</i>
American snout	<i>Libytheana carinenta</i>
Amethyst hairstreak	<i>Chlorostrymon maesites</i>
Antillean daggerwing	<i>Marpesia eleucea</i>
Atala	<i>Eumaeus atala</i>
Bahaman swallowtail	<i>Papilio andraemon</i>
Banded orange heliconian	<i>Dryadula phaetusa</i>
Baracoa skipper	<i>Polites baracoa</i>
Barred yellow	<i>Eurema दौरa</i>
Bartram's scrub hairstreak	<i>Strymon acis bartrami</i>
Berry's skipper	<i>Euphyes berryi</i>
Black swallowtail	<i>Papilio polyxenes</i>
Boisduval's yellow	<i>Eurema boisduvaliana</i>
Brazilian skipper	<i>Calpodēs ethlius</i>
Byssus skipper	<i>Problema byssus</i>
Cabbage white	<i>Pieris rapae</i>
Caribbean peacock	<i>Anartia chrysopelea</i>
Carolina satyr	<i>Hermeuptychia sosybius</i>
Cassius blue	<i>Leptotes cassius theonus</i>
Ceraunus blue	<i>Hemiargus ceraunus antibubastus</i>

Table 11. Butterfly Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Checkered white	<i>Pontia protodice</i>
Clouded skipper	<i>Lerema accius</i>
Cloudless sulphur	<i>Phoebis sennae</i>
Common buckeye	<i>Junonia coenia</i>
Common checkered-skipper	<i>Pyrgus communis</i>
Cramer's eighty-eight	<i>Diaethria clymena</i>
Cuban crescent	<i>Anthanassa frisia</i>
Dainty sulphur	<i>Nathalis iole</i>
Delaware skipper	<i>Anatrytone logan</i>
Dina yellow	<i>Pyrisitia dina</i>
Dingy purplewing	<i>Eunica monima</i>
Disguised scrub-hairstreak	<i>Strymon limenia</i>
Dorantes longtail	<i>Urbanus dorantes</i>
Eastern pygmy-blue	<i>Brephidium pseudofea</i>
Eastern tiger swallowtail	<i>Papilio glaucus</i>
Eufala skipper	<i>Lerodea eufala</i>
Fiery skipper	<i>Hylephila phyleus</i>
Florida duskywing	<i>Ephyriades brunnea</i>
Florida leafwing	<i>Anaea troglodyta floridalis</i>
Florida purplewing	<i>Eunica tatila</i>
Florida white	<i>Appias drusilla</i>
Fulvous hairstreak	<i>Electrostrymon angelia</i>
Funereal duskywing	<i>Erynnis funeralis</i>
Georgia satyr	<i>Neonympha areolatus</i>
Giant swallowtail	<i>Papilio cressphontes</i>
Grass skippers	<i>Hesperiinae</i>
Gray hairstreak	<i>Strymon melinus</i>
Gray ministreak	<i>Ministrymon azia</i>
Great southern white	<i>Ascia monuste</i>
Gulf fritillary	<i>Agraulis vanillae</i>
Hammock skipper	<i>Polygonus leo</i>
Hayhurst's scallopwing	<i>Staphylus hayhurstii</i>
Julia heliconian	<i>Dryas iulia</i>
Large orange sulphur	<i>Phoebis agarithe</i>
Little metalmark	<i>Calephelis virginensis</i>
Little yellow	<i>Pyrisitia lisa</i>
Long-tailed skipper	<i>Urbanus proteus</i>
Lyside sulphur	<i>Kricogonia lyside</i>
Malachite	<i>Siproeta stelenes</i>

Table 11. Butterfly Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Mallow scrub-hairstreak	<i>Strymon istapa</i>
Mangrove buckeye	<i>Junonia evarete</i>
Mangrove skipper	<i>Phocides pigmalion</i>
Manuel's skipper	<i>Polygonus savigny</i>
Many-banded daggerwing	<i>Marpesia chiron</i>
Martial scrub-hairstreak	<i>Strymon martialis</i>
Meske's skipper	<i>Hesperia meskei</i>
Miami blue	<i>Cyclargus thomasi</i>
Mimic	<i>Hypolimnas misippus</i>
Mimosa yellow	<i>Pyrisitia nise</i>
Monarch	<i>Danaus plexippus</i>
Monk	<i>Asbolis capucinus</i>
Neamathla skipper	<i>Nastra neamathla</i>
Nickerbean blue	<i>Cyclargus ammon</i>
Obscure skipper	<i>Panoquina panoquinoides</i>
Ocola skipper	<i>Panoquina ocola</i>
Orange sulphur	<i>Colias eurytheme</i>
Orange-barred sulphur	<i>Phoebis philea</i>
Orbed sulphur	<i>Aphrissa orbis</i>
Painted lady	<i>Vanessa cardui</i>
Palamedes swallowtail	<i>Papilio palamedes</i>
Palatka skipper	<i>Euphyes pilatka</i>
Pale cracker	<i>Hamadryas amphichloe</i>
Palmetto skipper	<i>Euphyes arpa</i>
Pearl crescent	<i>Phyciodes tharos</i>
Phaon crescent	<i>Phyciodes phaon</i>
Pipevine swallowtail	<i>Battus philenor</i>
Polydamas swallowtail	<i>Battus polydamas</i>
Queen	<i>Danaus gilippus</i>
Red admiral	<i>Vanessa atalanta</i>
Red-banded hairstreak	<i>Calycopis cecrops</i>
Ruddy daggerwing	<i>Marpesia petreus</i>
Ruddy hairstreak	<i>Electrostrymon sangala</i>
Sachem	<i>Atalopedes campestris</i>
Salt marsh skipper	<i>Panoquina panoquin</i>
Schaus' swallowtail	<i>Heraclides aristodemus ponceanus</i>
Silver-banded hairstreak	<i>Chlorostrymon simaethis</i>
Silver-spotted skipper	<i>Epargyreus clarus</i>
Sleepy orange	<i>Abaeis nicippe</i>

Table 11. Butterfly Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Soldier	<i>Danaus eresimus</i>
Southern broken-dash	<i>Wallengrenia otho</i>
Southern dogface	<i>Zerene cesonia</i>
Southern hairstreak	<i>Satyrium favonius</i>
Southern skipperling	<i>Copaeodes minima</i>
Spicebush swallowtail	<i>Papilio troilus</i>
Statira sulphur	<i>Aphrissa statira</i>
Swarthy skipper	<i>Nastra lherminier</i>
Tawny emperor	<i>Asterocampa clyton</i>
Tawny-edged skipper	<i>Polites themistocles</i>
Three-spotted skipper	<i>Cymaenes tripunctus</i>
Tropical buckeye	<i>Junonia genoveva</i>
Tropical checkered-skipper	<i>Pyrgus oileus</i>
Twin-spot skipper	<i>Oligoria maculata</i>
Variiegated fritillary	<i>Euptoieta claudia</i>
Viceroy	<i>Limenitis archippus</i>
Violet-banded skipper	<i>Nyctelius nyctelius</i>
Whirlabout	<i>Polites vibex</i>
White peacock	<i>Anartia jatrophae</i>
Yellow angled-sulphur	<i>Anteos maerula</i>
Zarucco duskywing	<i>Erynnis zarucco</i>
Zebra heliconian	<i>Heliconius charithonia</i>
Zebra swallowtail	<i>Eurytides marcellus</i>
Zestos skipper	<i>Epargyreus zestos</i>

Table 12. Mollusks Species Known to Occur on or near FKWEA

Common Name	Scientific Name
Banded tree snail	<i>Orthalicus floridensis</i>
Florida Keys tree snail	<i>Orthalicus reses nesodryas</i>
Florida tree snail	<i>Liguus fasciatus</i>
Lined tree snail	<i>Drymaeus multilineatus</i>
Master tree snail	<i>Drymaeus dominicus</i>
Stock Island tree snail	<i>Orthalicus reses [not incl. nesodryas]</i>

Table 13. Exotic Species Known to Occur on or Near FKWEA

Common Name	Scientific Name
Argentine tegu	<i>Tupinambis merianae</i>
Australian bluetongue lizard	<i>Tiliqua scincoides</i>
Black spiny-tailed iguana	<i>Ctenosaura similis</i>
Brown anole	<i>Anolis sagrei</i>
Burmese python	<i>Python molurus</i>
Common house gecko	<i>Hemidactylus frenatus</i>
Cuban green anole	<i>Anolis porcatius</i>
Cuban treefrog	<i>Osteopilus septentrionalis</i>
Eurasian collared-dove	<i>Streptopelia decaocto</i>
Gambian pouched rat	<i>Cricetomys gambianus</i>
Giant day gecko	<i>Phelsuma madagascariensis grandis</i>
Green iguana	<i>Iguana iguana</i>
Lionfish	<i>Pterois volitans</i>
Pallas's mastiff bat	<i>Molossus molossus</i>
Red imported fire ant	<i>Solenopsis invicta</i>
Tokay gecko	<i>Gekko gekko</i>
Tropical house gecko	<i>Hemidactylus mabouia</i>

2.3.1 Integrated Wildlife Habitat Ranking System

The FWC has developed the Integrated Wildlife Habitat Ranking System (IWHRS) as a Geographic Information Systems (GIS)-based assessment tool that incorporates a wide variety of land cover and wildlife species data. The IWHRS evaluates the Florida landscape based upon the habitat needs of wildlife as a way to identify ecologically significant lands in the state, and to assess the potential impacts of management and land-use changes. The IWHRS was developed to provide technical assistance to various local, regional, state, and federal agencies, and entities interested in wildlife needs and conservation in order to: (1) determine ways to avoid or minimize project impacts by evaluating alternative placements, alignments, and transportation corridors during early planning stages, (2) assess direct, secondary, and cumulative impacts to habitat and wildlife resources, and (3) identify appropriate parcels for public land conservation for wetland and upland habitat mitigation purposes. The IWHRS (2009) indicates that the FKWEA has a very high mean wildlife value of 6.3 (Figures 20-22).



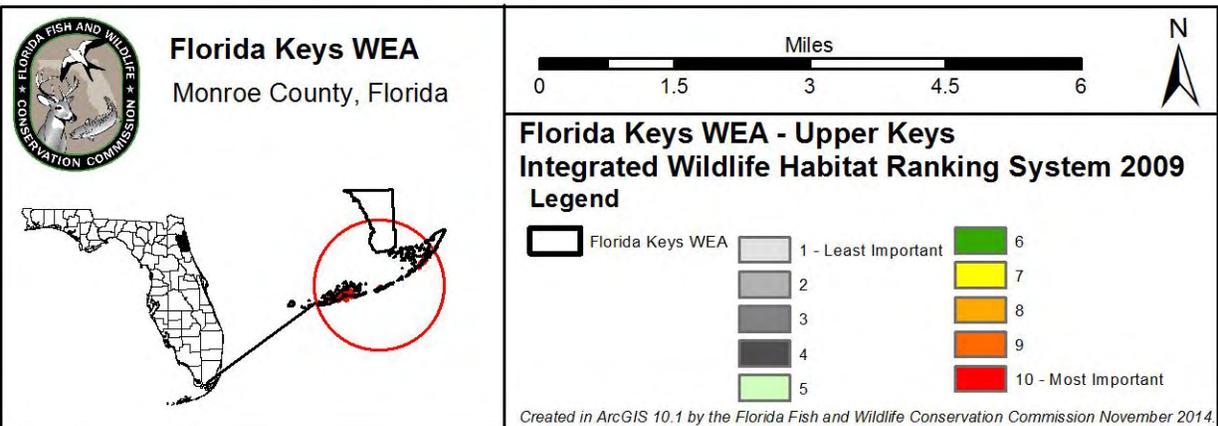
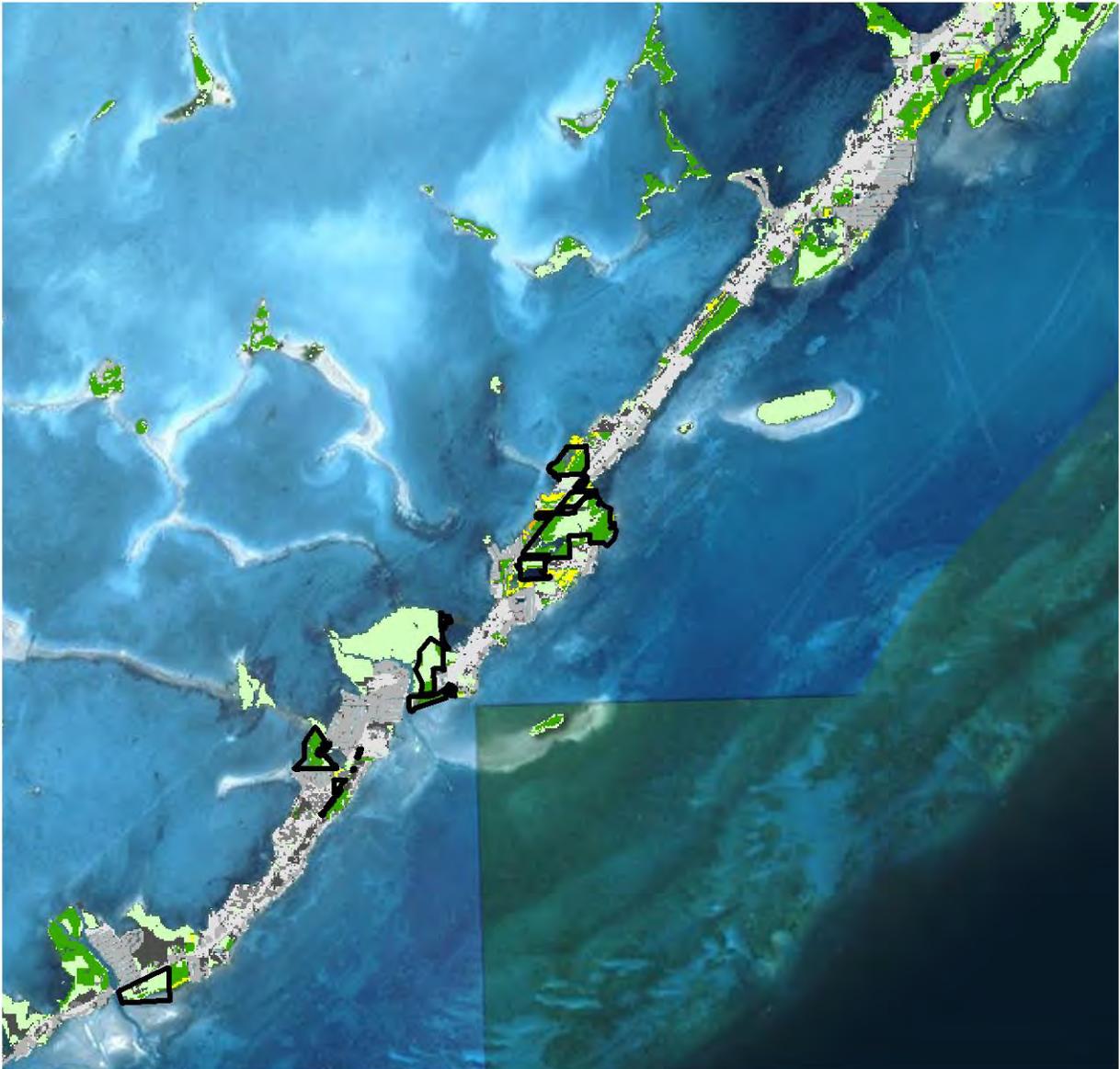


Figure 20. FWC IWHRs 2009 – FKWEA Upper Keys

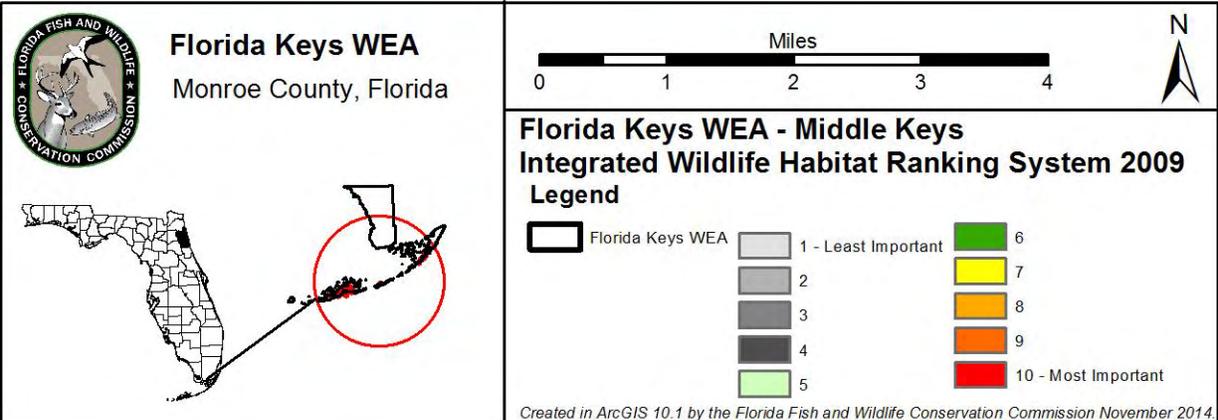


Figure 21. FWC IWHS 2009 – FKWEA Middle Keys

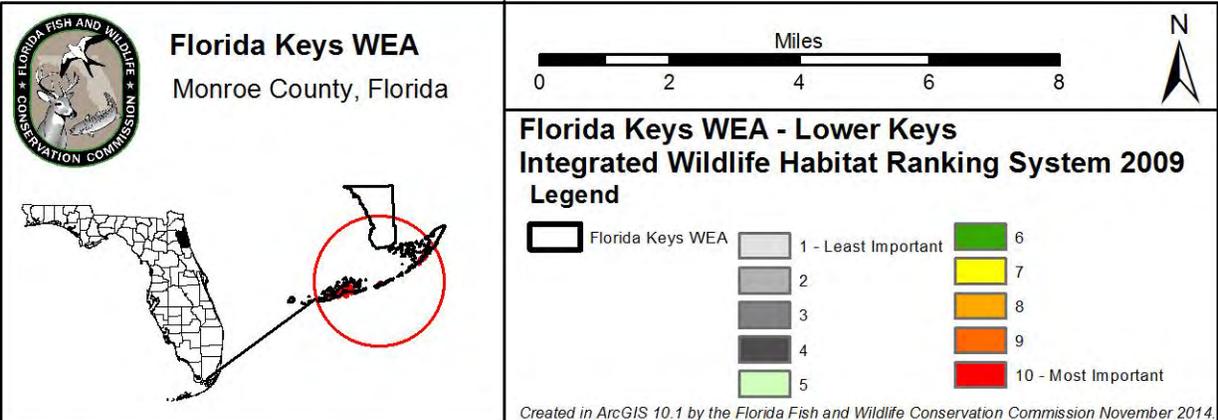
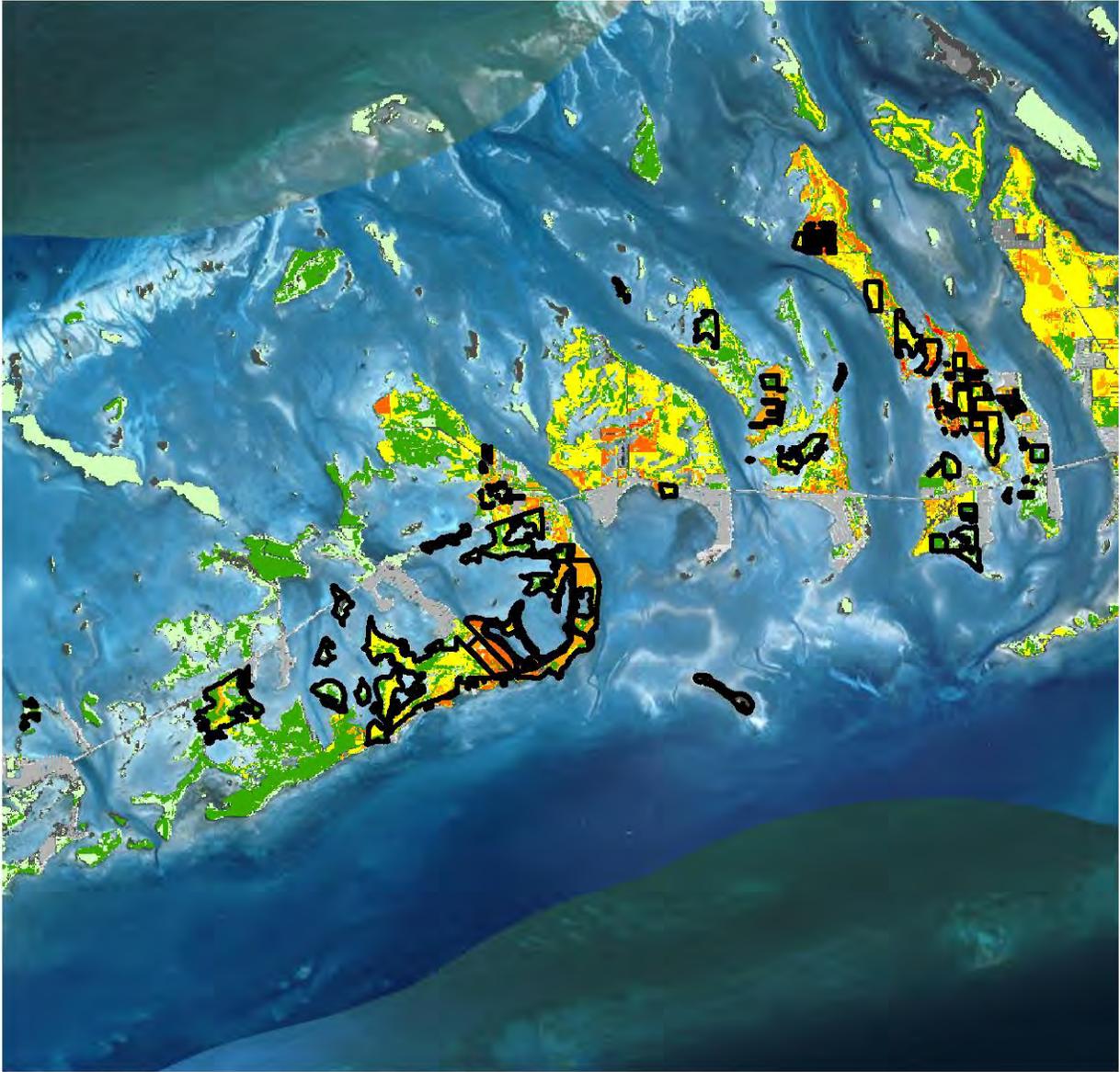


Figure 22. FWC IWHS 2009 – FKWEA Lower Keys

2.3.2 Imperiled Species

For the purposes of this Management Plan, the term “Imperiled Species” refers to plant and animal species that are designated as Endangered, Threatened, or Species of Special Concern by the FWC, or that are designated as Endangered or Threatened by the U.S. Fish and Wildlife Service. Such species are also commonly known as “listed species.” An inventory of the imperiled species documented on the FKWEA can be found in Table 14, below.



On November 8, 2010, new threatened species rules approved by the FWC were implemented. All federally listed species that occur in Florida will now be included on Florida’s list as federally-designated Endangered or federally-designated Threatened species. In addition, the state has implemented a listing process to identify species that are not federally listed, but that may be at risk of extinction. These species will be called state-designated Threatened. All previous state-designated imperiled species were grandfathered on the list and are currently undergoing status reviews. The FWC will continue to maintain a separate Species of Special Concern category until all the former imperiled species have been reviewed and those species are either determined to be state-designated Threatened or removed from the list.

Table 14. Rare and Imperiled Species Occurring on or near FKWEA

Common Name	Scientific Name	Status
Mammals		
Key deer	<i>Odocoileus virginianus clavium</i>	FE
Lower Keys marsh rabbit	<i>Sylvilagus palustris hefneri</i>	FE
Silver rice rat	<i>Oryzomys palustris natator</i>	FE
West Indian manatee	<i>Trichechus manatus</i>	FE
Reptiles		
American alligator	<i>Alligator mississippiensis</i>	FT (S/A)
American crocodile	<i>Crocodylus acutus</i>	FT
Eastern indigo snake	<i>Drymarchon corais couperi</i>	FT

Table 14. Rare and Imperiled Species Occurring on or near FKWEA

Common Name	Scientific Name	Status
Florida brown snake, Lower Keys pop.	<i>Storeria victa</i>	ST
Florida Keys mole skink	<i>Plestiodon egregius egregius</i>	SCC
Green sea turtle	<i>Chelonia mydas</i>	FE
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	FE
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	FE
Key ringneck snake	<i>Diadophis punctatus acricus</i>	ST
Loggerhead sea turtle	<i>Caretta caretta</i>	FT
Peninsula ribbon snake, Lower Keys pop.	<i>Thamnophis sauritus sackenii</i>	ST
Red rat snake, Lower Keys pop.	<i>Pantherophis guttatus</i>	SSC
Rim rock crowned snake	<i>Tantilla oolitica</i>	ST
Striped mud turtle, Lower Keys pop.	<i>Kinosternon baurii</i>	ST
Birds		
Black skimmer	<i>Rynchops niger</i>	SSC
Brown pelican	<i>Pelecanus occidentalis</i>	SSC
Burrowing owl	<i>Athene cunicularia</i>	SSC
Least tern	<i>Sterna antillarum</i>	ST
Little blue heron	<i>Egretta caerulea</i>	SSC
Osprey	<i>Pandion haliaetus</i>	SSC
Piping plover	<i>Charadrius melodus</i>	FT
Reddish egret	<i>Egretta rufescens</i>	SSC
Roseate spoonbill	<i>Platalea ajaja</i>	SSC
Roseate tern	<i>Sterna dougallii</i>	FT
Snowy egret	<i>Egretta thula</i>	SSC
Southeastern American kestrel	<i>Falco sparverius paulus</i>	ST
Tricolored heron	<i>Egretta tricolor</i>	SSC
White ibis	<i>Eudocimus albus</i>	SSC
White-crowned pigeon	<i>Patagioenas leucocephala</i>	ST
Wood stork	<i>Mycteria americana</i>	FE
Fish		
Key silverside	<i>Menidia conchorum</i>	ST
Rivulus	<i>Rivulus marmoratus</i>	SSC
Smalltooth sawfish	<i>Pristis pectinata</i>	FE
Butterflies		
Bartram's scrub hairstreak	<i>Strymon acis bartrami</i>	FE
Cassius blue butterfly	<i>Leptotes cassius theonus</i>	FT (S/A)

Table 14. Rare and Imperiled Species Occurring on or near FKWEA

Common Name	Scientific Name	Status
Ceraunus blue butterfly	<i>Hemiargus ceraunus antibubastus</i>	FT (S/A)
Florida leafwing	<i>Anaea troglodyta floridalis</i>	FE
Miami blue butterfly	<i>Cyclargus thomasi bethunebakeri</i>	FE
Nickerbean blue butterfly	<i>Cyclargus ammon</i>	FT (S/A)
Schaus' swallowtail butterfly	<i>Heraclides aristodemus ponceanus</i>	FE
Mollusks		
Florida tree snail	<i>Liguus fasciatus</i>	SSC
Stock Island tree snail	<i>Orthalicus reses [not incl. nesodryas]</i>	FT
Corals*		
Boulder star coral	<i>Orbicella franksi</i>	FT
Elkhorn coral	<i>Acropora palmata</i>	FT
Lobed star coral	<i>Orbicella annularis</i>	FT
Mountainous star coral	<i>Orbicella faveolata</i>	FT
Pillar coral	<i>Dendrogyra cylindricus</i>	FT
Rough cactus coral	<i>Mycetophyllia ferox</i>	FT
Staghorn coral	<i>Acropora cervicornis</i>	FT

*The species of coral listed in this table typically lie below the mean high water line and are therefore often found outside the boundary of the FKWEA.

2.3.3 FWC Wildlife Observations and FNAI Element Occurrences

A diversity of wildlife species is found on the FKWEA. The FNAI element occurrence records for the FKWEA include 59 species, of which 51 are imperiled, as well as a notable



bird rookery and numerous exemplary areas of the rare rockland hammock natural community. As defined by the FNAI, an “element” is any exemplary or rare component of the natural environment, such as a species, natural community, bird colony, spring, sinkhole, cave, or other ecological feature. An element occurrence is a single extant habitat which sustains or otherwise contributes to the survival of a population or a distinct, self-sustaining example of a particular element. The FNAI assigns a

rank to each “element” occurrence. This ranking system was developed by The Nature Conservancy (TNC) and the Natural Heritage Program Network based on the element’s global rank (element’s worldwide status) or state rank (status of element in Florida). The FNAI ranking system and definitions are located on the following website: www.fnai.org/ranks.cfm.



Known locations of FWC wildlife occurrences and FNAI element occurrences from the most recent GIS databases of the respective agencies are displayed in Figures 23-26. Appendix 13.6 contains a letter from the FNAI authorizing the FWC to utilize their database for the purpose of displaying known plant and animal resources.

2.3.4 United States Fish and Wildlife Service Critical Habitat

Portions of the FKWEA, and many of the waters surrounding the area, are designated as critical habitat by the United States Fish and Wildlife Service (USFWS). Approximately



713 acres of the FKWEA are designated critical habitat for the federally threatened American crocodile and approximately 1,168 acres are designated critical habitat the federally endangered silver rice rat. Additionally, the waters adjacent to portions of the FKWEA are designated as critical habitat for elkhorn coral and staghorn coral. Figure 27 displays the USFWS critical habitat areas for these four species in relation to the FKWEA.

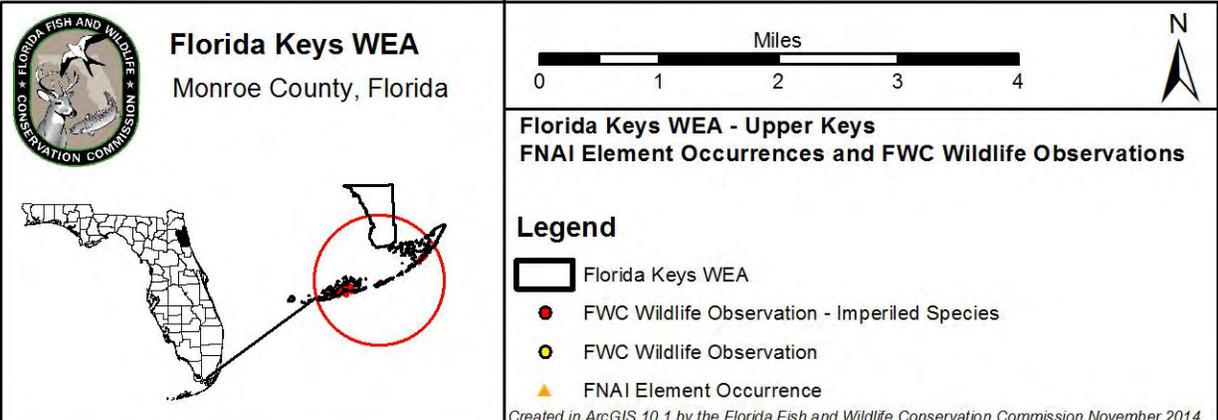


Figure 23. FWC Wildlife Observations & FNAI Element Occurrences—Upper Keys

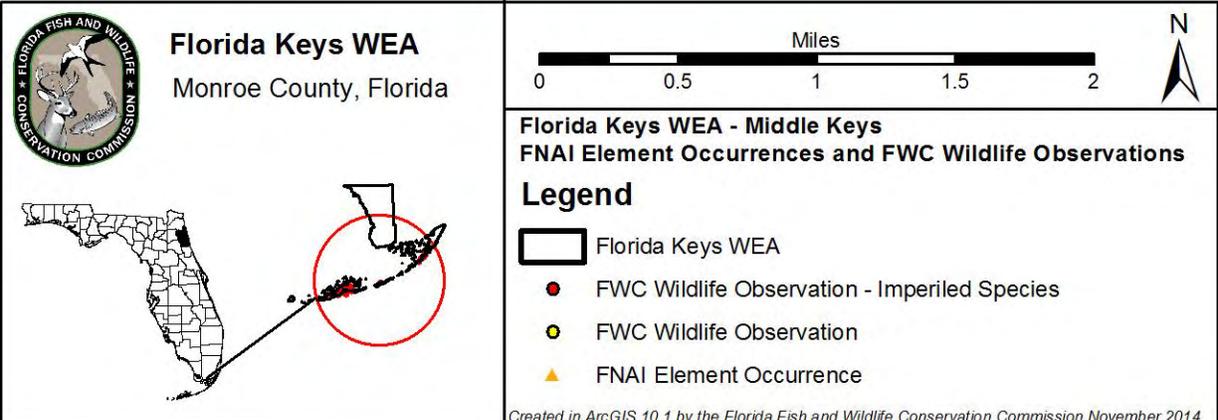


Figure 24. FWC Wildlife Observations & FNAI Element Occurrences–Middle Keys

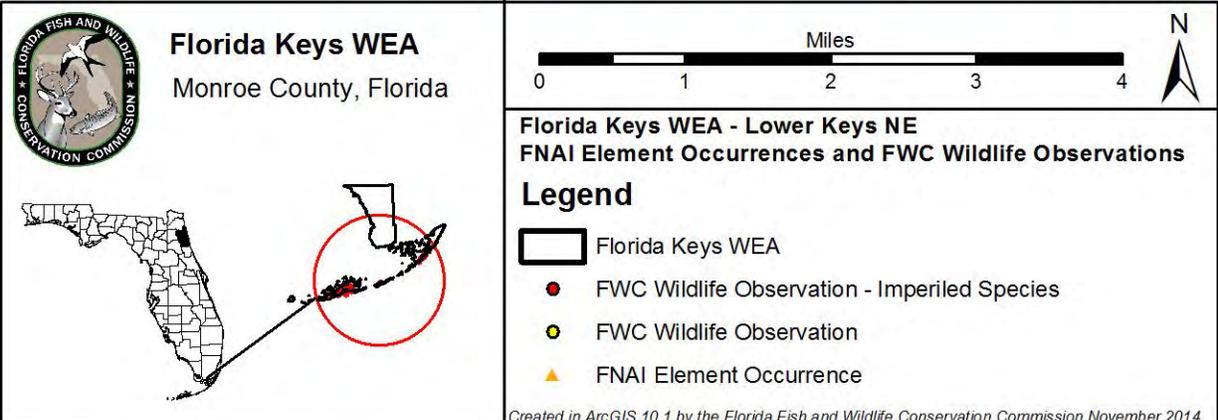


Figure 25. FWC Wildlife Observations & FNAI Element Occurrences—Lower Keys NE

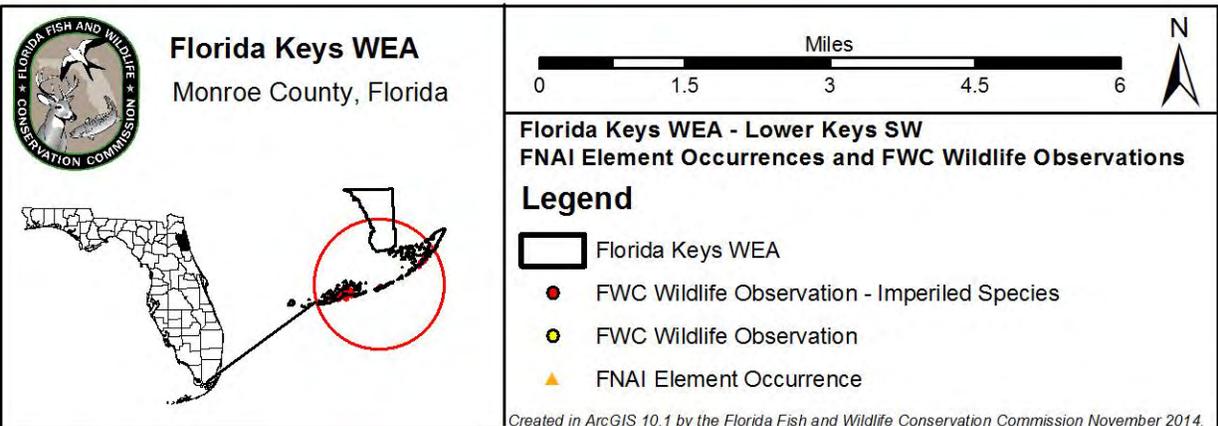
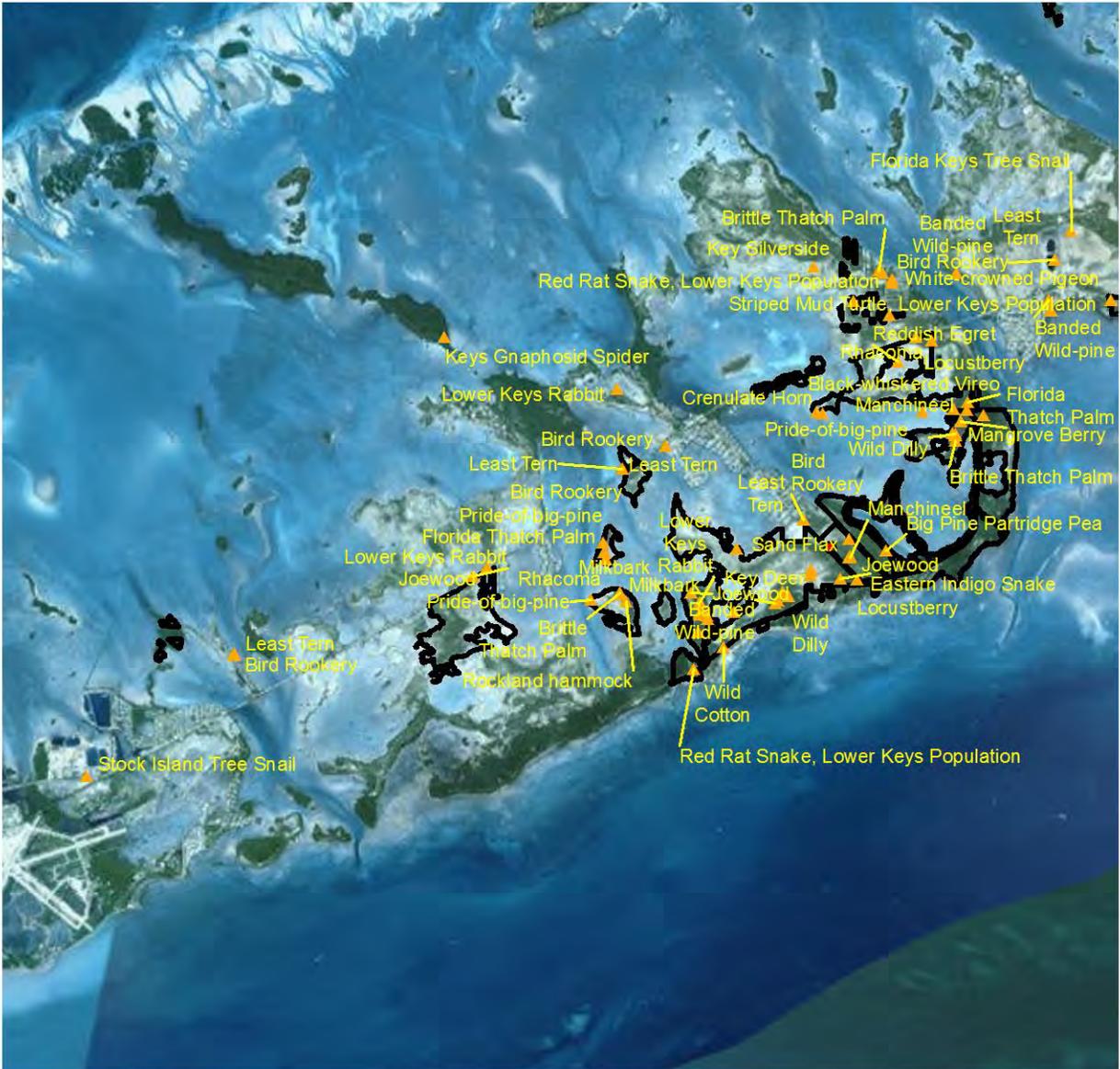


Figure 26. FWC Wildlife Observations & FNAI Element Occurrences—Lower Keys SW

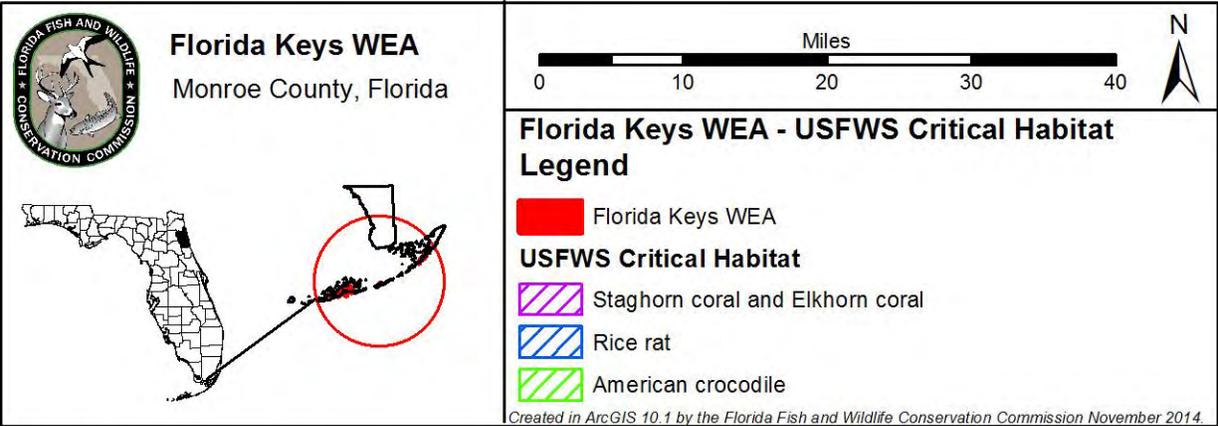
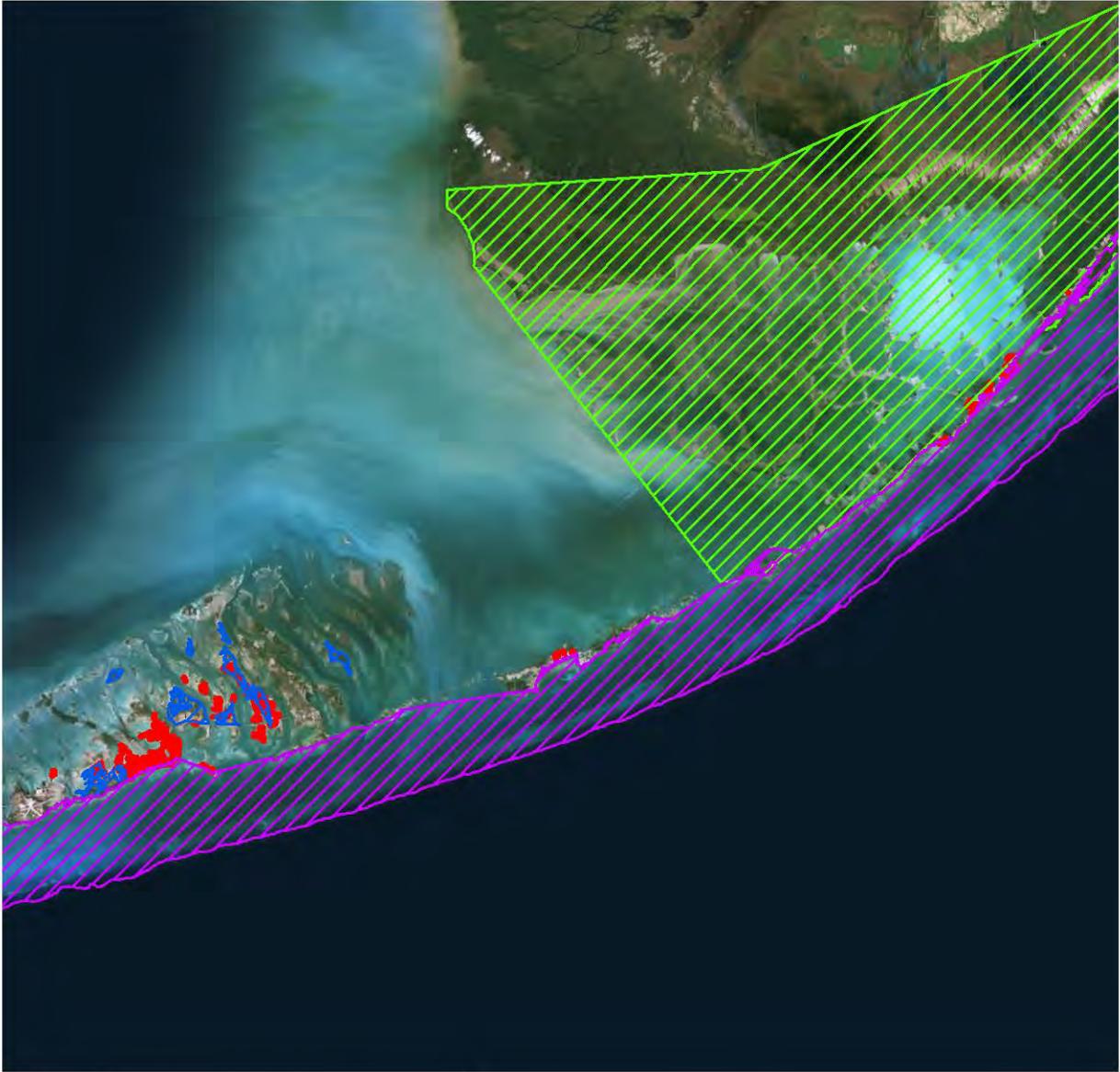


Figure 27. FKWEA – USFWS Critical Habitat

2.4 Native Landscapes

The predominant native landscapes on the FKWEA include mangrove swamps, rockland hammocks and the tropical hardwood hammocks they contain, and coastal rock barren. Additionally, much of the FKWEA borders and provides stunning views of the Atlantic Ocean and the Florida Bay. Complete descriptions of the natural communities present on the FKWEA can be found in Section 2.2.1 of this Management Plan.



2.5 Water Resources

In the Florida Keys, freshwater resources are found only in the Lower Keys. Non-tidal wetlands occur as sloughs, marshes, and small ponds. The small ponds and marshes are scattered amidst the hammocks where depressions in the caprock occur. These isolated wetlands are typically dominated by cattails, although the pond on Summerland Key has a few acres of open water. Water levels in the freshwater wetlands vary both seasonally and annually in response to variations in rainfall. Water-filled solution holes provide another, albeit minimal, source of freshwater. In most years, there is no standing surface water at the end of the dry season, except in small isolated depressions.



Brackish conditions can occur in these areas as residual salts become concentrated in the remaining water. Although freshwater wetlands proportionally constitute only a small percentage of the area, all freshwater resources in the Lower Keys are important. The entire freshwater system is sustained solely by rainfall and local recharge. Rainfall in the Keys accumulates in the shallow ground water table as lenses of freshwater. Some of the lenses are large enough to be tapped by wells,

although the water pumped from the lenses usually exceeds the chloride standard for potability. The Floridan Aquifer under the Keys is highly mineralized and is not a source of potable water. Due to size, shallow depth, and rainfall-dependent recharge, the freshwater lenses are highly vulnerable to reduction or depletion, in addition to being endangered by contamination by saltwater intrusion and pollution from on-site sewage disposal and urban land use.

Tidal wetlands occur in areas of the FKWEA that exhibit vegetation typical of all tidally-influenced lands in the Keys. Ditches constructed for mosquito control connect some of the tidal wetlands to freshwater wetlands, resulting in higher salinity levels and more brackish conditions in the freshwater wetlands. Wetlands within the FKWEA are in good to fair condition, although impacts from road and canal construction, and from mosquito control ditching, have caused local disruptions of hydrology by diminishing the retention time of surface waters. Ditches and canals tend to accelerate run-off and drainage and increase saltwater intrusion, thus reducing freshwater supplies on the islands.

All surface waters of the State are classified by the DEP according to designated uses as described in Chapter 62-302.44 FAC. All waters that are within or traverse the FKWEA are classified as Class III waters by the DEP and classified for fish consumption and recreation, as well as propagation and maintenance of a healthy, well-balanced population of fish and wildlife. Additionally, it is the policy of the DEP to afford the highest protection to OFW and Outstanding National Resource Waters (Chapter 62-302.700 FAC). All marine waters of Monroe County are designated OFW and are part of the Florida Keys National Marine Sanctuary. No degradation of water quality, other than that allowed in subsections Chapter 62-4.242(2) and (3) FAC, is permitted in these OFW, notwithstanding any other DEP rules that may allow water quality lowering. The FKWEA contains no natural bodies of freshwater which would be considered waters of the State. The area does not contain a first magnitude spring or any type of lake.

2.6 Beaches and Dunes

Though traditional sandy beaches and dunes are largely absent on the area, there are many parcels of the FKWEA that contain shoreline and are adjacent to the Atlantic Ocean and Florida Bay. Most of the shoreline natural communities on the FKWEA are unconsolidated substrate, mangrove swamp, coastal rock barren, or coastal berm. Shorelines throughout the FKWEA are generally either rocky or occupied by mangroves.



2.7 Mineral Resources

Limestone formations underlie the entirety of the Florida Keys. The Upper and Middle Keys contain exposed Key Largo Limestone and the Lower Keys contain significant exposures of Miami Limestone. Generally, mineral resources sufficient to be considered economically feasible for development or mining are not present in the Keys.

Although limerock mining was prevalent in the Keys during the early history of its development, there are no commercial limerock operations in existence today since most of the limerock used in constructing roads and buildings comes from the mainland of Florida. However, vestiges of these former lime rock mining sites or “borrow pits” are scattered throughout the Keys. One such site exists on the area at the Sandy Sprunt Dove Creek Hammocks unit of the FKWEA where an old quarry is now filled with water.

2.8 Historical Resources

There are a total of 14 sites recorded in the Florida Department of State’s Division of Historical Resources (DHR) Master Site File within the boundary of the FKWEA. The DHR observations and recorded site files are divided into five categories: archaeological sites, resource groups, historic structures, historic bridges, and historic cemeteries. There are 11 archaeological sites and three resource groups presently recorded by the DHR on the FKWEA. Fourteen field surveys have been conducted to document cultural resources on areas encompassing portions of the FKWEA.

The 11 archaeological sites on the FKWEA include three homesteads (MO01277, MO02108, & MO02100), one cistern (MO02063), two areas of low density artifact scatter (MO00009 & MO01337), two prehistoric mounds (MO00020, & MO00021), one prehistoric midden (MO00024), and two historic dumps (MO02111 & MO01962). The three resource groups include Old State Road 4A (MO03433), Overseas Highway and railway bridges (MO01131), and Tavernier Historic District Survey (MO01895). Further, some tracts within the FKWEA, particularly those that contain rockland and tropical hardwood hammocks, may contain additional archaeological and historical sites that have yet to be recorded. The FWC will coordinate with the DHR if any additional sites are discovered on the FKWEA. All Master Site recordings, assessments, and preservation strategies will be coordinated with the DHR.

2.9 Scenic Resources

The FKWEA offers remarkable vistas of the pristine waters that surround the Florida Keys, including the Atlantic Ocean and the Florida Bay. The area also provides scenic views of the unique natural communities of the Florida Keys and the rare tropical hardwood hammocks and mangrove swamps that they contain. Wildlife is abundant year-round throughout the FKWEA and the area provides habitat for an array of plant and animals that exist only within the Florida Keys ecosystem and thus are found nowhere else on Earth.

3 Uses of the Property

3.1 Previous Use and Development

Thousands of years before Europeans arrived, Native Americans hunted, fished, and gathered wild plants on and along the Florida Keys when the ancestors of the Calusa Indians migrated to the Keys to hunt the native wildlife and harvest the abundant marine resources. Evidence of several Native American campsites has been found within FKWEA on the same high and dry ground used to this day. Consequently, prior to European settlement, the landscape of Florida, including the Florida Keys, was settled and used by a variety of aboriginal peoples whose culture relied mainly on hunting, fishing, and subsistence agriculture. Though some land alteration occurred, only minor alteration of the landscape is thought to have taken place until the advent of European settlement beginning with the Spanish occupation of Florida in the sixteenth century.

The Spanish explored the Keys, but had no interest in colonizing this area. However, Spanish sailing vessels using the Straits of Florida and the Gulf Stream would shape the history of the Keys for many years to come. Returning home with their cargo of treasures taken from the Mayan, Incan, and Aztec empires, the cumbersome Spanish ships would frequently wreck on the dangerous offshore reefs along the Keys. The practice of “wrecking” and salvaging these treasure and cargo laden ships began with the Calusa Indians and continued with the British, Bahamians, and Americans, and, historically, was the primary industry of the Keys.

With the advent of European occupation and development, land use during early occupation was primarily domiciliary with a few small farms growing tropical fruits and vegetables. Except for Key West, which was the largest city in Florida with a population of 9,890 in 1880, most places in the Keys were barely populated. The construction of the Florida East Coast Railroad and the Florida Keys Overseas Highway, in 1905 and 1938 respectively, increased the use of the Keys for the cultivation of tropical plants and for commercial and recreational fishing.

Today, tourism is the primary industry in the Keys, and has greatly affected land uses on the islands. Development to

accommodate tourism and associated support industries, as well as a burgeoning population, has had considerable detrimental effects on the native tropical wildlife and plant communities. This development includes activities such as housing construction,



mosquito ditching, trash dumping, off-road vehicle use, rock mining, construction of boat basins and channels, and the creation of roads. The disturbance from development has also enabled an invasion of exotic plant and animal species, which remains one of the many challenges for the continued conservation of the fragile natural resources on the area.

3.2 Current Use of the Property

Currently, the FKWEA is managed for the conservation and protection of fish and wildlife habitat and fish and wildlife based public outdoor recreation. A wide range of operational and resource management actions are conducted on the FKWEA each year including activities such as wildlife habitat restoration and improvement; invasive exotic species maintenance and control; road repairs and maintenance; imperiled species management, monitoring and protection; facilities and infrastructure maintenance and repair; conservation acquisition and stewardship activities; archeological and historic resources monitoring and protection; and research related activities.

Current and anticipated resource uses of the property are diverse. Fishing, paddling, and wildlife viewing continue to be popular recreational activities on the FKWEA. The area also offers excellent opportunities for bird watching for both migratory and resident species. The diversity of vegetation not only harbors a variety of bird species but also provides excellent opportunities for the viewing of mammalian wildlife species and a wide range of unique and rare flora. Other uses include hiking, photography, biking, and sightseeing.

Due to the proximity of population centers in Monroe County and the recent acquisition and incorporation of the Johnson Tract into the area, public use of the FKWEA can be expected to increase as opportunities for public use expand and awareness of those opportunities grows.

3.2.1 Visitation and Economic Benefits

Visitation and public use of the area for fish and wildlife based public outdoor recreational opportunities is the primary source of economic benefits from the FKWEA, and contributes to the overall economy for the south region of Florida. Due to the dispersed nature of the area and the lack of a single point of entry, collecting precise visitation data for the FKWEA is not feasible. However, the FWC has determined that the FKWEA has a recreational carrying capacity of 32 visitors per day and this Management Plan contains



provisions to expand that carrying capacity to 168 visitors per day, given the potential for expanding recreational opportunities on the new addition of the Johnson Tract. For a more detailed discussion of these carrying capacities, see Section 5.6.3 of this Management Plan.

If the current maximum visitation level of 32 visitors per day were achieved, a total of 11,680 visitors per year could be expected. If the level of public use on the area were at carrying capacity, FWC economic analysis estimates indicate that the FKWEA could potentially generate an estimated economic benefit of \$1,469,811 for the State and the south region of Florida. This estimated annual benefit would aid in the creation of an estimated 23 jobs.

However, with the addition of the Johnson Tract to the FKWEA and the completion of planned recreational facilities there, the carrying capacity of the area is projected to increase to approximately 168 visitors per day. If this increased carrying capacity were achieved, a maximum total of 61,320 visitors per year could be expected. This greatly increased visitation level would generate an estimated economic benefit of \$7,716,508, which would aid in the creation of an estimated 122 jobs.

Further revenue generating potential of the FKWEA will depend upon future uses described in this Management Plan. Additional revenue from environmental lands such as the FKWEA might include sales of various permits and recreational user fees and ecotourism activities, if such projects could be feasibly developed. The annual area regulations can be consulted to clarify the necessary and required permits, fees, and regulations. Additionally, the long-term value of ecosystem services, including the protection of air and water quality functions, are considered to be significant to local and regional land and water resources, as well as human health.

3.3 Single- or Multiple-use Management

The FKWEA will be managed under the multiple-use concept as a Wildlife and Environmental Area. The FKWEA will provide fish and wildlife resource based public outdoor recreation and educational opportunities, while protecting the natural and historical resources found on the area. Any natural and historical resources of the FKWEA will be managed under the guidance of the ARC, the Conceptual State Lands Management Plan, and as outlined in the original purposes for acquisition.

3.3.1 Analysis of Multiple-use Potential

The following actions or activities have been considered under the multiple-use concept as possible uses to be allowed on the FKWEA. Uses classified as "Approved" are considered to be in accordance with the purposes for acquisition, as well as with the Conceptual State Lands Management Plan, and with the FWC agency mission, goals and objectives as expressed in the Agency Strategic Plan (Appendix 13.7). Uses classified as "Conditional"

indicate that the use may be acceptable but will be allowed only if approved through a process other than the management plan development and approval process (e.g., special-use permitting, managed-area regulation and rule development). Uses classified as “Rejected” are not considered to be in accordance with the original purpose of acquisition or one or more of the various forms of guidance available for planning and management:

	<u>Approved</u>	<u>Conditional</u>	<u>Rejected</u>
Apiaries		✓	
Astronomy		✓	
Bicycling	✓		
Cattle grazing			✓
Citrus or other agriculture			✓
Ecosystem services and maintenance	✓		
Ecotourism		✓	
Environmental Education	✓		
First-responder training			✓
Fishing		✓	
Geocaching		✓	
Hiking	✓		
Horseback riding			✓
Hunting			✓
Linear facilities			✓
Military training			✓
Preservation of historical resources	✓		
Primitive camping			✓
Protection of imperiled species	✓		
Off-road vehicle use			✓
Shooting sports park			✓
Soil and water conservation	✓		
Timber harvest			✓
Wildlife observation	✓		

3.3.2 Incompatible Uses and Linear Facilities

Consideration of incompatible uses and linear facilities on the FKWEA are made in accordance with the requirements of Section 253.034(10), FS, and other applicable Florida constitution, statute, rule, and policy requirements, as well as other provisions governing applications for proposed incompatible uses or linear facilities on state-owned conservation lands. Upon approval and implementation of this Management Plan, any proposed future

uses that have been classified herein as Rejected, or other proposed future uses that are determined to be incompatible with the purposes of acquisition or other management authorizations and guidance, will be forwarded for review and approval consideration to the DEP-DSL, the ARC and the Board of Trustees prior to any incompatible use or linear facility being authorized on the FKWEA.

3.3.3 Assessment of Impact of Planned Uses of the Property

To communicate the FWC's planned uses and activities, specific management intentions, long- and short-term goals and with associated objectives, identified challenges, and solution strategies have been developed for the FKWEA (Sections 5 -8). A detailed assessment of the benefits and potential impacts of planned uses and activities on natural and historical resources was an integral part of the development of the management activities and intent, goals, objectives, challenges, and strategies sections of this Management Plan.

3.4 Acreage Recommended for Potential Surplus Review

On conservation lands where the FWC is the lead manager, the FWC evaluates and identifies recommended areas for a potential surplus designation by the DSL, the ARC, and the Board of Trustees. This evaluation consists of GIS modeling and analysis, aerial photography interpretation, analysis of fish and wildlife resources, a review of resource and operational management needs, and a review of public access and recreational use of the area. Also, the FWC considers recommendations for surplus lands as they relate to Florida's "No Net Loss of Hunting Lands" legislation (Ch. 379.3001 F.S.), as well as surplus restrictions for lands acquired through the Federal Aid in Wildlife Restoration Act (Pittman-Robertson) or through other federal grant programs.

The evaluation of the FKWEA by the FWC has determined that all portions of the area are being managed and operated for the original purposes of acquisition, and remain integral to the continued conservation of important fish and wildlife resources, and continue to provide valuable fish and wildlife resource based public outdoor recreational opportunities. Therefore, no portion of the FKWEA is recommended for potential surplus review.

4 Accomplished Objectives from the FKWEA Management Plan 2004 – 2014

This section is dedicated to reporting the extent to which the objectives described in the 2004 – 2014 FKWEA Management Plan (pages 46 - 49) were successfully completed. Accomplishments for the FKWEA during the previous planning timeframe are further discussed in more comprehensive detail throughout Section 5 Management Activities and Intent of this Management Plan.

The following Resource Management Goals and Objectives from the 2004 – 2014 FKWEA Management Plan describe the planned activities for the FKWEA during that period. The degree to which the FWC was able to accomplish the planned activities during this period is reflected as Percent Accomplished for each associated objective.

Objectives Accomplished from the 2004 Florida Keys WEA Management Plan	
Goals and Objectives	Percent Accomplished
Goal 1: Incorporate new parcels into the management area system as quickly as possible.	
Objective 1: Continue to post all acquired parcels within 3 months of establishment order approval by the FWC. (Ongoing) <i>Comment: Given the habitat characteristics of some of the parcels within the FKWEA (such as large tracts of mangrove), the feasibility and need to post every site varies.</i>	80%
Objective 2: Coordinate with the DSL to ensure that adequate surveys for liabilities and hazards are completed prior to acquisition; then secure properties within 6 months of establishment by FWC as part of the Keys WEA. (Ongoing)	100%
Objective 3: By means of flyers or personal contacts, notify nearby landowners of State ownership prior to posting, if deemed necessary. (Ongoing)	100%
Objective 4: Communicate FWC acquisition priorities for the Keys WEA to DSL and Monroe County Land Authority (MCLA) by 2003.	100%
Goal 2: Prepare unit-specific management strategies.	
Objective 1: In order to protect resources subject to exploitation, identify and map locations of sensitive natural and cultural resources within one year of tract establishment within the Keys WEA. (Ongoing)	100%
Objective 2: By 2004 , or within one year of establishment, classify all tracts for intensity of public use (medium, low, or no use) and develop site-specific public use strategies.	100%

Objective 3: By 2004 , or within one year of tract establishment, identify management access points and eliminate vehicular access where not necessary for management. <i>Comment: Some roads must be maintained for private property access.</i>	100%
Objective 4: By 2007 , if feasible, utilize the disturbed site on the Dove Creek tract as an ancillary facility for the Overseas Heritage Trail. <i>Comment: The Overseas Heritage Trail designated an alternate site for an ancillary facility.</i>	0%
Goal 3: Manage and protect the natural system to maintain biodiversity.	
Objective 1: Continue to coordinate with DEP to identify and control exotic plant species, as specified in the 1998 Memorandum of Understanding (Appendix F). (Ongoing)	100%
Objective 2: Remove selected exotic plant species that represent threats to natural resource integrity (e.g., mature individuals of white leadtree, Australian pine, Brazilian pepper found in hammock canopy openings). (Ongoing) <i>Comment: Removal of these selected exotic plant species is ongoing.</i>	95%
Objective 3: Continue to monitor the necessity of implementing a fire ant control program to protect tree snails. (Ongoing) <i>Comment: Fire ants are controlled where identified</i>	100%
Objective 4: Continue to monitor the need for a site-specific feral animal control program; if warranted, coordinate the control program with Monroe County Animal Control. (Ongoing)	100%
Objective 5: As necessary, develop site-specific restoration projects to re-vegetate disturbed areas and recapture native species diversity. (Ongoing)	100%
Objective 6: Continue to investigate the necessity of establishing Closed Areas to protect sensitive resources. (Ongoing)	100%
Objective 7: To avoid damage to plants and other resources and to prevent or lessen exotic plant invasion, coordinate with surveyors (DSL, developers, et. al.) to minimize native plant clearing during property surveys. (Ongoing)	100%

Objective 8: Continue to cooperate and coordinate with the USFWS regarding management of Key deer and other threatened and endangered species. (Ongoing) <i>Comment: The FKWEA manager participates in the USFWS Key Deer Stakeholders Group.</i>	100%
Objective 9: Continue to submit annual exotic plant control proposals to DEP for funding. (Ongoing)	100%
Objective 10: Continue coordination with the USFWS regarding development of refuge plans, implementation of recovery plans, as well as strategies and translocation efforts for species such as Key Largo wood rat and tree snails. (Ongoing)	100%
Objective 11: In order to improve the protection of natural and cultural resources, increase the patrol time on the Keys WEA by a minimum of 10% above the FY 2003/04 logged patrol time. (Ongoing)	100%
Objective 12: By 2004 , develop and submit to Monroe County Mosquito Control District an updated Arthropod Control Plan to minimize known or suspected impacts of mosquito control programs.	100%
Objective 13: By 2005 , contract with Florida Natural Areas Inventory (FNAI) to identify historic and current vegetative community types pursuant to objective-based vegetation management.	100%
Objective 14: Develop an optimum boundary and nominate appropriate parcels for Keys WEA acquisition by 2005. (This addresses the Management Review Team's first checklist finding.) <i>Comment: Recommended parcels for acquisition have been identified through the Florida Keys Ecosystem Florida Forever project and in an Optimum Conservation Planning Boundary that will be developed in the update to this management plan.</i>	50%
Objective 15: Develop quantifiable vegetation management objectives by 2006. <i>Comment: Habitat composition and management regimes on the FKWEA do not warrant the implementation of the FWC OBVM program on the area.</i>	0%
Goal 4: Encourage and solicit community involvement in WEA management, protection and use.	

Objective 1: Continue the volunteer program for both occasional service and regular service volunteers. (Ongoing)	100%
Objective 2: Train volunteers in plant identification and exotic plant removal. (Ongoing)	100%
Objective 3: Continue to coordinate and encourage appropriate research activities with National Audubon Society, The Nature Conservancy, USFWS, universities, and other non-governmental organizations. (Ongoing)	100%
Objective 4: Plan and implement at least three public relations contacts annually to inform Keys residents regarding environmental concerns and management activities. (Ongoing)	100%
Goal 5: Ensure adequate manpower and funding for WEA operations.	
Objective 1: Continue to allow the use of mitigation as a means to accomplish WEA habitat management objectives. (Ongoing)	100%
Objective 2: Continue to coordinate and encourage appropriate management and research activities with National Audubon Society, The Nature Conservancy, USFWS, universities, and other non-governmental agencies. (Ongoing)	100%
Objective 3: Because of the urbanized character of Keys WEA land parcels and the distance between them, continue to request an additional biologist position. (Ongoing) (This addresses the Management Review Team’s second Checklist Finding.)	100%
Objective 4: Continue the volunteer program for both occasional service and regular service volunteers. (Ongoing)	100%
Objective 5: Continue to prepare and submit annual exotic plant control proposals to DEP for funding. (Ongoing)	100%
Objective 6: Train volunteers in plant identification and exotic plant removal. (Ongoing)	100%

Goal 6: Provide opportunities for high quality environmental education.	
Objective 1: By 2004 , complete the Keys WEA segment of the NBR internet website. <i>Comment: This website is currently being updated.</i>	100%
Objective 2: By 2004 , update the existing informational and educational brochure, providing biological resource information, including endangered and threatened species, for Keys WEA tracts. <i>Comment: Information on the area has been developed and is available on the FKWEA website. An informational brochure will also be developed in the update to this management plan.</i>	0%
Objective 3: By 2007 , if feasible, utilize the disturbed site on the Dove Creek tract as an ancillary facility for the Overseas Heritage Trail. <i>Comment: The Overseas Heritage Trail designated an alternate site for an ancillary facility.</i>	0%
Goal 7: Protect and Manage the Cultural Resources of the WEA.	
Objective 1: Continue to coordinate with the DHR for assistance in protecting the cultural resources and conducting inventories of them. (Ongoing)	100%
Objective 2: When conducting ground-disturbing restoration activities, continue to request assistance from the DHR to prevent damage to archaeological or historic sites. (Ongoing)	100%
Objective 3: By 2004 , send the area biologist to participate in the DHR cultural resource protection training (now known as Archaeological Resources Management Training), concerning the provisions of Chapter 267, F.S. <i>Comment: Area staff will participate in DHR training as part of the requirements of the update to this management plan.</i>	0%

5 Management Activities and Intent

The following section provides a description of agency plans to locate, identify, protect, preserve or otherwise use fragile natural resources and nonrenewable historical resources. In general, the FWC management intent for the FKWEA is to restore and maintain natural communities in a condition that sustains ecological processes and conserves biological diversity, especially fish and wildlife resources. In conjunction with this primary emphasis, it is the FWC's intent to provide quality fish and wildlife resource based public outdoor recreational opportunities on the FKWEA. The FWC will utilize the best available data,

guidelines, natural resource management practices, and recreational management practices to achieve these outcomes in accordance with the original purposes for acquisition. Furthermore, as noted earlier, the management activities described in this section are in compliance with those of the Conceptual State Lands Management Plan.

5.1 Land Management Review

The 2011 Land Management Review of the FKWEA (Appendix 13.4) found that the FWC was managing the area in accordance with its original purposes for acquisition. The recommendations of the Land Management Review were considered and addressed in the development of this Management Plan, including the development of management intent language, goals and objectives, and the identification of management challenges and the development of solution strategies (Sections 5 – 8).

5.2 Adaptive Management

Adaptive management is "learning by doing";¹ it is the adjustment or modification of conservation actions to achieve a desired conservation goal. In practice, adaptive management is a rigorous process that includes sound planning and experimental design with a systematic evaluation process that links monitoring to management.^{1,2} 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.^{2,3} 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, adaptive management can involve applying a conservation action at a site, observing the results and adjusting the action in the future if warranted.^{2,3}

Proposed adaptive management, monitoring and performance measures are developed through literature reviews and FWC staff meetings. Overall, a results-based approach is incorporated into this Management Plan, for which effective monitoring is an integral component. The FWC will monitor conservation actions, species, habitats, and major threats to the conservation of the natural and historical resources of the FKWEA.

5.2.1 Monitoring

A well-developed monitoring protocol is also one of the principal, required criteria for the management of the FKWEA. 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.²

For imperiled and focal fish and wildlife species, monitoring protocols are established through the FWC's Wildlife Conservation Prioritization and Recovery (WCPR, Section 5.4.2) program. FWC staff may monitor additional fish and wildlife species when deemed appropriate. Exotic and invasive plant and animal species (Section 5.5) are also monitored as needed and appropriate. Recreational uses are monitored through the FWC's Public Access and Wildlife Viewing program, and work in conjunction with the establishment and adjustment of public access carrying capacities (Section 5.6.3). Historical resources (Section 5.9) are monitored with guidance from the DHR.

5.2.2 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 specific goals. Successful monitoring programs and their associated performance measures provide natural resource professionals with valuable feedback on the effectiveness of conservation actions 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.

5.2.3 Implementation

The FKWEA Management Plan serves as the guiding framework to implement this adaptive management process. It serves as the underpinning for the integration of management programs (WCPR, Public Access and Wildlife Viewing, Recreation Master Plans, etc.) underway to accomplish needed conservation actions that are planned to manage the natural resources of the FKWEA, and resolve conservation threats to fish and wildlife and the habitats they occupy. Based on evaluations of project results, the conservation actions are revised as necessary, and the adaptive management process is repeated.

5.3 Habitat Restoration and Improvement

Management of the FKWEA will focus on the perpetuation of native plant communities and their associated endemic species, particularly state and federally listed species. The tropical hardwood hammocks of the Florida Keys are an imperiled plant community that comprises one of the most diverse assemblage of plant species in the continental United States. Also called rockland hammock, it is an upland forest rich in rare plant and animal species. It is the intent of the FWC to protect, preserve, and perpetuate this diversity

primarily by protecting the species on the area from illegal collection, exotic species competition, and from unnecessary disturbance such as clearing, dumping, motorized vehicles, and unauthorized fires. Aggressive exotic plant species removal programs are implemented on the FKWEA, and utilize both chemical and mechanical means of control. Additional management activities include re-planting of native species where necessary. Areas with altered hydrology and other disturbed sites will be managed for natural system values, which may include restoration of native community types and historic hydrological conditions.

As described above, the FWC has completed natural community mapping of the area through the services of the FNAI and has conducted surveys and mapped the current vegetative communities on the FKWEA. This information will be used to guide and prioritize management and restoration efforts on the area.

5.3.1 Objective-Based Vegetation Management

The FWC uses a comprehensive resource management approach to managing FWC-managed areas. Restoring the form and function of Florida's natural communities is the foundation of this management philosophy. The FWC uses OBVM to monitor how specific vegetative attributes are responding to FWC management.

The first step in implementing OBVM is to map the current, and in most cases the historic natural communities, on the managed area using the FNAI Natural Community Classification. The FWC contracts with FNAI to provide these mapping services, and plans to have natural community maps recertified on most areas on a five-year basis. A natural community, as defined by FNAI, is a distinct and recurring assemblage of populations of plants, animals, fungi and microorganisms naturally associated with each other and their physical environment.

After natural communities have been mapped, management units are delineated. Delineating management units takes into account the distribution and extent of the current and/or historic mapped natural communities, existing and proposed infrastructure, and other management considerations. FWC land managers then identify the predominant current or historic natural community within each management unit that guides the type and frequency of management activities that should be applied. Through OBVM monitoring, FWC collects data on a number of specific vegetation attributes that provide insight about the condition of the natural community. Because FWC is interested in the overall effect of management on the natural communities, OBVM data is analyzed at the natural community level.

Measurable habitat management objectives referred to as 'desired future conditions' are established for each actively managed natural community. Desired future conditions are the acceptable range of values for quantifiable vegetation attributes, such as basal area,

shrub height and cover, and ground cover. The FWC collaborated with the FNAI to identify ‘reference sites’ for each actively managed natural community and applied the OBVM monitoring methodology at these reference sites to determine what attribute values occur in a high-quality community (<http://www.fnai.org/reference-natural-communities.cfm>). FWC staff considers the reference site attribute values when setting area-specific desired future conditions for natural communities.

Vegetation monitoring samples the selected attributes, with the results being compared to the established desired future conditions. All monitoring performed under OBVM is completed using the program’s Standard Operating Procedures.

Consistent, long-term monitoring of managed natural communities will quantify changes in habitat conditions, provide information on the cumulative effects of management activities, and measure progress towards meeting management objectives for desired habitat conditions. Measured changes in vegetation condition are intended to be used to inform future land management actions.

Initial mapping and vegetation sampling provides FWC staff with baseline data indicating natural community structure, distribution, and condition on the area. Comparing the subsequent monitoring results to desired future conditions, provides important operational information on a natural community’s vegetation structural status at a given point in time and trend over time. Using this information, managers can evaluate, adjust and modify their management practices to meet the stated objectives. By comparing natural community mapping products through the years, managers can track progress in moving altered communities to functioning natural communities.

However, the FKWEA is unique among FWC-managed areas in that, due to the composition and quality of the natural communities found on the area, OBVM is not currently utilized by FWC staff to manage the area’s natural communities. As is described in more detail below, this is partially due to the fact that prescribed fire is neither appropriate nor feasible for maintenance of the FKWEA’s natural communities. As a result, an OBVM program and corresponding prescribed fire regime are not appropriate tools for the management of the FKWEA at this time. However, it is possible that in the future an OBVM program will be tailored to the unique nature of the FKWEA and its natural resources and would at that time be implemented and utilized in the management of the area.

5.3.2 Prescribed Fire and Fire Management

As described above, due to the composition of the natural communities found on the FKWEA, FWC staff does not utilize prescribed fire to manage the area’s natural communities. The natural communities of the FKWEA are generally not fire-adapted communities and the widely dispersed nature of the area and its close proximity to

developed land precludes the use of prescribed fire as a management tool. The FNAI notes that fires are historically rare to non-existent in most of the natural communities found on the FKWEA, and in some communities, such as rockland hammock, fire can have a significantly negative and damaging impact on habitat. As a result, an OBVM program and corresponding prescribed fire regime are not appropriate tools for the management of the FKWEA at this time.

5.3.3 Habitat Restoration

Significant habitat restoration and maintenance activities have taken place on several of the parcels throughout the FKWEA over the course of the previous management planning period beginning in 2004. Habitat restoration, including revegetation through the planting of appropriate site-specific native species, was implemented on several disturbed sites throughout the FKWEA. Additionally, FWC staff, in cooperation with several partners



including the USFWS and the University of South Florida, initiated a program to reintroduce and establish the imperiled semaphore cactus on select sites throughout the FKWEA. FWC staff also participated in the USFWS Key Deer Stakeholders Group and its ongoing efforts to manage Key deer and its associated habitat.

Continuing habitat restoration activities on the area will focus on restoring natural communities, treating and removing exotic plant species, and protecting intact natural communities from disturbances. Exotic species control is more extensively discussed in Section 5.5, below. Further habitat restoration and improvement objectives planned for the area are delineated in Section 6, below.

5.4 Fish and Wildlife Management, Imperiled and Focal Species Habitat Maintenance, Enhancement, Restoration, or Population Restoration

5.4.1 Fish and Wildlife

Due to the variety and unique characteristics of the natural communities on the FKWEA, a diversity of associated wildlife, including rare, imperiled, and more common species, can be found on the area. In managing for wildlife species, an emphasis will be placed on conservation, protection and management of natural communities. As noted above, natural communities important to wildlife include coastal rock barren, rockland hammock, and mangrove swamp. Natural communities that are less represented on the FKWEA but still important to wildlife include coastal berm, unconsolidated substrate, and estuarine.

The size and natural community diversity of the FKWEA creates a habitat mosaic for a wide variety of wildlife species. Resident wildlife will be managed for optimum richness, diversity and abundance. In addition to resident wildlife, the FKWEA provides resources critical to many migratory birds including waterfowl, passerines, raptors, shorebirds, and others. Habitats important to migratory species will be protected, maintained, or enhanced.

Wildlife management emphasis is placed on documenting the occurrence and abundance of rare and imperiled species on the property. The FWC will continue to update inventories for certain species, with emphasis on rare and imperiled fish and wildlife species. Monitoring of wildlife species will continue as an ongoing effort for the area.

Concurrent with ongoing species inventory and monitoring activities, management practices are designed to restore, enhance, or maintain rare and imperiled species and their habitats. This will be further augmented by following approved federal and FWC species recovery plans, guidelines, and other scientific recommendations for these species. Guided by these recommendations, land management activities will address rare and imperiled species requirements and habitat needs. Section 5.4.2 below provides further information on the FWC's comprehensive species management strategy for rare and imperiled wildlife and their respective habitats.

5.4.2 Imperiled and Focal Species: Wildlife Conservation Prioritization and Recovery

The FWC has identified the need to: 1) demonstrate optimal wildlife habitat conservation on FWC-managed lands; 2) develop science-based performance measures to evaluate management; 3) recover imperiled species; and 4) prevent future imperilment of declining wildlife species. To help meet these needs, the FWC uses a comprehensive resource management approach to managing FWC-managed areas. Restoring the form and function of Florida's natural communities is the foundation of this management philosophy. The FWC uses the WCPR program to ensure management is having the desired effect on wildlife.

The goal of WCPR is to provide assessment, recovery, and planning support for the FWC-managed areas to enhance management of focal species and the recovery of imperiled species. WCPR program objectives include prioritizing what the FWC does for imperiled and focal species on FWC-managed areas; ensuring the actions taken on these areas are part of statewide conservation programs and priorities; and informing others about the work accomplished on lands the FWC manages.

The WCPR program helps the FWC take a proactive, science-based approach to species management on FWC-managed lands. This approach assesses information from statewide

potential habitat models and Population Viability Analysis, and in conjunction with input from species experts and people with knowledge of the area, creates site-specific wildlife assessments for imperiled wildlife species and a select suite of focal species. Staff combines these assessments with area-specific management considerations to develop a wildlife management strategy for the area. Each strategy contains area-specific measurable objectives for managing priority species and their habitat, prescribes management actions to achieve these objectives, and establishes monitoring protocols to verify progress towards meeting the objectives. By providing FWC managers with information on actions they should undertake, the FWC intends for the strategy to assure the presence and persistence of Florida's endangered and threatened fish and wildlife species (see http://myfwc.com/media/1515251/Threatened_Endangered_Species.pdf), as well as select focal species found on the area.

In summary, for FWC-managed areas, the WCPR program helps assess imperiled and focal wildlife species needs and opportunities, prioritize what the FWC does for imperiled and focal species, prescribe management actions to aid in species recovery, prescribe monitoring protocols to allow evaluation of the species' response to management, and ensure the information is shared with others. Through the actions of this program, the FWC will facilitate fulfilling the needs of focal and imperiled wildlife species on the FKWEA. In the long-term, by implementing these strategies on FWC-managed lands and continuing to



assess wildlife species' needs, the FWC will continue to play an integral role in aiding the recovery of imperiled species and preventing the future imperilment of declining wildlife species.

An FWC WCPR Species Management Strategy (WCPR Strategy) was completed for the FKWEA in August 2014 (see Appendix 13.10 for more detailed information). Using statewide landcover-based habitat models, the FKWEA WCPR Strategy identifies 12 focal species and one group of species (wading birds) as having potential habitat on the FKWEA (Table 15). Of the focal species identified as having habitat on the area, the FKWEA WCPR Strategy provides measurable objectives and recommends some level of monitoring for mangrove cuckoo, white-crowned pigeon, and Lower Keys marsh rabbit.

The WCPR Strategy also recommends management actions and some level of monitoring for a suite of species that are listed and locally important but are not considered focal species. These listed and locally important species include Florida tree snail, eastern indigo snake, Florida brown snake, Key ringneck snake, peninsula ribbon snake (Lower Keys population), red rat snake (Lower Keys population), osprey, Wilson's plover, and other

federally listed species as well as five species of rare butterflies, including Florida purplewing, Florida white, Martial scrub-hairstreak, mangrove buckeye, and Palatka skipper. The WCPR Strategy also identifies the semaphore cactus and a suite of 60 endangered and threatened plant species as present on the FKWEA whose habitat will also be managed to enhance their long-term viability on the area.

Table 15. Focal Species Occurring on or Near the FKWEA

Common Name	Scientific Name	Status
American crocodile	<i>Crocodylus acutus</i>	FT
Black-whiskered vireo	<i>Vireo altiloquus</i>	
Florida Key deer	<i>Odocoileus virginianus clavium</i>	FE
Florida Keys mole skink	<i>Plestiodon egregius egregius</i>	SSC
Lower Keys marsh rabbit	<i>Sylvilagus palustris hefneri</i>	FE
Mangrove cuckoo	<i>Coccyzus minor</i>	
Rim rock crowned snake	<i>Tantilla oolitica</i>	ST
Silver rice rat	<i>Oryzomys palustris natator</i>	FE
Southern bald eagle	<i>Haliaeetus leucocephalus</i>	
Striped mud turtle	<i>Kinosternon baurii</i>	ST
Swallow-tailed kite	<i>Elanoides forficatus</i>	
Wading birds	Multiple spp.	
White-crowned pigeon	<i>Patagioenas [Columba] leucocephala</i>	ST

5.5 Exotic and Invasive Species Maintenance and Control

The FWC will continue efforts to control the establishment and spread of Florida Exotic Pest Plant Council (FLEPPC) Category I or II plants on the FKWEA. Control technologies may include mechanical, chemical, biological, and other appropriate treatments.

Treatments utilizing herbicides will comply with instructions found on the herbicide label and employ the Best Management Practices for their application.



Exotic and invasive plant species known to occur on the FKWEA and treated annually by the FWC include Australian pine, Asiatic colubrina, leadtree, sapodilla, Guinea grass, bowstring hemp, beach naupaka, Brazilians pepper, and seaside mahoe.

Exotic and invasive plant species have been identified as occurring at varying densities on approximately 515 acres of the FKWEA. However, the FWC’s methodology for determining the number of acres “infested” with invasive exotic plants only represents a cumulative acreage, and does not reflect the degree of the invasive exotic occurrence. The degree of

infestation among areas identified with invasive exotic plant occurrences often varies substantially by species, level of disturbance, environmental conditions, and the status of ongoing eradication and control efforts. The FWC will continue to focus treatments on areas identified as having invasive exotic plant occurrences, as well as treating any new occurrences as they are identified through continued monitoring.

During the previous management planning cycle, an aggressive exotic plant species control and removal program was implemented on the FKWEA utilizing both mechanical and chemical treatments, with an average of 350 to 500 acres of exotics treated each year during that time period. Control measures were also implemented on red imported fire ants on an ongoing basis.

Additionally, the FWC will continue efforts to control the introduction of exotic and invasive species, as well as pests and pathogens, on the FKWEA by inspecting any vehicles and equipment brought onto the area by contractors and requiring that they be free of vegetation and dirt. If vehicles or equipment used by contractors are found to be contaminated, they will be referred to an appropriate location to clean the equipment prior to being allowed on the area. This requirement is included in every contract for contractors who are conducting any operational or resource management work on the area. In this way, the FWC implements a proactive approach to controlling the introduction of exotic pests and pathogens to the area.

An exotic animal species of concern on the FKWEA is the red imported fire ant. This invasive species feeds on a wide variety of invertebrates and can pose a significant threat to many of the rare and imperiled species found in the rockland hammocks and other natural communities of the Florida Keys. In particular, the red imported fire ant poses a threat to the Florida Keys mole skink, rim rock crowned snake, and a number of rare butterfly species. FWC staff actively controls red imported fire ants on the FKWEA in an effort to mitigate the negative impacts of this invasive species.



Another exotic animal species of concern is the Gambian pouch rat. FWC staff actively participates in a project to eradicate this species from the Florida Keys, though to date the species has not been documented within the boundaries of FKWEA. Other exotic animal species that are found or could potentially occur on the FKWEA include Burmese python, Nile monitor, black spiny-tailed iguana, Cuban treefrog, Cuban green anole, and Argentine tegu. The FWC will continue to implement measures to monitor for and control exotics species on the area as outlined in Section 6.3 of this Management Plan.

5.6 Public Access and Recreational Opportunities

5.6.1 Americans with Disabilities Act

When public facilities are developed on areas managed by FWC, every effort is made to comply with the Americans with Disabilities Act (Public Law 101-336). As new facilities are developed, the universal access requirements of this law are followed in all cases except where the law allows reasonable exceptions. Recreation facilities in semi-primitive or primitive zones will be planned to be universally accessible to the degree possible except as allowed by the ADA⁴ where:

1. Compliance will cause harm to historic sites, or significant natural features and their characteristics.
2. Compliance will substantially alter the nature of the setting and therefore the purpose of the facility.
3. Compliance would not be feasible due to terrain or prevailing construction practices.
4. Compliance would require construction methods or materials prohibited by federal or state statutes, or local regulations.

5.6.2 Recreation Master Plan

The FWC has adopted a comprehensive approach to the planning and administration of fish and wildlife resource based public outdoor recreational opportunities for the FKWEA. To accomplish this, the FWC has worked with recreational stakeholders and the general public to develop a Recreation Master Plan for the FKWEA that is used to further design and develop appropriate infrastructure to support the recreational use of the area by the general public. This Recreation Master Plan includes planning for parking, trail design, and area resource interpretation. The Recreation Master Plan is attached to this Management Plan as Appendix 13.11.

5.6.3 Public Access Carrying Capacity

Baseline carrying capacities for users on FWC-managed lands are established by conducting a site specific sensitivity analysis using available data for the site. The intent of the carrying capacity analysis is to minimize wildlife and habitat disturbance and provide the experience of being “immersed in nature” that visitors to FWC-managed areas desire. Carrying capacities are just a first step; management of recreational use requires a means of monitoring visitor impacts. Responding to these impacts may require adjusting the carrying capacities as necessary. The carrying capacities generated through this process are used as a tool to help plan and develop public access, wildlife viewing, and fish and wildlife resource based public outdoor recreation opportunities.

Based on an analysis of the overall approved uses and supported public access user opportunities, and the anticipated proportional visitation levels of the various user groups, the FWC has determined that the FKWEA can currently support 32 visitors per day. However, an objective to increase the public access carrying capacity to 168 visitors per day has been proposed in Section 6.4 of this Management Plan. This expanded carrying capacity is based on the recent addition of the Johnson Tract and the completion of planned recreational facilities there.

It is important to note that public access carrying capacities are not developed to serve as a goal for expanding the public use of a particular area to match the established carrying capacity. Rather, they are developed to establish maximum thresholds for public use of the respective area in order to protect the natural and historical resources on the FKWEA and to ensure that visitors will have a high-quality visitor experience. The public access carrying capacity will be periodically reevaluated, and additional capacity may be contemplated as part of the Recreation Master Plan development and implementation process.

5.6.4 Wildlife Viewing

As described above, the FKWEA is home to a variety of resident wildlife found its rockland hammocks, mangrove swamps, and other natural communities. The area also provides critical feeding and resting habitat for a wide variety of migratory species. With the high quality and rarity of its natural communities and associated wildlife habitat, the FKWEA is an excellent place to view wildlife. Additionally, wildlife viewing opportunities are projected to increase upon the completion of planned improvements for public access and wildlife viewing outlined in Section 6.5 of this Management Plan.

5.6.5 Hunting

Hunting is prohibited on the FKWEA due to the sensitive nature of the habitat and species composition of the area.

5.6.6 Fishing

Fishing is authorized year-round at the FKWEA. Currently, the most accessible sites for fishing within the FKWEA are Sammy Creek Landing in the Lower Keys and Sandy Sprunt Dove Creek Hammocks in the Upper Keys. The recently acquired Johnson Tract also provides additional fishing opportunities for the public.

5.6.7 Paddling

Paddling is a very popular activity in the waters surrounding the FKWEA. There is a small boat launch at Sammy Creek Landing on Lower Sugarloaf Key which is accessible for non-motorized boats such as kayaks and canoes. Launching motorized boats at this location is currently prohibited.

5.6.8 Roads and Trails

Currently, there are 5.5 miles of roads on the FKWEA, the vast majority of which are private roads that run alongside parcels of the FKWEA that the FWC manages along with private landowners. In addition, there is an approximately six-mile road on the newly acquired Johnson Tract that is not part of the FKWEA boundary since the right-of-way is owned by Monroe County. Portions of the old road bed were once part of the Old State Road 4A but it is no longer open to vehicular traffic. It now forms a trail that is open to the public for hiking and bicycling on the newly acquired Johnson Tract.



5.6.8.1 Hiking

Hiking is permitted on the FKWEA, however there are few trails throughout the area that can be utilized for hiking. The best area for hiking within the FKWEA is the newly acquired Johnson Tract, as the six-mile trail provides users with an excellent place to hike and observe the rare wildlife and plants on the area.

5.6.8.2 Bicycling

Like hiking, bicycling is permitted on the FKWEA but is limited due to the lack of trails on the area. The best area for bicycling within the FKWEA is the newly acquired Johnson Tract, as much of the six-mile trail is paved and provides users with an excellent place to bicycle to observe wildlife.

5.6.8.3 Equestrian

Horseback riding is prohibited on the FKWEA due to the sensitive nature and composition of the area's resources.

5.6.9 Camping

Camping is also prohibited on the FKWEA due to the sensitive nature and composition of the area's resources.

5.6.10 Geocaching

Geocaching, also known as Global Positioning System (GPS) Stash Hunt and GeoStash, is a contemporary combination of orienteering and scavenger hunting generally utilizing a GPS receiver unit. Geocache websites routinely promote good stewardship. However, the potential exists for resource damage, user conflicts, or safety issues caused by inappropriately placed caches and/or links that do not provide adequate information about the area.

It is the policy of the FWC to allow placement of geocaches only in those locations that do not present the potential for resource damage, user conflicts, or threats to the safety of the activity participants. The placement of geocaches on FWC-managed lands is governed by specific guidelines. These guidelines may be found on the following FWC website: [http://myfwc.com/media/1074886/FWC Geocache Guidelines.pdf](http://myfwc.com/media/1074886/FWC_Geocache_Guidelines.pdf).

5.6.11 Environmental Education

The FWC will assess the need for and pursue research and environmental education partnership opportunities as appropriate. The FWC will develop and conduct periodic environmental education and outreach programs and will continue to identify opportunities to provide and/or expand as feasible interpretive and educational programs. The FWC will continue to identify partnerships that could provide for environmental educational programs and outreach opportunities.



5.6.11.1 Interpretation

Interpretive facilities on the FKWEA include a three-panel kiosk at Sammy Creek Landing that provides information on the wildlife and natural resources of the area. The FWC also provides a bird list and website for the FKWEA.

5.7 Hydrological Preservation and Restoration

The hydrology of the FKWEA is influenced primarily by tidal action and rainfall. As described in Section 2.5 of this Management Plan, the only freshwater resources found in the FKWEA are located in the Lower Keys. The entire freshwater system of ponds and marshes is sustained by rainfall and local recharge accumulating in depressions. These freshwater resource are critically important for maintaining viable habitat for a wide range of wildlife species. All freshwater resources within the FKWEA are protected, restored, or enhanced where possible.

Due to the development that has occurred throughout the Florida Keys, historic tidal flow patterns have been altered in some areas. The restoration of historic tidal flow in disturbed areas would provide benefits to fish and wildlife habitat and would improve water quality. Hydrological restoration will be guided by a site-specific hydrological assessment, discussed below.

5.7.1 Hydrological Assessment

The FWC will conduct or obtain an onsite hydrological and risk assessment to identify potential hydrology restoration needs on the FKWEA. To maintain and enhance natural

hydrological functions, the FWC will maintain and install low-water crossings and culverts as appropriate.

5.7.2 Water Resource Monitoring

Currently, the FWC cooperates with the DEP, the SFWMD, and the Florida Keys National Marine Sanctuary for the monitoring of surface and ground water quality and quantity. In addition, the FWC will continue to cooperate with the SFWMD and the DEP to develop and implement any additional surface water quality and quantity monitoring protocols for the FKWEA. In this capacity, the FWC will primarily rely on the expertise of the SFWMD, the Florida Keys National Marine Sanctuary, and the DEP to facilitate these monitoring activities. As necessary, the FWC may independently conduct or contract for water resource monitoring, as guided by the DEP and the SFWMD.

5.8 Forest Resource Management

There are no timber resources on the FKWEA, with the exception of tropical hardwoods found throughout the hammocks on the area. Those tropical hardwood hammocks are designated as an imperiled plant community and therefore any type of harvesting of trees and plants on the area is prohibited in order to ensure their long-term survival. As a result, the FWC and the FFS have determined that a professional forest assessment for the FKWEA is unnecessary. The FWC will cooperate with the FFS or a qualified professional forestry consultant regarding any forestry management activities if they ever become necessary or appropriate.

Although the FKWEA has a low diversity of forest types, it contains some of the best examples of tropical hardwood hammocks in the Florida Keys. The FWC will continue to manage, maintain, and preserve the area's tropical hardwood hammocks to ensure their health and viability and to provide benefits to native wildlife. Management activities, including planting native species and controlling exotic species, are employed to preserve and enhance the intrinsic quality of the mangroves and tropical hammocks on the area. Disturbed areas are managed so as to restore their original plant communities. Additionally, the FWC continues to protect the tropical hardwood hammocks and other plant communities within the FKWEA by protecting them from motorized vehicle damage, pesticide use, poaching, and illegal dumping and clearing.

5.9 Historical Resources

Procedures outlined by the DHR will be followed to preserve the historical sites of the FKWEA. If deemed necessary, the FWC will consult with the DHR in an attempt to locate any additional historical features on the area. In addition, the FWC will ensure management staff has DHR Archaeological Resources Monitoring training. The FWC will refer to and follow the DHR's Management Procedures for Archaeological and Historical Sites and Properties on State-Owned or Controlled Properties for management of these resources, and prior to any facility development or other ground disturbing activities.

Furthermore, as appropriate and necessary, the FWC will contact professionals from the DHR for assistance prior to any ground-disturbing activity on the FKWEA.

As discussed in Section 2.8, the DHR Master Site File indicates 14 known historical sites on the FKWEA. These sites include 11 archaeological sites and three resource groups. A full listing of these sites can be found in Appendix 13.9.1. As recommended by the DHR, the FWC will continue to preserve and protect as necessary all 14 of these sites and they will be monitored annually, at a minimum. Further, some tracts within the FKWEA, particularly those that contain rockland and tropical hardwood hammocks, may contain additional archaeological and historical sites that have yet to be recorded. The FWC will submit subsequently located historical sites on the FKWEA to the DHR for inclusion in their Master Site File.

As noted above, in cooperation with the DHR, the FWC will monitor all of the 14 archaeological and historical sites within the FKWEA at least annually.

5.10 Capital Facilities and Infrastructure

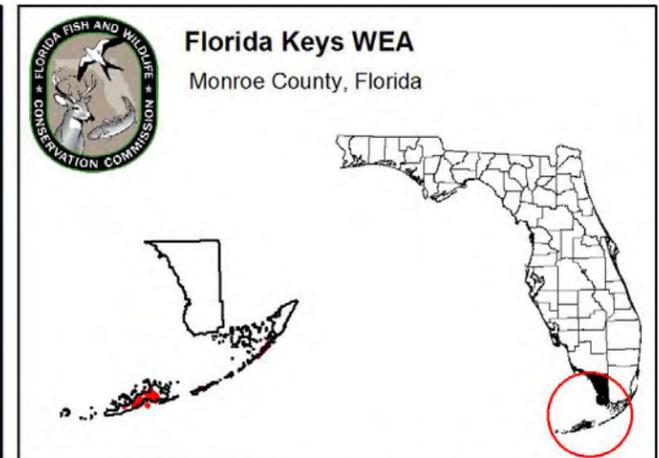
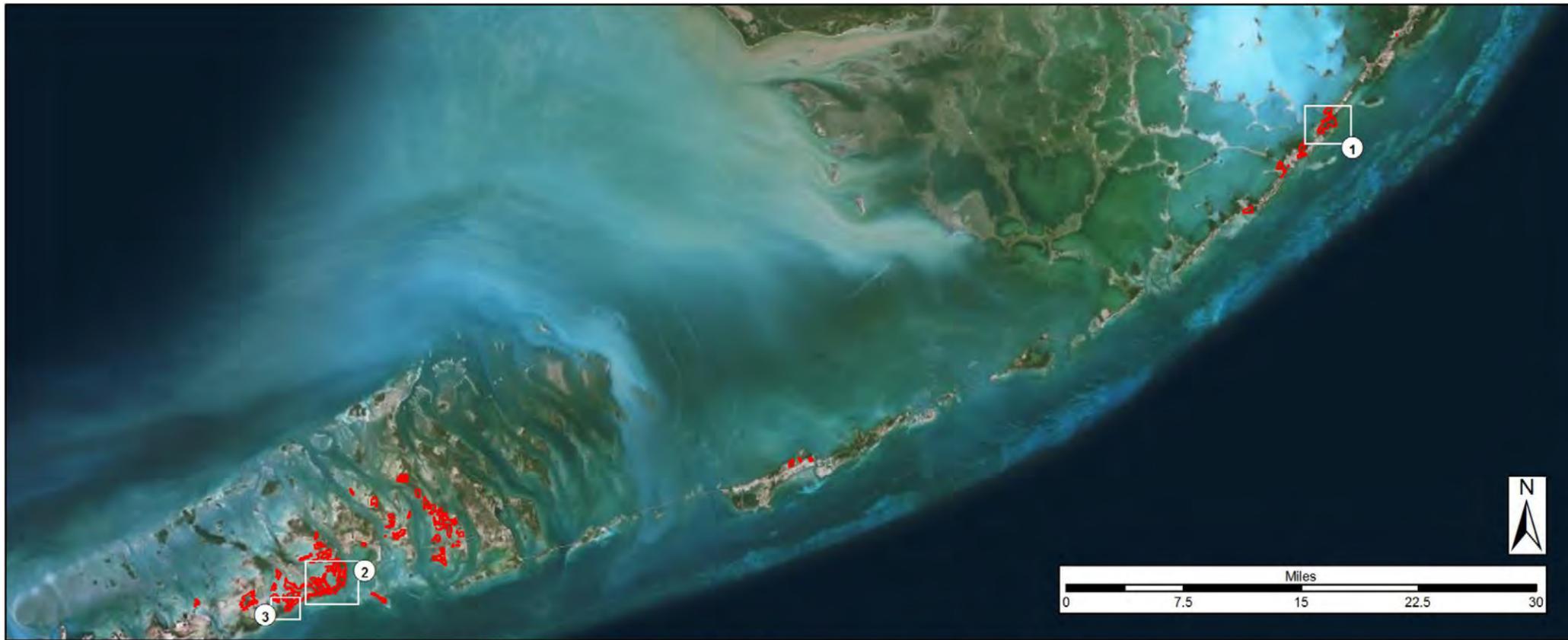
The FWC's land management philosophy is designed to conserve the maximum amount of wildlife habitat while providing the minimal number of capital facilities and infrastructure necessary to effectively conduct operational and resource management activities, and to provide opportunities for fish and wildlife resource based public outdoor recreation. For



these reasons, planned capital facilities and infrastructure will focus on improving access, recreational potential, hydrology, or other resource and operational management objectives. Due to the unique and sensitive nature of the area's natural communities, the vast majority of the FKWEA is in a natural state with very few facilities throughout the area.

Current capital facilities and infrastructure on the FKWEA are depicted in Figure 26, below, and include 5.5 miles of roads; a boat launch, picnic shelter, and kiosk at Sammy Creek Landing; and a sign and access gate at Sandy Sprunt Dove Creek Hammock. Additionally, as previously described, there is an approximately six-mile trail that runs through the newly acquired Johnson Tract, which is Monroe County right-of-way and not part of the FKWEA boundary but is available for recreational use.

As described in Section 5.6.1 of this Management Plan, for any public facilities that are developed on areas managed by the FWC, every effort is made to comply with the Americans with Disabilities Act (Public Law 101-336).



FKWEA Facilities and Infrastructure

Legend

- Florida Keys WEA
- + Access gate
- K Kiosk
- B Boat launch
- A Picnic shelter
- - - Johnson Tract loop road



Created in ArcGIS 10.1 by the Florida Fish and Wildlife Conservation Commission July 2015

Figure 28. FKWEA Capital Facilities and Infrastructure

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5.11 Land Conservation and Stewardship Partnerships

The FWC utilizes a three-tiered approach to identifying, acquiring or otherwise protecting important conservation lands adjacent to or in proximity to existing FWC-managed areas. This involves development of an Optimal Resource Boundary (ORB), Optimal Conservation Planning Boundary (OCPB) and associated Conservation Action Strategy (CAS).

Increasingly, cooperative land steward partnership efforts with private landowners plays an integral role in this effort as does ongoing land conservation, either through fee-simple or less-than-fee conservation easements. In combination, this tiered model helps the FWC to further the regional conservation of important fish and wildlife habitats through a proactive, comprehensive, and cooperative approach towards conservation.

5.11.1 Optimal Resource Boundary

This three tiered model begins with the development of an ORB, which is a resource-based analysis on a regional scale that integrates important FWC conservation research and analysis into practical planning, acquisition, and management efforts through GIS analysis. The ORB focuses on critical and important wildlife species or habitat considerations such as rare and imperiled species habitat within a particular region or ecosystem-like area on a landscape scale within which an FWC-managed area is contained while eliminating urban areas or lands that have already been conserved or protected.

5.11.2 Optimal Conservation Planning Boundary

The second tier is known as the OCPB. The OCPB combines the regional natural resources identified in the ORB, as well as regional and local area conservation planning, including habitat conservation and restoration, habitat linkages, management challenges, land use and zoning issues, infrastructure including roads and developments, improving access, eliminating inholdings, providing prescribed burn buffers, resolving boundary irregularities, water resource protection, and conserving other important natural and historical resources.

The OCPB provides the basis for development of a broader CAS for the FKWEA. Although the OCPB provides the basis for potential future voluntary, willing-seller conservation acquisitions, it is designed to function primarily as a conservation planning boundary. The OCPB identifies surrounding lands and natural resources that may be important to the continued viability of fish and wildlife populations in the region. As they are currently managed, these lands appear to contribute to regional conservation and may support conservation landscape linkages.

5.11.3 Conservation Action Strategy

The CAS is the third tier, and implements the results of the ORB and OCPB tiers. This element of the process incorporates the conservation planning recommendations into an action strategy that prioritizes conservation needs. The CAS is integral to the development

of conservation stewardship partnerships and also implements the current approved process for establishing the FWC Florida Forever Inholdings and Additions acquisition list.

Primary components of the CAS may include:

- FWC Landowner Assistance Program
- FWC conservation planning
- FWC Additions and Inholdings Program Land Conservation Work Plan
- Forest Stewardship Program proposals
- Florida Forever project proposals and boundary modifications
- Conservation easements
- Federal or State grant conservation proposals
- Regional or local conservation proposals
- Local, state, and federal planning proposals
- Non-governmental organization conservation proposals

Continued conservation of these lands may be aided by available voluntary landowner stewardship programs, conservation easements, and in some cases, potential voluntary conservation acquisitions. Participation in any FWC conservation effort is entirely voluntary and at the sole choice of willing landowners.

Private landowners seeking assistance with habitat management will likely find it offered within FWC's Landowner Assistance Program (LAP). The FWC employs biologists who are available to provide wildlife-related assistance with land-use planning and habitat management. There are many forms of assistance that include technical, financial, educational, and various forms of recognition that seek to award landowners who manage their wildlife habitat responsibly. More information on FWC's LAP program and online habitat management tools are available online at: <http://myfwc.com/conservation/special-initiatives/lap/> .

5.11.4 FWC Florida Forever Additions and Inholdings Acquisition List

Currently, the FWC has identified a total of approximately 92 acres of potential additions or privately held inholdings for the FKWEA. These potential additions or privately held inholdings consist of multiple tracts divided into three separate ownerships that total approximately 70, 13, and 8 acres. In addition, approximately 6,392 acres of the FKEFFP remain to be acquired. Upon completion of the CAS, additions to the FWC Florida Forever Additions and Inholdings acquisition list may be recommended.

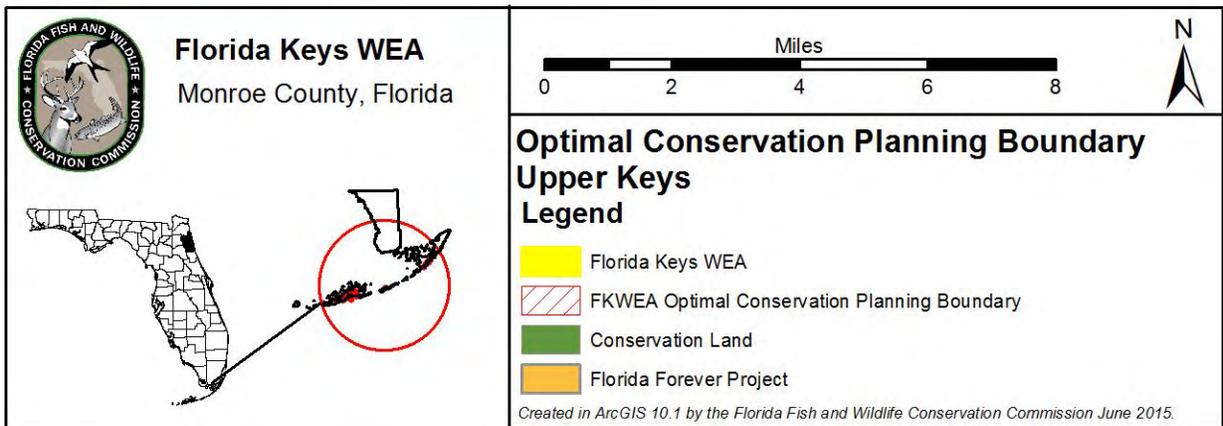


Figure 29. FKWEA Optimal Conservation Planning Boundary – Upper Keys

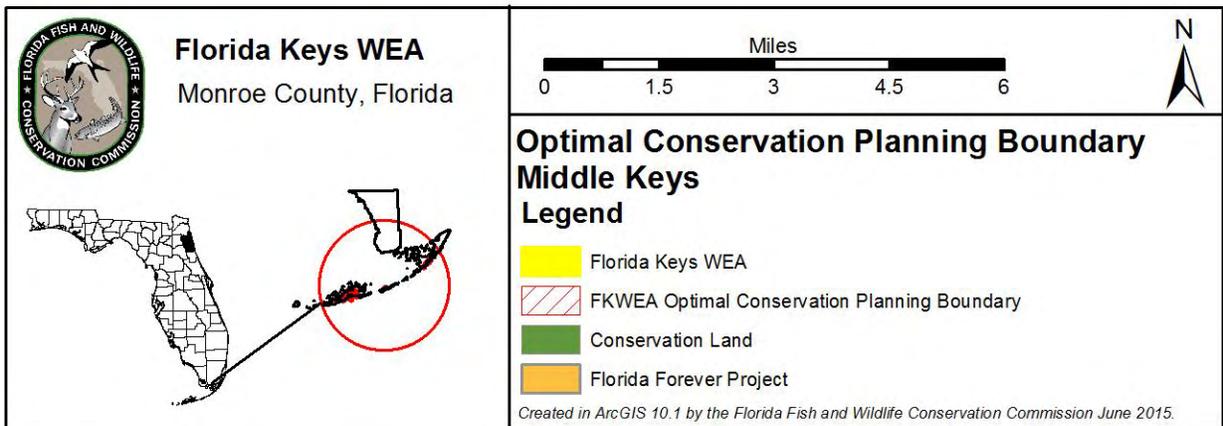


Figure 30. FKWEA Optimal Conservation Planning Boundary – Middle Keys

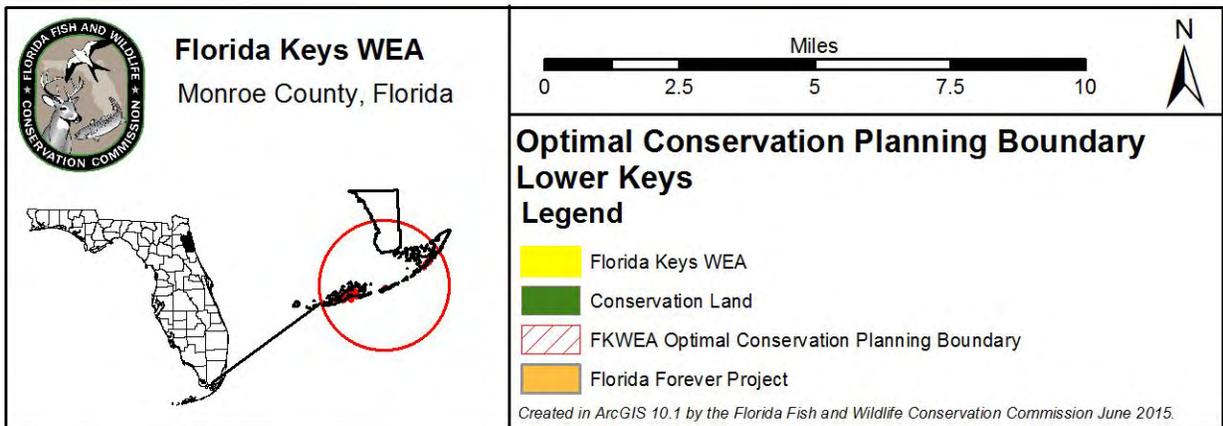
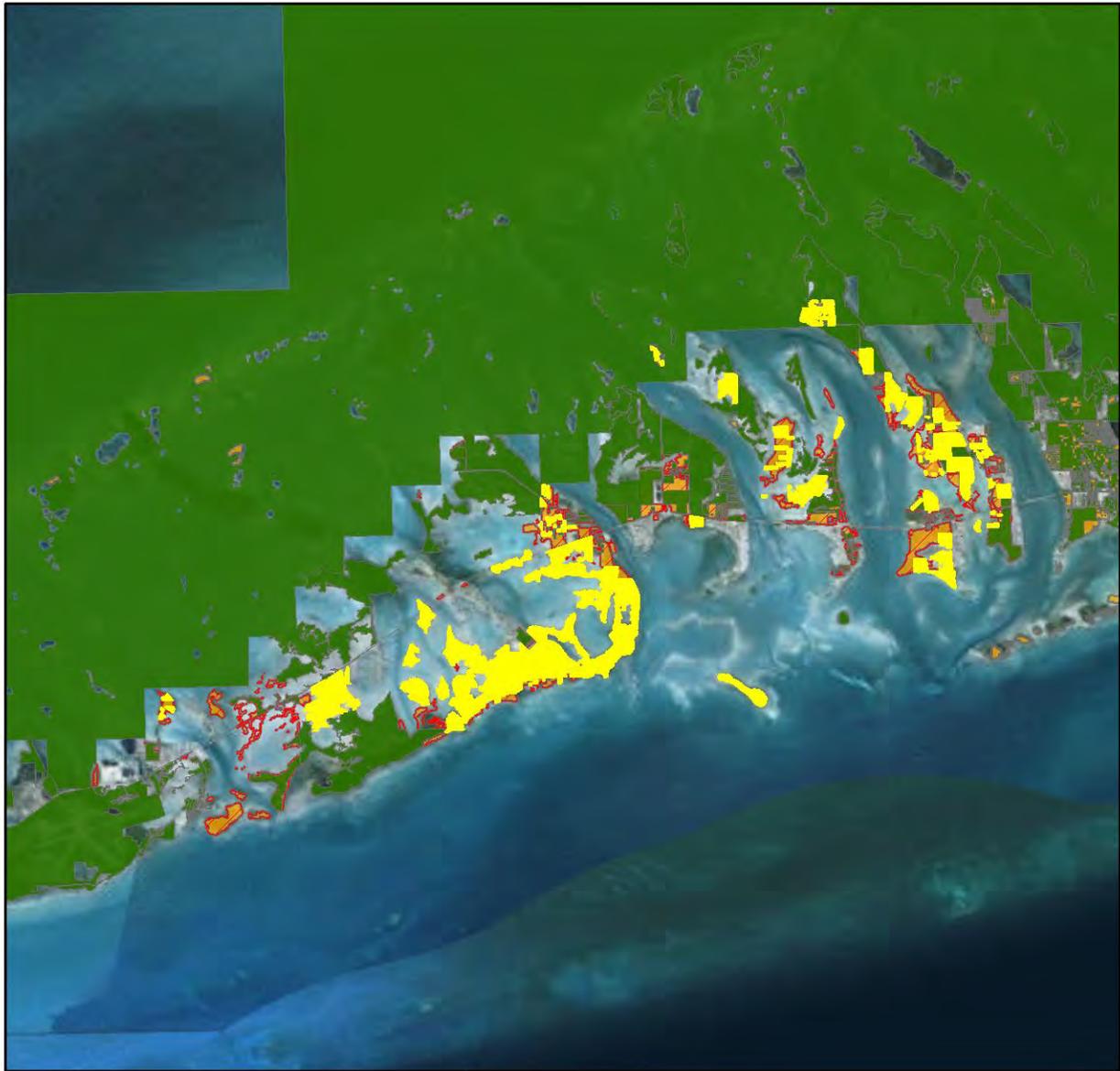


Figure 31. FKWEA Optimal Conservation Planning Boundary – Lower Keys

5.12 Research Opportunities

The FWC intends to cooperate with researchers, universities, and others as feasible and appropriate. For the FKWEA, the FWC will continue to assess and identify research needs, and pursue research and environmental education partnership opportunities as appropriate. Research proposals involving the use of the area are evaluated on an individual basis. All research activities on the FKWEA must have prior approval by FWC.

5.13 Cooperative Management and Special Uses

5.13.1 Cooperative Management

The FWC is responsible for the overall management and operation of the FKWEA as set forth in the lease agreements with the Board of Trustees. In keeping with the lease agreements, and in order to conduct its management operations in the most effective and efficient manner, the FWC cooperates with other agencies to achieve management goals and objectives described in this management plan. These include cooperating with the DHR to ensure the requirements of the Management Procedures Guidelines - Management of Archaeological and Historical Resources document (Appendix 13.9) are followed with regard to any ground-disturbing activities. In addition, the FFS assists the FWC by providing technical assistance on forest resource management when necessary. Also, the FWC cooperates and consults with the SFWMD and the DEP for the monitoring and management of both ground and surface water resources and the overall management of the FKWEA.

The FWC continues to cooperate with the NOAA, the DEP, and Florida Keys National Marine Sanctuary staff on a range of issues regarding the waters that surround the FKWEA, all of which fall within the Florida Keys National Marine Sanctuary. The FWC also cooperates with the USFWS and the National Key Deer Refuge in the management and protection of the wildlife and natural communities of the Florida Keys.

Additionally, the FWC cooperates with the Monroe County Land Authority on the conservation, protection, and use of land within the Florida Keys. The FWC also cooperates with the DEO in the administration of the requirements of the Florida Keys Area of Critical State Concern.

5.13.2 First Responder and Military Training

First-responder (public governmental police department or agency, fire and emergency medical service personnel) training and military training are often conditionally allowed on many FWC-managed areas. However, due to the sensitivity of the habitat and natural resources of the area, first-responder training and military training are prohibited on the FKWEA.

5.13.3 Apiaries

Currently, there are no apiaries operating on the FKWEA. Use of apiaries is conditionally approved for the FKWEA and is deemed to be consistent with purposes for acquisition, is in compliance with the Conceptual State Lands Management Plan, and is consistent with the FWC agency mission, goals, and objectives as expressed in the agency Strategic Plan and priorities document (Appendix 13.7). Location, management, and administration of apiaries on is guided by the FWC Apiary Policy (Appendix 13.8). The FWC Apiary Policy states that apiaries should not be located in areas that are within one-half of a mile of a boundary or in areas that may be potentially prone to flooding. As a result, at the current time, there are no appropriate sites on the FKWEA for the placement of apiaries.

5.14 Climate Change

Because of Florida's unique ecology and topography, any potential impacts as a result of climate change may be particularly acute and affect multiple economic, agricultural, environmental, and health sectors across the state. The impact of climate change on wildlife and habitat may already be occurring, from eroding shorelines and coral bleaching to increases in forest fires and saltwater intrusion into inland freshwater wetlands.

The Intergovernmental Panel on Climate Change (IPCC), a multi-national scientific body, reports that climate change is likely proceeding at a rate where there will be unavoidable impacts to humans, wildlife, and habitat. Given current levels of heat-trapping greenhouse gas emissions, shifts in local, regional, and national climate patterns including changes in precipitation, temperature, increased frequency and intensity of extreme weather events, rising sea levels, tidal fluctuations, and ocean acidification are projected. The current trend of global temperature increase has appeared to accelerate in recent decades, and continued greenhouse gas emissions may result in projected global average increases of 2 – 11.5° F by the end of the century.⁵

This apparent change in global climate has the potential to disrupt natural processes; in some areas, climate change may cause significant degradation of ecosystems that provide services such as clean and abundant water, sustainable natural resources, protection from flooding, as well as fishing and other recreational opportunities. Consequently, climate change is a challenge not only because of its likely direct effects, but also because of its potential to amplify the stress on ecosystems, habitats, and species from existing threats



such as exponential increases in surface and ground water use, habitat loss due to increased urbanization, introduction of invasive species, and fire suppression.

Potential impacts that may be occurring as a result of climate change include: change in the timing of biological processes, such as flowering, breeding, hibernation, and migration;^{6, 7, 8} more frequent invasions and outbreaks of exotic invasive species;⁹ and loss of habitat in coastal areas due to sea level rise.¹⁰ Some species are projected to adjust to these conditions through ecological or evolutionary adaptation, whereas others are projected to exhibit range shifts as their distributions track changing climatic conditions. Those species that are unable to respond to changing climatic conditions are projected to go extinct. Some estimates suggest that as many as 20% - 30% of the species currently assessed by the IPCC are at risk of extinction within this century if global mean temperatures exceed increases of 2.7 – 4.5° F.¹¹ A number of ecosystems are projected to be affected at temperature increases well below these levels.

At this time, the potential effects of climate change on Florida's conservation lands are just beginning to be studied and are not yet well understood. For example, FWC has begun a process for currently developing climate change adaptation strategies for monitoring, evaluating, and determining what specific actions, if any, may be recommended to ameliorate the projected impacts of climate change on fish and wildlife resources, native vegetation, and the possible spread of exotic and invasive species. Currently, FWC is continuing its work on the development of these potential adaptation strategies. However, as noted above, the effects of climate change may become more frequent and severe within the time period covered by this Management Plan.

For these reasons, there is a continuing need for increased information and research to enable adaptive management to cope with potential long-term climate change impacts. The most immediate actions that FWC can take are to work with partners to gather the best scientific data possible for understanding natural processes in their current state, model possible impacts and subsequent changes from climate change, develop adaptive management strategies to enhance the resiliency of natural communities to adapt to climate change, and formulate criteria and monitoring for potential impacts when direct intervention may be necessary to protect a species. To this end, when appropriate, FWC will participate in organizations such as the Peninsular Florida Land Conservation Cooperative or similar organizations so that FWC continues to gain understanding and share knowledge of key issues related to potential climate change. In addition, FWC will consider the need for conducting vulnerability assessments to model the potential effects of climate change, especially sea level rise and storm events, on imperiled species and their habitats on FWC managed land.

Climate change could have a very significant impact on the FKWEA. Elements of climate change that may potentially affect the FKWEA include inundation and saltwater intrusion from sea level rise (Figures 28-30), loss of habitat, more frequent and more potent storm events, and alteration of vegetation reproductive cycles. Saltwater intrusion into the already sparse and fragile freshwater resources of the Lower Keys would have a devastating impact on a wide range of wildlife species. The results of a Sea Level Affecting Marsh Model for the FKWEA shows habitats that may potentially be impacted. The low-



lying coastal habitats, which make virtually the entirety of the FKWEA, are projected to face the most direct and dramatic impacts of climate change, particularly from a projected rising sea level and from the projected increased frequency and intensity of coastal storms.^{12, 13, 14, 15} The potential loss of habitat may result in the loss of species using that habitat, including migrating and nesting birds. Storm events also cause considerable physical damage to native vegetation along vulnerable shorelines,

impacting nesting habitat for sea life and shorebirds. The projected rise in sea levels may decrease the availability and abundance of prey for wading birds that forage in shallow waters on the expansive tidal flats of the Florida Keys. Climate change may amplify and hasten these effects, potentially at rates that exceed the normal resiliency of plant communities to recover, shift or adapt accordingly.^{16, 17} Projected salt water intrusion into the subsurface freshwater lens from potential sea level rise and saltwater inundation of surface freshwaters from storm surges may alter coastal ecosystems and freshwater marshes, possibly resulting in more salt-tolerant aquatic plant communities.

To address the potential impacts of climate change on the FKWEA, Goals and Objectives have been developed as a component of this Management Plan (Section 6.12). Depending on the recommendations of the adaptive management strategies described above, additional specific goals and objectives to mitigate potential climate change impacts may be developed for the FKWEA Management Plan in the future.

5.15 Soil and Water Conservation

Soil disturbing activities will be confined to areas that have the least likelihood of experiencing erosion challenges. On areas that have been disturbed prior to acquisition, an assessment will be made to determine if soil erosion is occurring, and if so, appropriate measures will be implemented to stop or control the effects of this erosion. Water conservation is accomplished through hydrological restoration, management, and monitoring as described in Section 5.7, above.

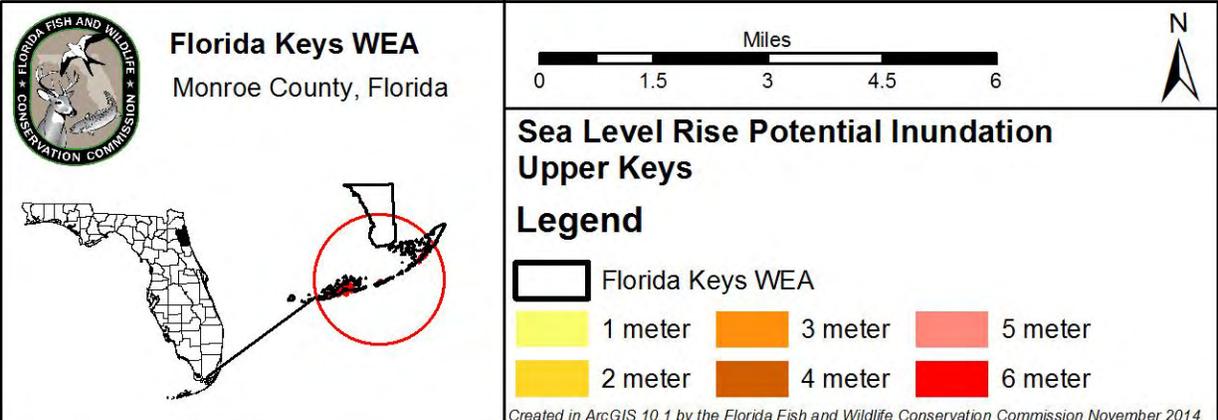
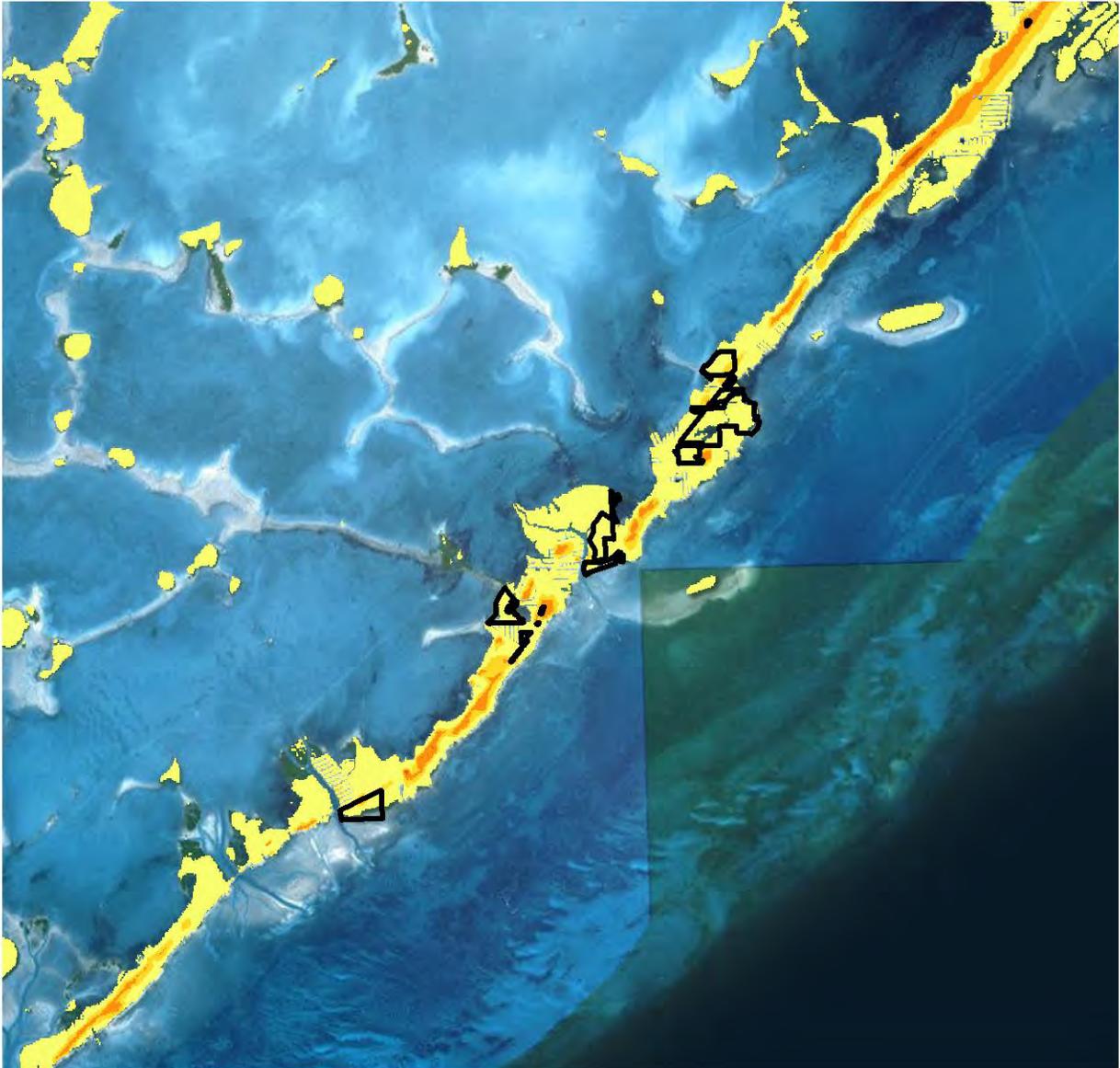


Figure 32. Sea Level Rise Potential Inundation – Upper Keys

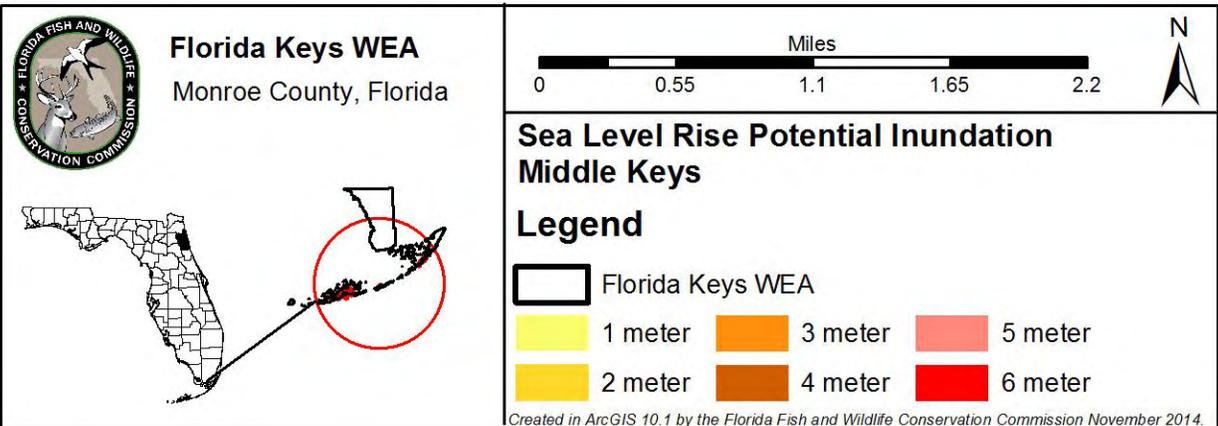


Figure 33. Sea Level Rise Potential Inundation – Middle Keys

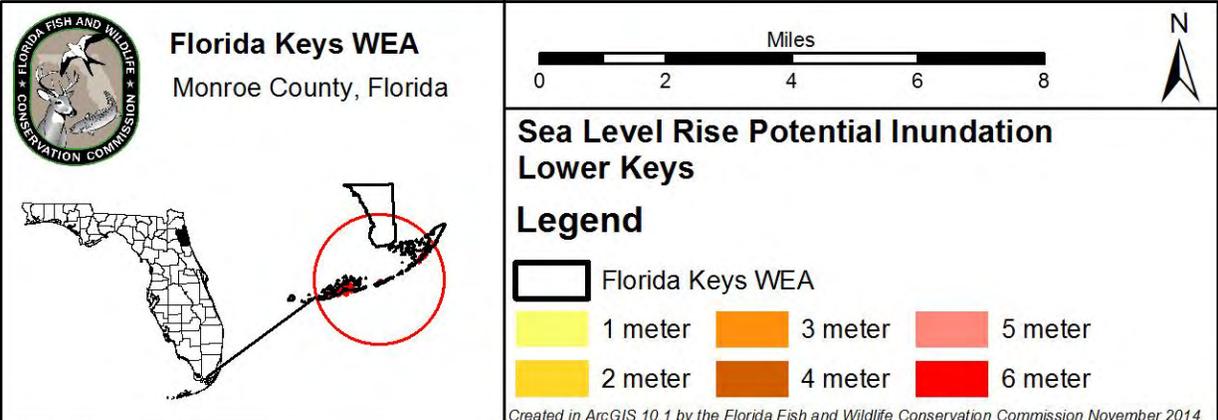
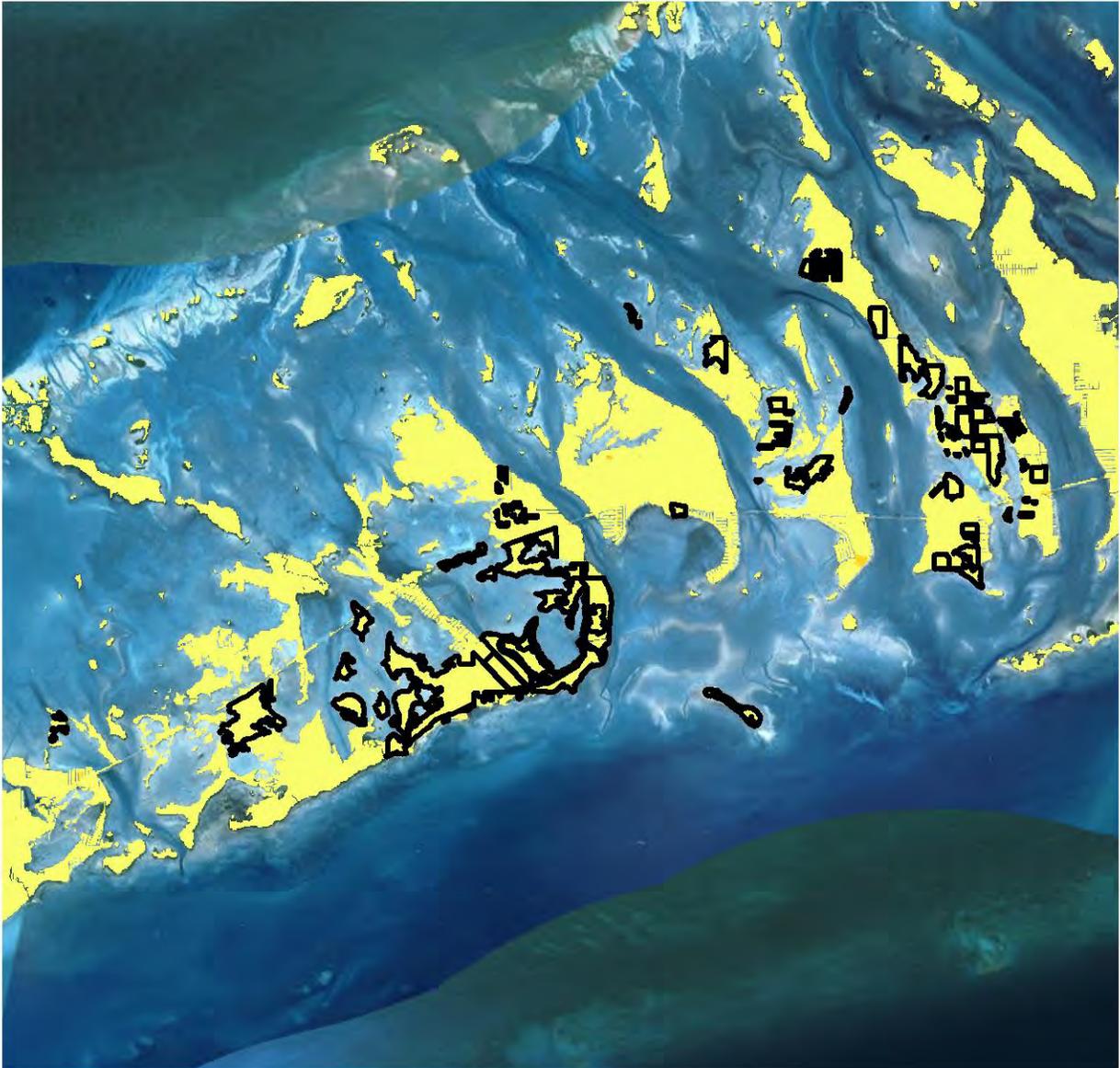


Figure 34. Sea Level Rise Potential Inundation – Lower Keys

6 Resource Management Goals and Objectives

The management goals described in this section are considered broad, enduring statements designed to guide the general direction of management actions to be conducted in order to achieve an overall desired future outcome for the FKWEA. The objectives listed within each management goal offer more specific management guidance and measures, and are considered the necessary steps to be completed to accomplish the management goals. Many of the objectives listed have specific end-of-the-calendar-year target dates for completion and all of them are classified as having either short-term (less than two years) or long-term (up to ten years) timelines for completion.

6.1 Habitat Restoration and Improvement

Goal: Improve extant habitat and restore disturbed areas.

Short-term

- 6.1.1 Continue to work with the FNAI to develop and update mapping of historic and current natural communities.
- 6.1.2 Conduct habitat/natural community improvement including ground preparation and planting native species beneficial to wildlife on approximately five acres per year, or as necessary and feasible, in Snake Creek and Sandy Sprunt Dove Creek Hammocks as well as on approximately one acre per year in Vaca Cut Hammock (Figure 35).
- 6.1.3 Initiate identification of freshwater depressions on the area that are in need of habitat improvement or restoration.
- 6.1.4 Coordinate with the USFWS, the FNAI, and other agencies as applicable to obtain site locations for freshwater depressions on the area.
- 6.1.5 Continue to cooperate with Monroe County on use of tropical hardwood hammock mitigation funds to restore and improve tropical hardwood hammocks on the area.

Long-term

- 6.1.6 Continue to conduct habitat/natural community improvement including ground preparation and planting native species beneficial to wildlife on approximately 10 acres per year, or as necessary and feasible, in Snake Creek, Sandy Sprunt Dove Creek Hammocks, and Vaca Cut Hammock (Figure 35).
- 6.1.7 If new parcels are acquired, conduct habitat/natural community improvement or restoration activities as necessary and appropriate.
- 6.1.8 Restore or improve freshwater depressions on the area as necessary and feasible.

- 6.1.9 In cooperation with the USFWS, the FNAI, and other agencies, continue to identify and map locations of freshwater depressions on the area.
- 6.1.10 Continue to cooperate with Monroe County on use of tropical hardwood hammock mitigation funds to restore and improve tropical hardwood hammocks on the area.

6.2 Imperiled and Focal Species Habitat Maintenance, Enhancement, Restoration, or Population Restoration

Goal: Maintain, improve, or restore imperiled species populations and habitats.

Short-term

- 6.2.1 Continue to implement the WCPR strategy by managing identified habitats and monitoring identified species.
- 6.2.2 Monitor 13 imperiled and focal species and one focal species group (American crocodile, Florida Keys mole skink, rim rock crown snake, striped mud turtle, swallow-tailed kite, black-whiskered vireo, mangrove cuckoo, southern bald eagle, wading birds, white-crowned pigeon, Florida Key deer, Lower Keys marsh rabbit, silver rice rat, and Florida tree snail).
- 6.2.3 Continue to collect opportunistic wildlife species occurrence data.
- 6.2.4 Determine presence or absence of mangrove cuckoos on parcels with adequate mangrove and tropical hardwood hammock habitat by 2017.
- 6.2.5 Survey and identify FKWEA parcels for presence or absence of Florida tree snails by 2017.
- 6.2.6 By 2017, identify and prioritize parcels of Lower Keys marsh rabbit habitat that are adjacent to the FKWEA to facilitate species conservation through acquisition or landowner cooperation.
- 6.2.7 Coordinate and work with white-crowned pigeon experts to develop a monitoring protocol for the species.
- 6.2.8 Initiate working with species experts and area staff on developing a monitoring protocol for Florida tree snails.
- 6.2.9 Monitor parcels with trees snails biennially to determine persistence of the species.
- 6.2.10 Coordinate with the USFWS for monitoring and habitat mapping of imperiled and rare butterfly species.

- 6.2.11 Update the FKWEA Arthropod Control Plan and restrict and monitor mosquito control activities that are potentially harmful to non-target species on the FKWEA.
- 6.2.12 Monitor occurrences of the imperiled semaphore cactus on the FKWEA.
- 6.2.13 Continue reintroduction of the imperiled semaphore cactus on appropriate sites throughout the FKWEA.
- 6.2.14 Continue to cooperate with the USFWS, Fairchild Tropical Botanical Garden, University of South Florida, and others to facilitate the reintroduction and establishment of the imperiled semaphore cactus on the FKWEA.

Long-term

- 6.2.15 Update and implement the WCPR strategy by 2024.
- 6.2.16 Continue to monitor 13 imperiled and focal species and one focal species group (American crocodile, Florida Keys mole skink, rim rock crown snake, striped mud turtle, swallow-tailed kite, black-whiskered vireo, mangrove cuckoo, southern bald eagle, wading birds, white-crowned pigeon, Florida Key deer, Lower Keys marsh rabbit, silver rice rat, and Florida tree snail).
- 6.2.17 Conduct a survey for the white-crowned pigeon.
- 6.2.18 Conduct a survey for six imperiled reptiles (rim rock crown snake, Keys mole skink, red rat snake, peninsula ribbon snake, Key ringneck snake, and Florida brown snake).
- 6.2.19 Conduct a survey for mangrove cuckoo on the FKWEA.
- 6.2.20 If determined to be feasible, cooperate with the USFWS to conduct presence/absence surveys for the striped mud turtle and silver rice rat.
- 6.2.21 Conduct a survey for imperiled freshwater and brackish fish species, including Key silverside and mangrove rivulus.
- 6.2.22 Continue to collect opportunistic wildlife species occurrence data.
- 6.2.23 Continue working with white-crowned pigeon experts to develop a monitoring protocol, identify the conservation role the FKWEA has for this species, and implement the monitoring protocol for the FKWEA by 2019.
- 6.2.24 In cooperation with species experts and area staff, complete development of a monitoring protocol for Florida tree snails by 2018.
- 6.2.25 Continue to monitor parcels with trees snails biennially to determine the persistence

of that species.

- 6.2.26 Coordinate with the USFWS for monitoring and habitat mapping of imperiled and rare butterfly species.
- 6.2.27 Per the updated FKWEA Arthropod Control Plan, continue to restrict and monitor mosquito control activities potentially harmful to non-target species on the FKWEA.
- 6.2.28 Continue to monitor occurrences of the imperiled semaphore cactus on the FKWEA.
- 6.2.29 Continue reintroduction of the imperiled semaphore cactus on appropriate sites throughout the FKWEA.
- 6.2.30 Continue to cooperate with the USFWS, Fairchild Tropical Botanical Garden, University of South Florida, and others to facilitate the reintroduction and establishment of the imperiled semaphore cactus on the FKWEA.

6.3 Other Wildlife (Game and Nongame) Habitat Maintenance, Enhancement, Restoration, or Population Restoration

Goal: Monitor, maintain, improve, or restore game and non-game species populations and habitats.

Short-term

- 6.3.1 Continue to document nesting occurrences of Wilson’s plover on the area and protect nest sites as needed.
- 6.3.2 Continue to monitor for butterfly species, including Palatka skipper, mangrove buckeye, martial scrub-hairstreak, Florida white, and Florida purplewing.
- 6.3.3 Continue to collect opportunistic wildlife occurrence data for uncommon species.

Long-term

- 6.3.4 Continue to document nesting occurrences of Wilson’s plover on the area and protect nest sites as needed.
- 6.3.5 Continue to monitor for butterfly species on the area, including Palatka skipper, mangrove buckeye, martial scrub-hairstreak, Florida white, and Florida purplewing.
- 6.3.6 Continue to collect opportunistic wildlife occurrence data on uncommon species.
- 6.3.7 As feasible, plant appropriate native fruit-bearing and nectar plant species as food sources for resident and migratory birds and butterfly species.

6.4 Exotic and Invasive Species Maintenance and Control

Goal: Remove exotic and invasive plants and animals and conduct needed maintenance and control.

Short-term

- 6.4.1 Annually treat at least 30 acres of EPPC Category I and Category II invasive exotic plant species.
- 6.4.2 Implement control measures on at least nine exotic plant species, including Australian pine, Asiatic colubrina, leadtree, sapodilla, Guinea grass, bowstring hemp, beach naupaka, Brazilian pepper and seaside mahoe, as well as other species on the area, as necessary and appropriate.
- 6.4.3 As necessary, implement control measures on red imported fire ants and Gambian pouch rats.
- 6.4.4 Monitor for and, as necessary, control other exotic animal species, including Burmese python, Nile monitor, common boa and Argentine tegu.
- 6.4.5 Contract to conduct survey and mapping of invasive exotic plant species on the Sugarloaf Key Johnson Tract.
- 6.4.6 Continue to cooperate with the Florida Keys Invasive Exotic Task Force to update the priority list for addressing exotic plant and animal species.
- 6.4.7 In cooperation with the Florida Keys Invasive Exotic Task Force, develop Early Detection Rapid Response protocols for invasive plant and animal species.

Long-term

- 6.4.8 Continue to annually treat at least 30 acres of EPPC Category I and Category II invasive exotic plant species.
- 6.4.9 Implement control measures on at least nine exotic plant species, including Australian pine, Asiatic colubrina, leadtree, sapodilla, Guinea grass, bowstring hemp, beach naupaka, Brazilian pepper and seaside mahoe, as well as other species on the area, as necessary and appropriate.
- 6.4.10 As necessary, implement control measures on red imported fire ants and Gambian pouch rats.
- 6.4.11 Continue to monitor for and control as necessary other exotic animal species, including Burmese python, Nile monitor, common boa and Argentine tegu.

- 6.4.12 Continue to contract to conduct survey and mapping of invasive exotic plant species on newly acquired parcels.
- 6.4.13 In coordination with the FWC Nonnative Fish and Wildlife Program, develop and implement an exotic animal species control strategy for the FKWEA.
- 6.4.14 Continue to cooperate with the Florida Keys Invasive Exotic Task Force to update the priority list for addressing exotic plant and animal species.
- 6.4.15 In cooperation with the Florida Keys Invasive Exotic Task Force, continue to develop Early Detection Rapid Response protocols for invasive plant and animal species.

6.5 Public Access and Recreational Opportunities

Goal: Provide public access and recreational opportunities.

Short-term

- 6.5.1 Maintain public access and recreational opportunities to allow for a recreational carrying capacity of 32 visitors per day.
- 6.5.2 Develop additional public access and recreational opportunities to allow for a carrying capacity of 168 visitors per day primarily through enhancement of recreational opportunities on the Sandy Sprunt Dove Creek Hammocks and the Johnson Tract.
- 6.5.3 Continue to provide a website, three-panel kiosk at Sammy Creek Landing, and bird list for interpretation and education.
- 6.5.4 Develop a Recreation Master Plan for the FKWEA.
- 6.5.5 Develop and establish at least six miles of trails on the Sandy Sprunt Dove Creek Hammocks and the Johnson Tract, in cooperation with Monroe County which owns the former road right-of-way.
- 6.5.6 Monitor trails annually for visitor impacts.
- 6.5.7 Continue to provide paddling access at appropriate locations.
- 6.5.8 Continue to provide fishing opportunities on appropriate water bodies and at appropriate locations.
- 6.5.9 Cooperate with the DEP on the Overseas Heritage Trail.
- 6.5.10 Coordinate and cooperate with the Monroe County Tourism Development Council to promote recreation and awareness of the FKWEA.

Long-term

- 6.5.11 Develop new interpretive/education programs including a recreation guide, trail guide and map, and two kiosks at the Johnson Tract and Sandy Sprunt Dove Creek Hammocks (Figure 35).
- 6.5.12 Continue to provide a website, three-panel kiosk at Sammy Creek Landing, and bird list for interpretation and education.
- 6.5.13 Continue to monitor trails annually for visitor impacts.
- 6.5.14 Reassess recreational opportunities every three years.
- 6.5.15 Continue to provide paddling access at appropriate locations.
- 6.5.16 Continue to provide fishing opportunities on appropriate water bodies and at appropriate locations.
- 6.5.17 Continue to cooperate with the DEP on the Overseas Heritage Trail.
- 6.5.18 Cooperate with other agencies, Monroe County, stakeholders, and regional landowners to investigate regional recreational opportunities including linking hiking and multi-use trail systems between adjacent public areas as feasible and appropriate.
- 6.5.19 Continue to identify partnerships that could provide for environmental educational programs and outreach.
- 6.5.20 Continue to coordinate and cooperate with the Monroe County Tourism Development Council to promote recreation and awareness of the FKWEA.
- 6.5.21 Propose selected sites of the FKWEA for Great Florida Birding and Wildlife Trail designation.

6.6 Hydrological Preservation and Restoration

Goal: Protect water quality and quantity, restore hydrology to the extent feasible, and maintain the restored condition.

Short-term

- 6.6.1 Conduct or obtain a site hydrological assessment to identify potential hydrology restoration needs on the area.
- 6.6.2 To maintain and enhance natural hydrological functions, install and maintain low-water crossings and culverts as appropriate.

- 6.6.3 Continue to cooperate with the SFWMD, the National Marine Sanctuary, and the DEP for the monitoring of surface and ground water quality and quantity.

Long-term

- 6.6.4 To maintain and enhance natural hydrological functions, continue to install and maintain low-water crossings and culverts as appropriate.
- 6.6.5 Implement the recommendations of the hydrological assessment.
- 6.6.6 Restore natural hydrologic condition and functions on the area as recommended by the hydrological assessment.
- 6.6.7 Continue to cooperate with the SFWMD, the National Marine Sanctuary, and the DEP for the monitoring of surface and ground water quality and quantity.

6.7 Forest Resource Management

Goal: Manage timber resources to improve or restore natural communities for the benefit of wildlife.

Short-term

- 6.7.1 Continue to assess and evaluate the health and viability of the tropical hardwood hammocks on the area.
- 6.7.2 Continue to manage, maintain, and preserve the tropical hardwood hammocks on the area.

Long-term

- 6.7.3 Continue to assess and evaluate the health and viability of the tropical hardwood hammocks on the area.
- 6.7.4 Continue to manage, maintain, and preserve the tropical hardwood hammocks on the area.

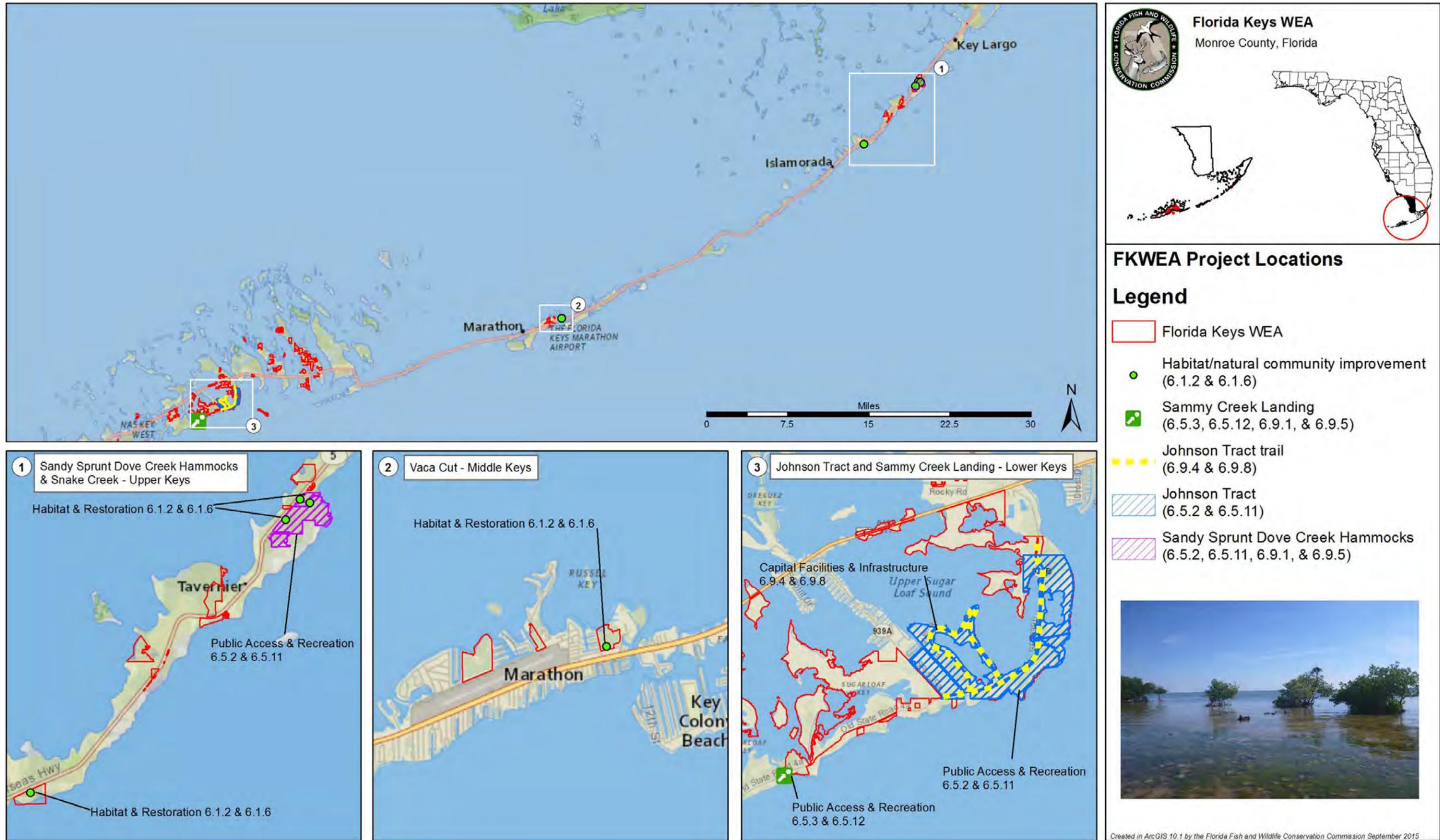


Figure 35. FKWEA Project Locations

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6.8 Historical Resources

Goal: Protect, preserve and maintain historical resources.

Short-term

- 6.8.1 Ensure all known sites are recorded in the DHR Master Site file.
- 6.8.2 Continue to monitor, protect, and preserve as necessary 14 identified sites.
- 6.8.3 Cooperate with the DHR in designing site plans for development of infrastructure.
- 6.8.4 Continue to cooperate with the DHR to manage and maintain known existing historical resources.
- 6.8.5 Coordinate with the DHR to ensure that FWC staff receives Archaeological Resources Management training.
- 6.8.6 Coordinate with the DHR to assess the need for conducting a historical resource survey.
- 6.8.7 Continue to follow the DHR's Management Procedures for Archaeological and Historical Sites and Properties on State-Owned or Controlled Properties for the management of cultural and historic resources.

Long-term

- 6.8.8 Continue to cooperate with the DHR in designing site plans for development of infrastructure and providing guidelines for all ground-break activities.
- 6.8.9 Continue to cooperate with the DHR to manage and maintain known existing historical resources.
- 6.8.10 Continue to monitor, protect, and preserve as necessary 14 identified sites.
- 6.8.11 Continue to coordinate with the DHR to ensure that FWC staff receives Archaeological Resources Management training.
- 6.8.12 Ensure any new acquisitions with identified sites are adequately documented and monitored.
- 6.8.13 Continue to follow the DHR's Management Procedures for Archaeological and Historical Sites and Properties on State-Owned or Controlled Properties for the management of cultural and historic resources.

6.9 Capital Facilities and Infrastructure

Goal: Develop the capital facilities and infrastructure necessary to meet the goals and objectives of this Management Plan.

Short-term

- 6.9.1 Continue to maintain 2 facilities (Sammy Creek Landing and Sandy Sprunt Dove Creek Hammocks).
- 6.9.2 Maintain 5.5 miles of roads.
- 6.9.3 Monitor trails and infrastructure annually for visitor impacts.
- 6.9.4 Cooperate with Monroe County on the use of approximately 6 miles of county owned former road right-of-way to use as trails on the Johnson Tract.

Long-term

- 6.9.5 Continue to monitor trails and infrastructure annually for visitor impacts.
- 6.9.6 Continue to maintain 2 facilities.
- 6.9.7 Continue to maintain 5.5 miles of roads.
- 6.9.8 Continue to cooperate with Monroe County on the use of approximately 6 miles of county right-of-way trails on the Johnson Tract.

6.10 Land Conservation and Stewardship Partnerships

Goal: Enhance fish and wildlife conservation, resource, and operational management through development of an optimal boundary.

Short-term

- 6.10.1 Identify potential important wildlife habitat, landscape-scale linkages, wildlife corridors, and operational/resource management needs.
- 6.10.2 Identify and develop conservation stewardship partnerships.
- 6.10.3 Identify and pursue conservation acquisition needs.
- 6.10.4 Develop and maintain a GIS shapefile and other necessary data to facilitate nominations from the FWC OCPB and for FWC's LAP and Land Acquisition Programs.
- 6.10.5 Develop a CAS.

- 6.10.6 Contact and inform adjoining landowners about the FWC LAP to pursue non-acquisition conservation stewardship, partnerships, and potential conservation easements.
- 6.10.7 Identify parcels that should be added to the FWC acquisition list.
- 6.10.8 Identify potential non-governmental organization partnerships and grant program opportunities.
- 6.10.9 Determine efficacy of conducting an adjacent landowner's assistance/conservation stewardship partnership workshop.
- 6.10.10 Identify potential conservation easements donations.
- 6.10.11 Evaluate and determine if any portions of the FKWEA are no longer needed for conservation purposes, and therefore may be designated as surplus lands.

Long-term

- 6.10.12 To minimize fragmentation of the area, continue to identify strategic parcels to revise the completed OCPB for FKWEA as appropriate and necessary.
- 6.10.13 Continue to identify and develop conservation stewardship partnerships.
- 6.10.14 Continue to identify and pursue conservation acquisition needs.
- 6.10.15 Continue to maintain a GIS shapefile and other necessary data to facilitate nominations from the FWC OCPB and for the FWC LAP and Land Acquisition Program.
- 6.10.16 Continue to propose nominations of selected properties as additions to the FWC acquisition list.
- 6.10.17 Continue to pursue acquisition of parcels added to the FWC acquisition list as acquisition work plan priorities and funding allow.
- 6.10.18 As feasible, continue to periodically contact and meet with adjacent landowners for willingness to participate in the CAS, and coordinate landowner assistance/conservation stewardship partnership workshops as deemed appropriate.
- 6.10.19 Coordinate and conduct landowner assistance/conservation stewardship partnership workshop(s) as necessary and appropriate.
- 6.10.20 Continue to identify potential conservation easements donations.

- 6.10.21 Continue to evaluate and determine if any portions of the FKWEA are no longer needed for conservation purposes, and therefore may be designated as surplus lands.

6.11 Cooperative Management and Special Uses

Goal: Provide access and use of the FKWEA to current cooperative managers and continue collaborative management efforts.

Short-term

- 6.11.1 Coordinate with USFWS, Florida Keys National Marine Sanctuary, Monroe County Land Authority, DEP Division of Recreation and Parks (DEP-DRP), TNC, and other conservation land managers on land acquisition, exotic species control and habitat and species management issues.
- 6.11.2 Continue to cooperate with the DEO Florida Keys Area of Critical State Concern regarding ongoing land use and planning issues for the area.
- 6.11.3 Cooperate with Monroe County on the use of approximately 6 miles of county owned former road right-of-way to use as trails on the Johnson Tract.

Long-term

- 6.11.4 Continue to coordinate with USFWS, Florida Keys National Marine Sanctuary, Monroe County Land Authority, DEP-DRP, TNC, and other conservation land managers on land acquisition, exotic species control and habitat and species management issues.
- 6.11.5 Continue to cooperate with the DEO Florida Keys Area of Critical State Concern regarding ongoing land use and planning issues for the area.
- 6.11.6 Continue to cooperate with Monroe County on the use of approximately 6 miles of county owned former road right-of-way to use as trails on the Johnson Tract.

6.12 Climate Change

Goal: Develop appropriate adaptation strategies in response to projected climate change effects and their potential impacts on natural resources, including fish and wildlife, and the operational management of the FKWEA.

Long-term

- 6.12.1 Coordinate with FWC-FWRI Climate Change Adaptation Initiative to identify potential impacts of projected climate change on fish and wildlife resources and operational management of the FKWEA.
- 6.12.2 Incorporate appropriate climate change adaptation strategies into the WCPR for the FKWEA.
- 6.12.3 As science, technology, and climate policy evolve, educate natural resource management partners and the public about the agency's policies, programs and efforts to study, document and address potential climate change; assess the need to incorporate public education about climate change into the update of the FKWEA Recreation Master Plan.

6.13 Research Opportunities

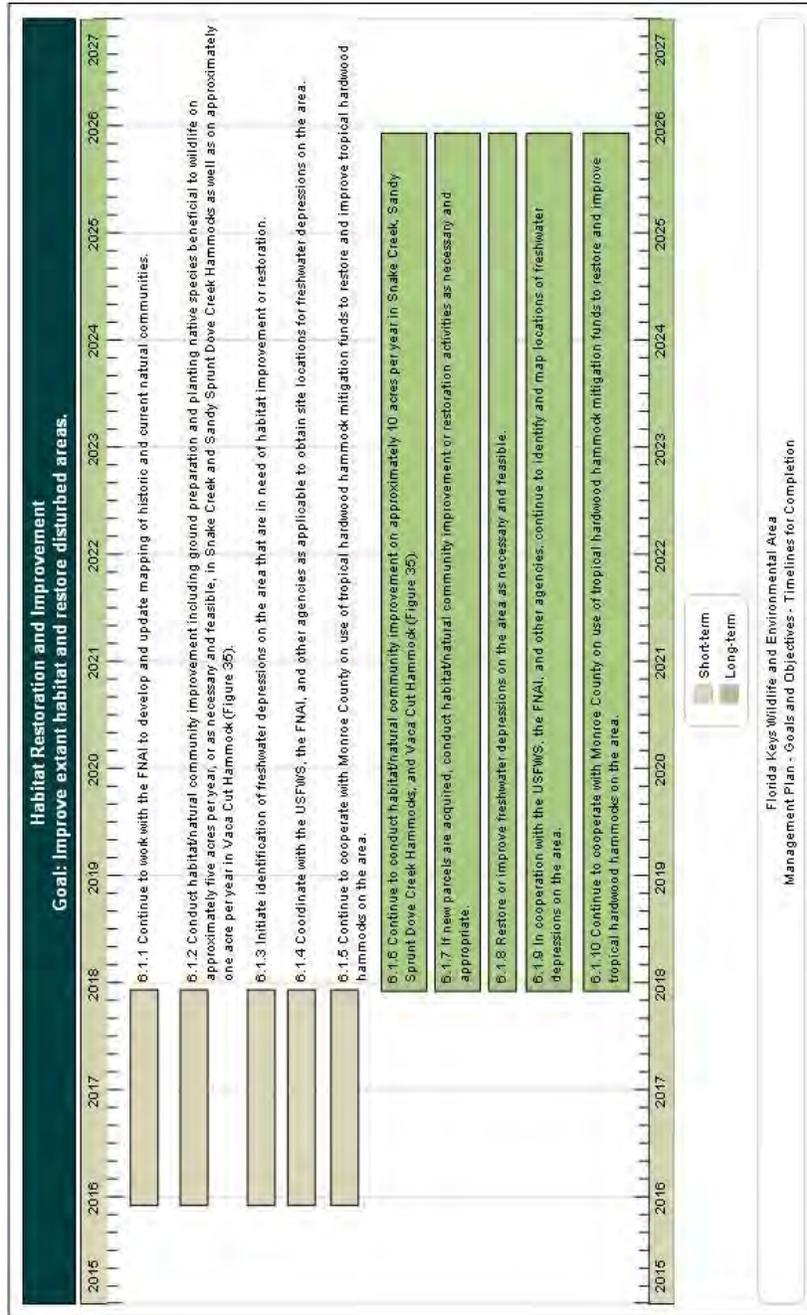
Goal: Explore and pursue cooperative research opportunities.

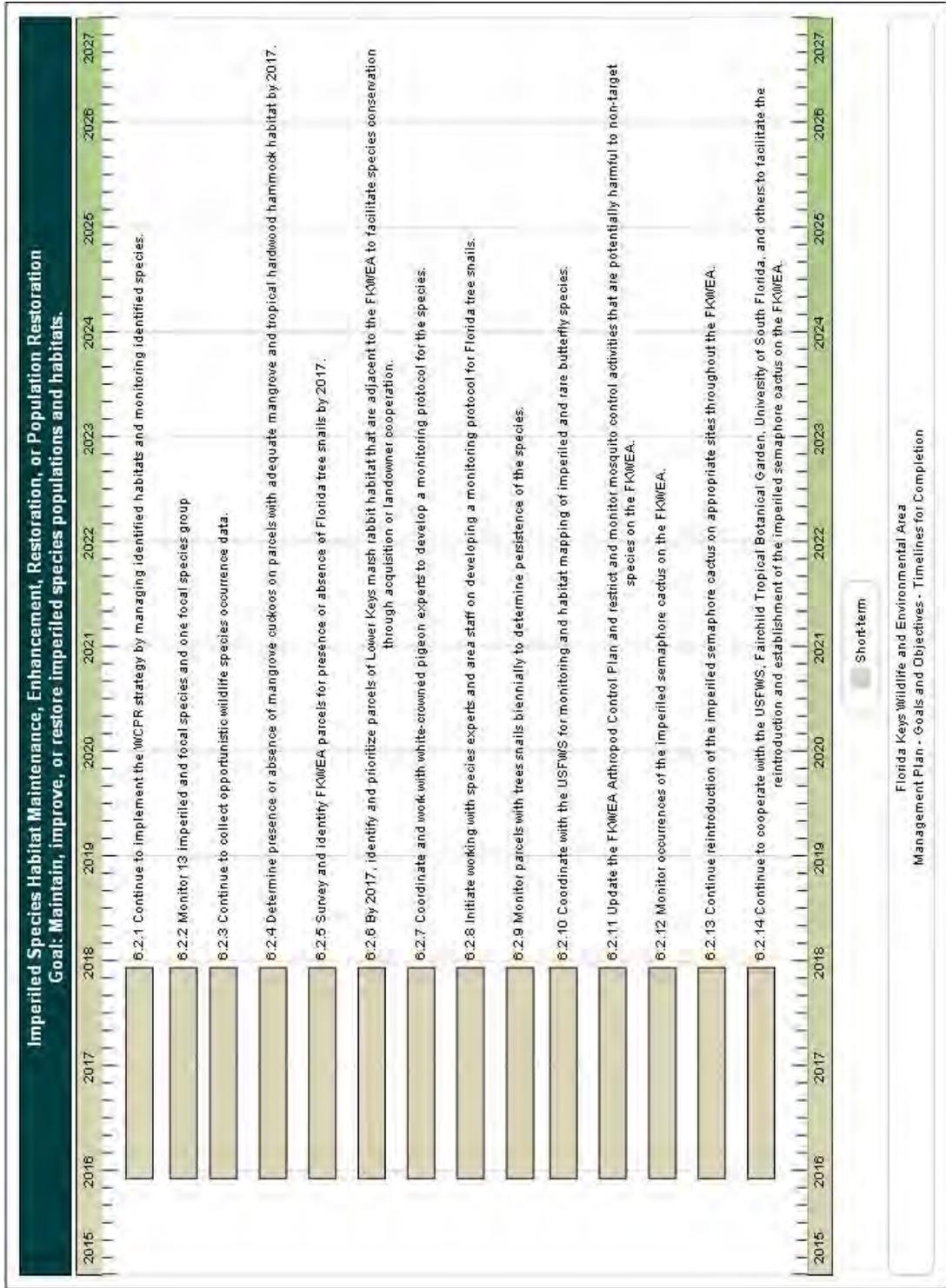
Long-term

- 6.13.1 Explore and pursue cooperative research opportunities through universities, FWRI, and other entities, including the USFWS, Fairchild Tropical Botanical Garden, and the University of South Florida
- 6.13.2 Continue to cooperate with researchers, universities, and others as appropriate.
- 6.13.3 Continue to assess the need for and pursue research and environmental education partnership opportunities as appropriate.

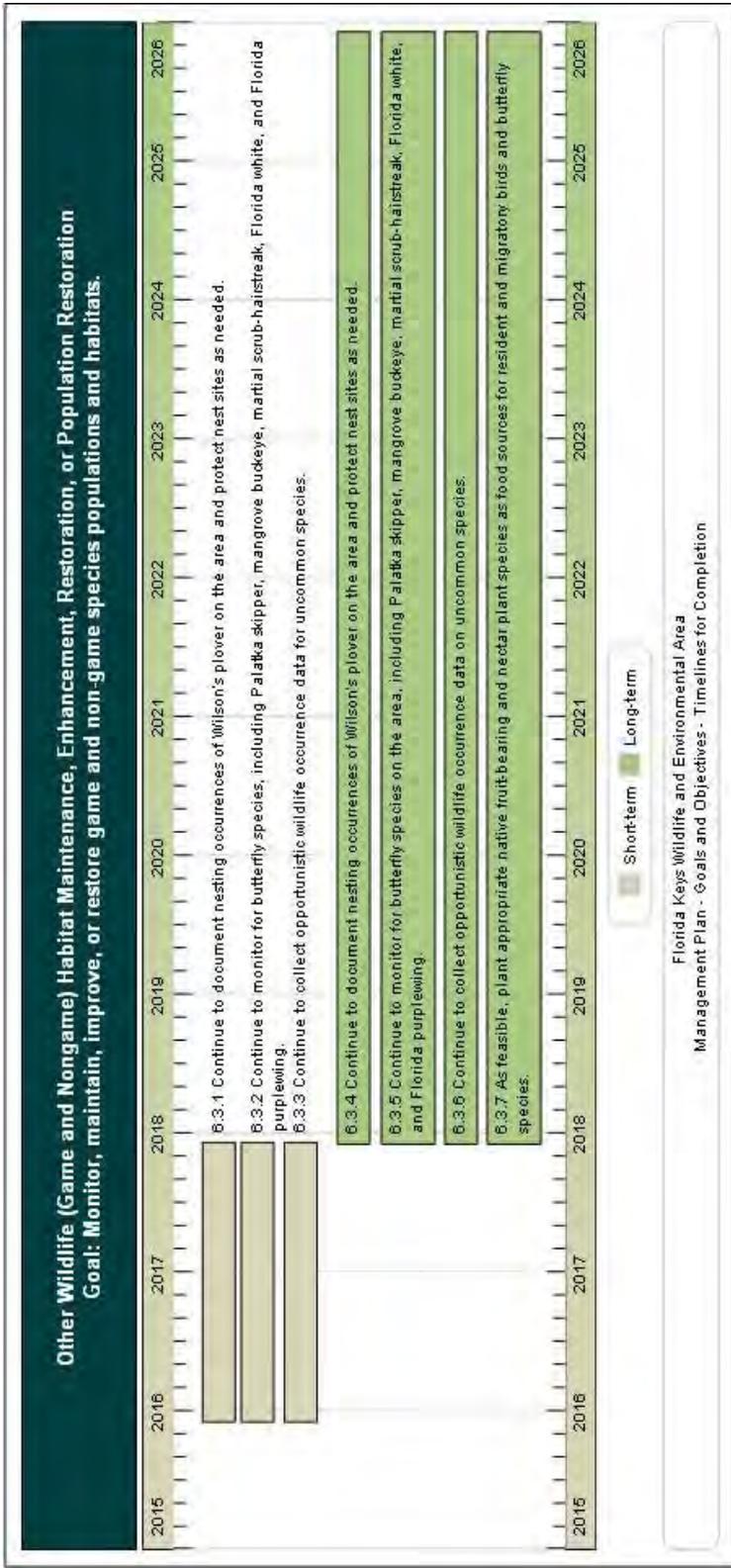
7 Schedule: Timelines for Completion of Resource Management Goals and Objectives

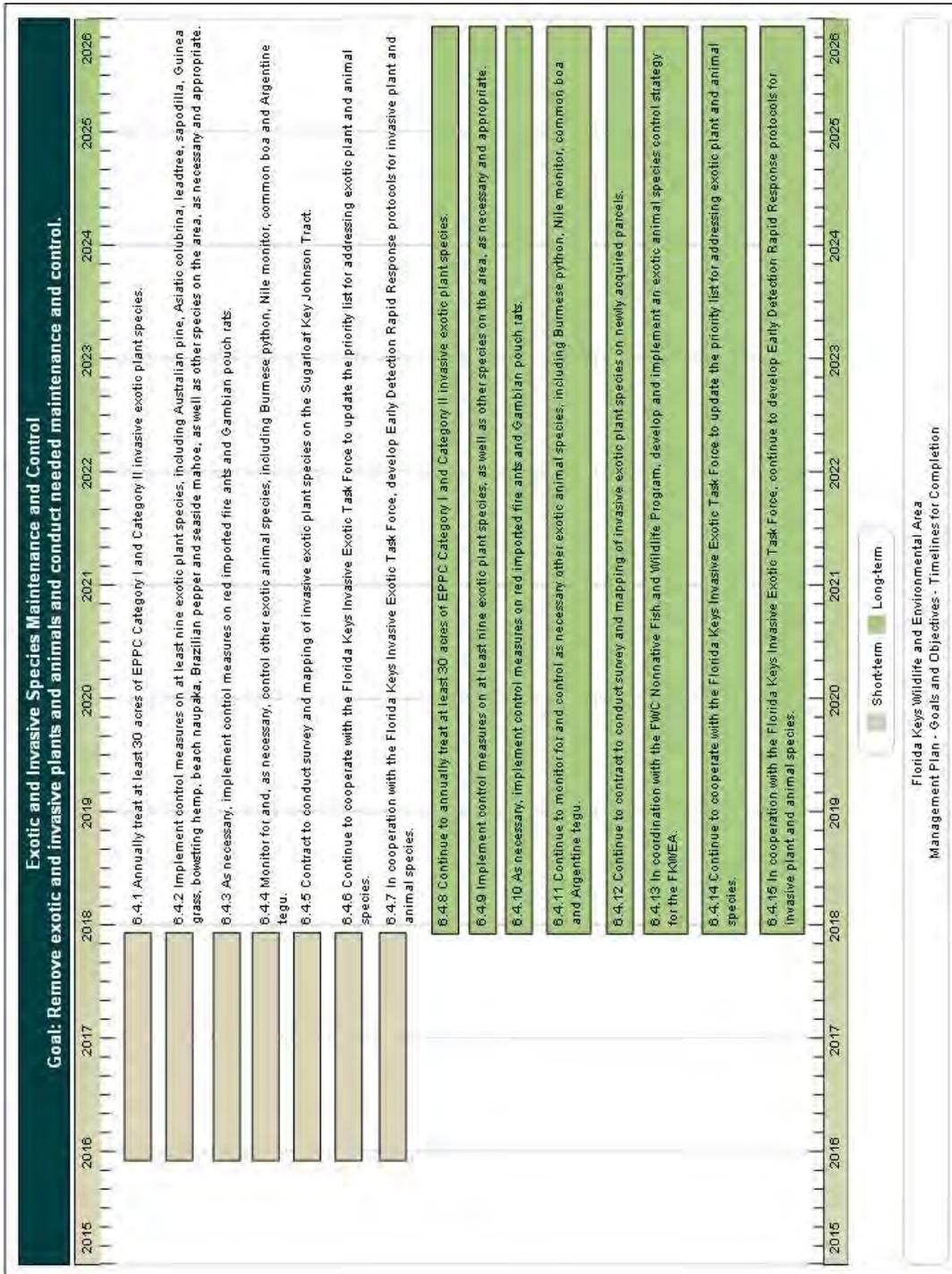
The following section presents the short- and long-term goals and objectives for the management of the FKWEA graphically in a timeline format. These timelines directly reflect the short- and long-term goals and objectives presented above in Section 6.



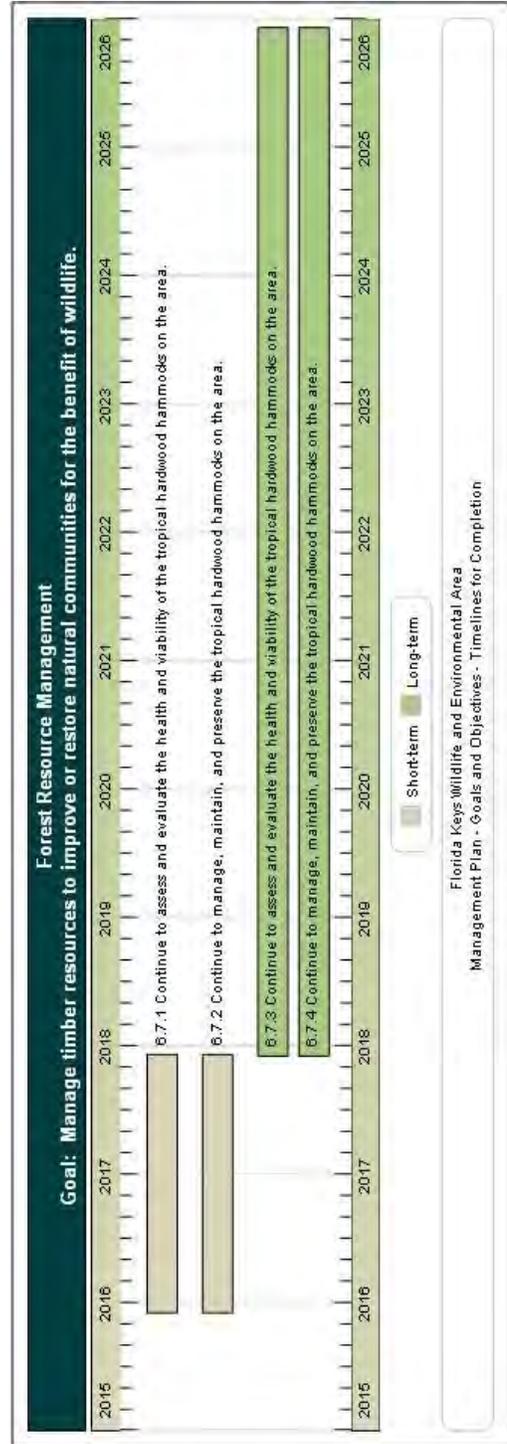
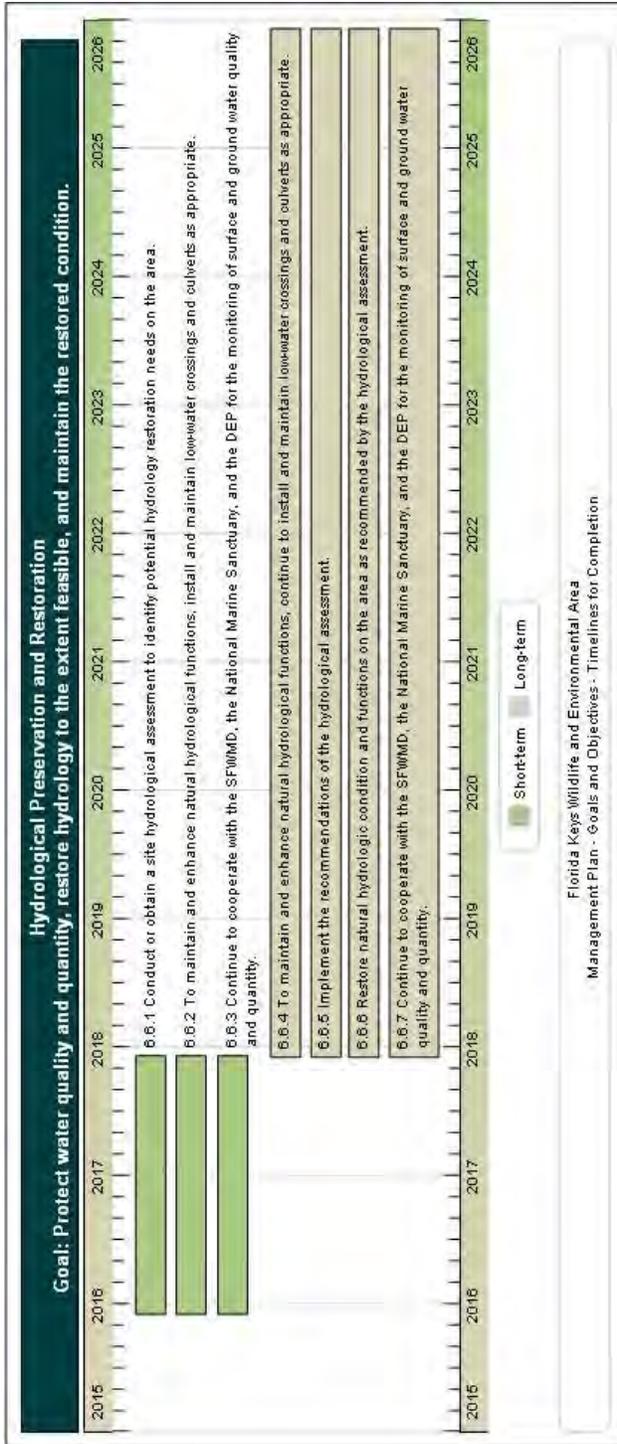


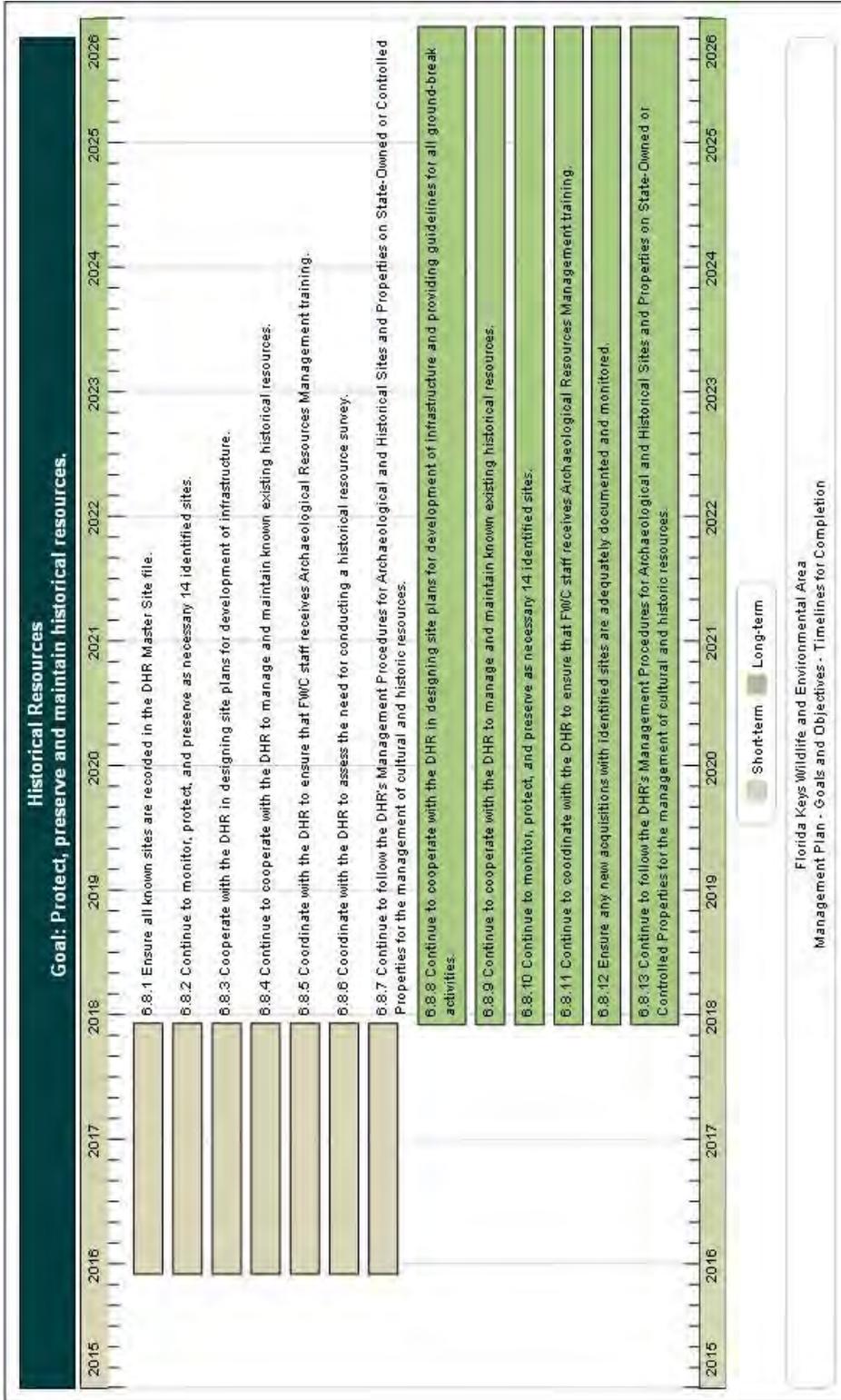


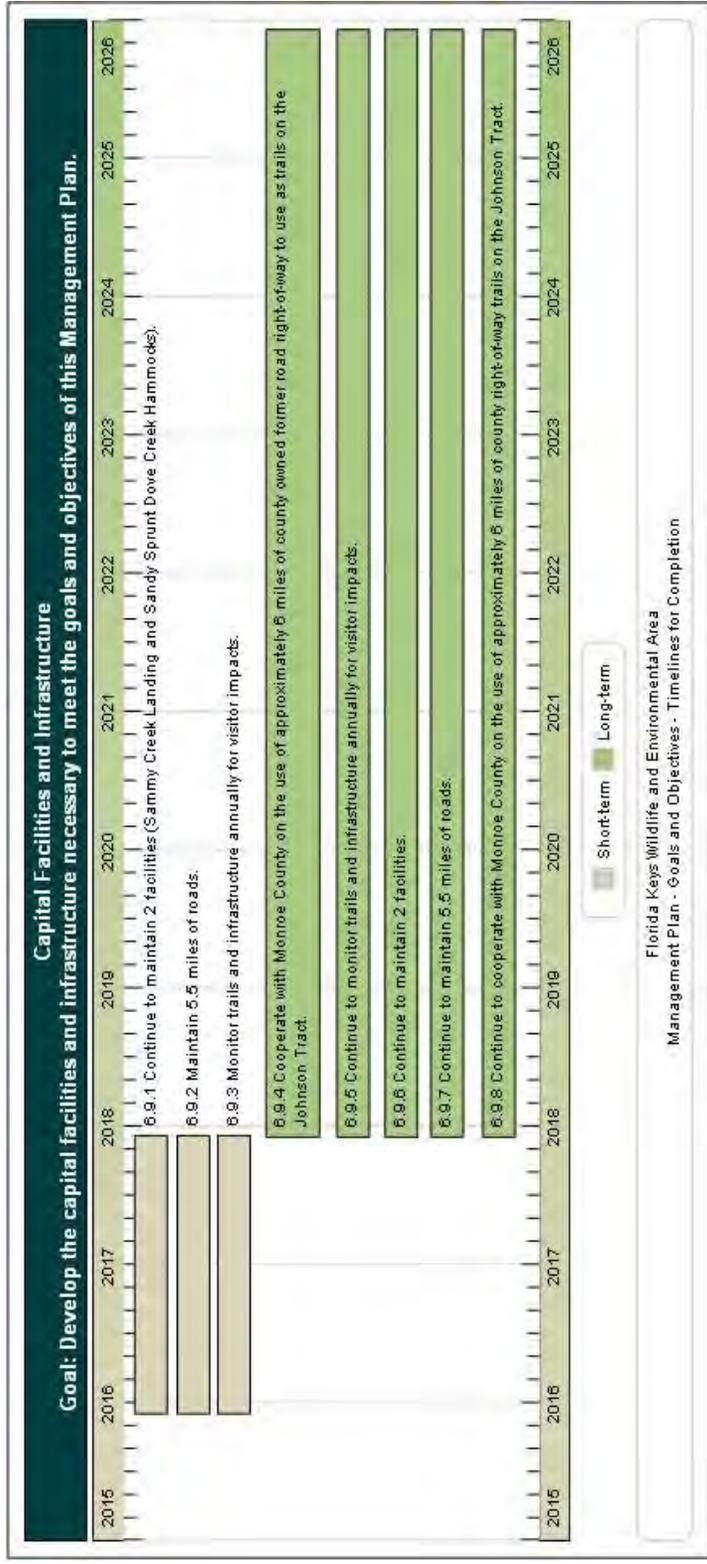




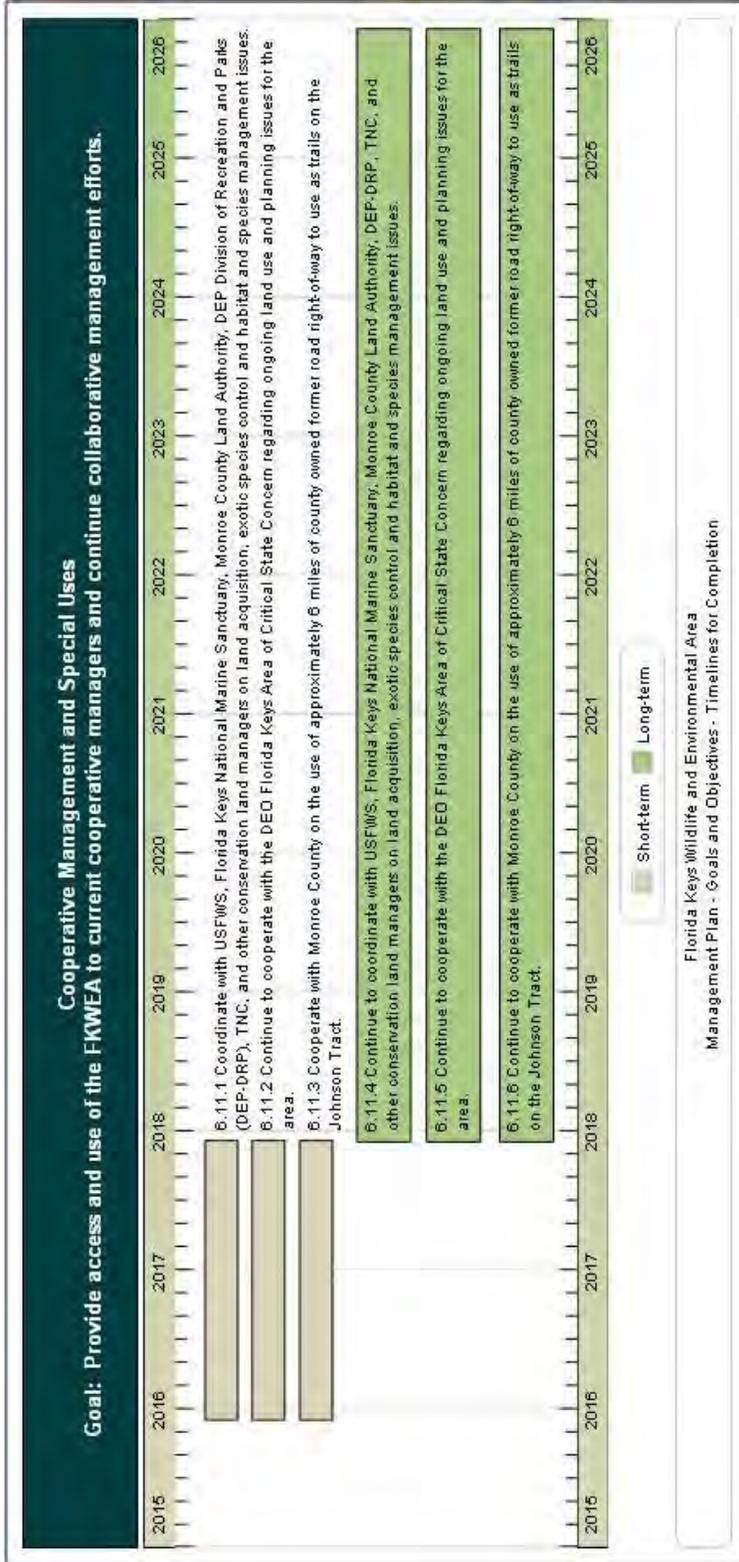


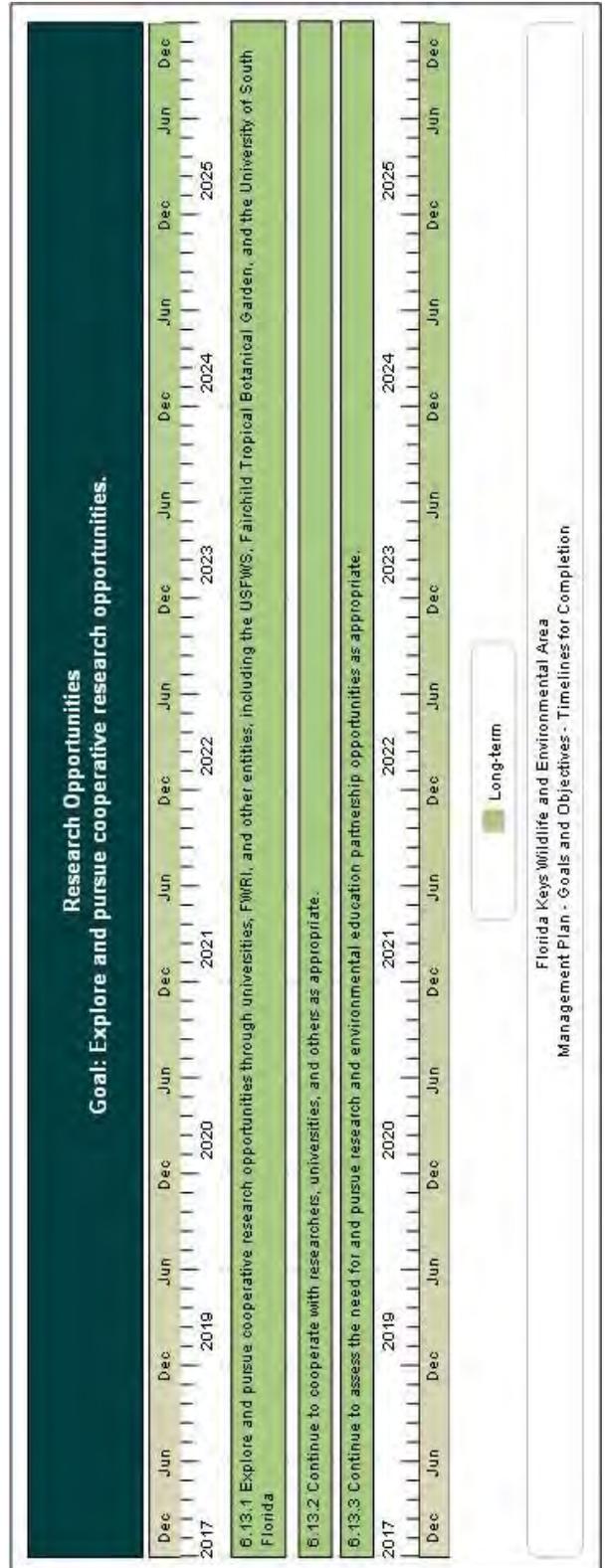
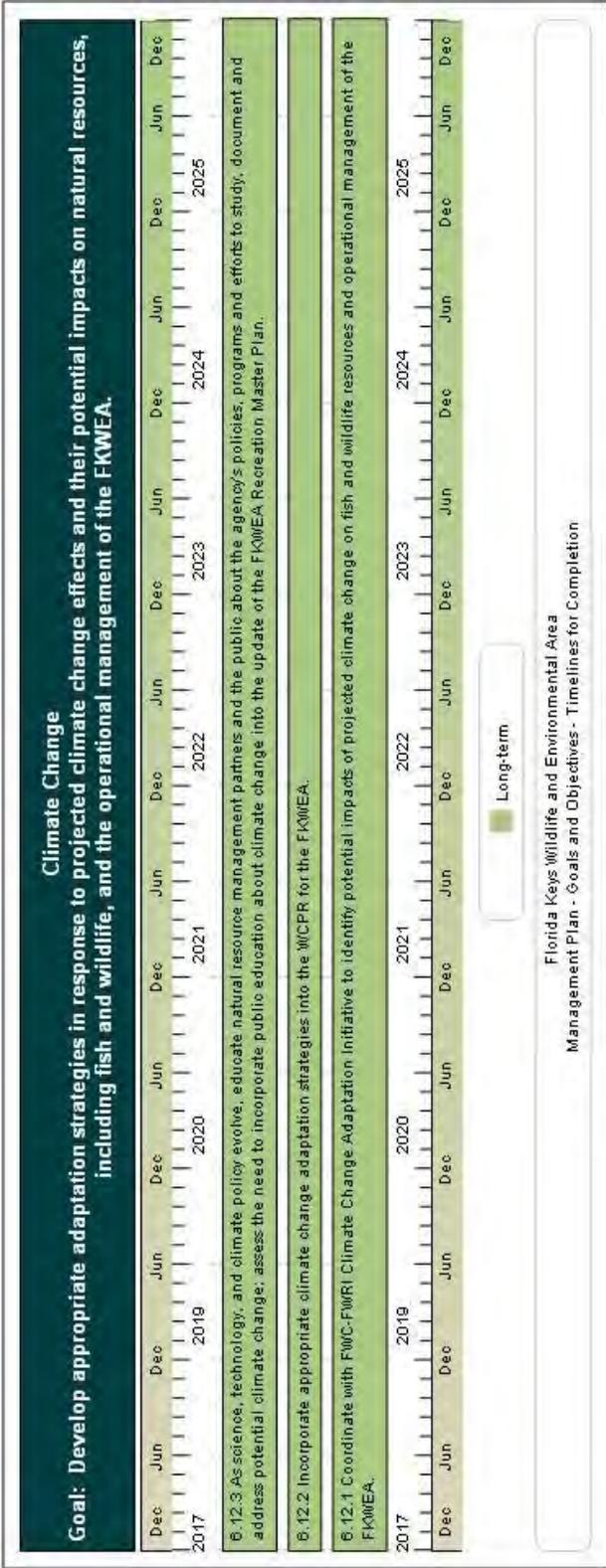












8 Resource Management Challenges and Strategies

The following section identifies and describes further management needs and challenges associated with the FKWEA and provides solution strategies that will address these challenges. These specific challenges may not be fully addressed in the broader goals and objectives section above, and are thereby provided here.

8.1 Challenge: Given the geographic extent and widely distributed parcels that make up the FKWEA, it is an increasingly difficult challenge to manage the area with existing staff and resources.

8.1.1 Strategy: Continue to cooperate and coordinate with the FWC Division Law Enforcement to promote awareness and understanding of the area's boundaries, regulations, and ongoing issues.

8.1.2 Strategy: Request additional funding for management staff and resources.

8.2 Challenge: The FKWEA's close proximity to urbanized areas in many locations creates a variety of problems including illegal clearing and encroachment, vandalism, feral and free roaming domestic animals, dumping, illegal campsites, feeding of wildlife, and other illegal activities.

8.2.1 Strategy: Increase law enforcement presence and public education, and develop strategies for mitigating the impacts of feral and free roaming domestic animals.

8.2.2 Strategy: Continue to cooperate with stakeholders to increase public awareness of these issues.

8.2.3 Strategy: Coordinate with the FWC Volunteer Program to develop a volunteer initiative for the FKWEA to aid in outreach and monitoring to reduce these illegal activities.

8.3 Challenge: The FKWEA is not a well-known recreation destination.

8.3.1 Strategy: Cross-promote the FKWEA with other regional public conservation lands such as state parks, USFWS refuges, City of Marathon parks, and Monroe County parks.

8.4 Challenge: Exotic invasive plants from adjacent private lands are spreading to the FKWEA.

8.4.1 Strategy: Coordinate with the FWC's LAP to work with adjacent landowners to control and manage exotic invasive plants on adjacent properties.

8.4.2 Strategy: Coordinate with other governmental and private organizations to obtain resources to control and manage exotic invasive species on adjacent properties.

8.5 Challenge: Free-roaming and feral animals continue to have devastating impacts on many of the area's most imperiled species such as Florida Keys marsh rabbit.

8.5.1 Strategy: Coordinate with the FWC's LAP to work with adjacent landowners to manage free-roaming and feral domestic animals.

8.5.2 Strategy: Coordinate with other governmental and private organizations to obtain resources to manage free-roaming and feral domestic animals.

8.6 Challenge: De-listing certain species endemic to the Florida Keys, such as Florida tree snails and certain rare species of snakes, could lead to increased taking and collecting of these important species.

8.6.1 Strategy: Cooperate with FWC Law Enforcement to prevent poaching on the FKWEA.

8.6.2 Strategy: Recommend continued protection of de-listed species by continuing to prohibit the taking and collection of these endemic species.

8.7 Challenge: Continued development and alteration of native habitat in the Florida Keys is decreasing the amount and availability of freshwater for wildlife.

8.7.1 Strategy: Preserve and protect existing freshwater wetlands, marshes, and ponds on the FKWEA.

8.7.2 Strategy: Cooperate with local stakeholders to preserve and protect the freshwater resources of the Florida Keys.

8.8 Challenge: There is a large amount of land within the FKEFFP boundary and on the FWC Acquisition and Inholding List that has yet to be acquired; acquisition of these parcels would improve ongoing management capabilities and increase habitat, facilitating the conservation of many wildlife species.

8.8.1 Strategy: Coordinate with the DEP-DSL, Monroe County Land Authority, and private organizations to pursue acquisition of private lands within the Florida Forever boundary.

9 Cost Estimates and Funding Sources

The following represents the actual and unmet budgetary needs for managing the lands and resources of the FKWEA. This cost estimate was developed using data developed by the FWC and other cooperating entities, and is based on actual costs for land management activities, equipment purchase and maintenance, and for development of fixed capital facilities. Funds needed to protect and manage the property and to fully implement the recommended program are derived primarily from the Land Acquisition Trust Fund and from State Legislative appropriations. However, private conservation organizations may be cooperators with the agency for funding of specific projects. Alternative funding sources, such as monies available through mitigation, may be sought to supplement existing funding.

The cost estimate below, although exceeding what the FWC typically receives through the appropriations process, is estimated to be what is necessary for optimal management, and is consistent with the current and planned resource management and operation of the FKWEA. Cost estimate categories are those currently recognized by the FWC and the Land Management Uniform Accounting Council. More information on these categories, as well as the Fiscal Year 2014-2015 operational plan showing detailed cost estimates by activity and categories of expenditures, may be found in Appendix 13.12.

Florida Keys WEA Management Plan Cost Estimate

Maximum expected one year expenditure

<u>Resource Management</u>	<u>Expenditure</u>	<u>Priority</u>	Priority schedule:
Exotic Species Control	\$123,676	(1)	(1) Immediate (annual)
Prescribed Burning	\$0	(1)	(2) Intermediate (3-4 years)
Cultural Resource Management	\$3,178	(1)	(3) Other (5+ years)
Timber Management	\$0	(1)	
Hydrological Management	\$29,274	(1)	
Other (Restoration, Enhancement, Surveys, Monitoring, etc.)	\$147,255	(1)	
Subtotal	\$303,383		
<u>Administration</u>			
General administration	\$7,400	(1)	
<u>Support</u>			
Land Management Planning	\$23,921	(1)	
<i>Land Management Reviews</i>	\$17,241	(3)	
Training/Staff Development	\$4,466	(1)	
Vehicle Purchase	\$63,014	(2)	
Vehicle Operation and Maintenance	\$12,880	(1)	
Other (Technical Reports, Data Management, etc.)	\$4,443	(1)	
Subtotal	\$125,965		
<u>Capital Improvements</u>			
New Facility Construction	\$201,506	(2)	
Facility Maintenance	\$59,548	(1)	
Subtotal	\$261,054		
<u>Visitor Services/Recreation</u>			
Info./Education/Operations	\$27,009	(1)	
<u>Law Enforcement</u>			
Resource protection	\$3,882	(1)	
<u>Total</u>	\$728,694	*	

*Based on the characteristics and requirements of this area, 3 FTE positions would be optimal to fully manage this area. All land management funding is dependent upon annual legislative appropriations.

FKWEA Management Plan Cost Estimate

Ten-year projection

<u>Resource Management</u>	<u>Expenditure</u>	<u>Priority</u>	Priority schedule:
Exotic Species Control	\$1,086,629	(1)	(1) Immediate (annual)
Prescribed Burning	\$0	(1)	(2) Intermediate (3-4 years)
Cultural Resource Management	\$27,925	(1)	(3) <i>Other</i> (5+ years)
Timber Management	\$0	(1)	
Hydrological Management	\$257,202	(1)	
Other (Restoration, Enhancement, Surveys, Monitoring, etc.)	\$1,293,802	(1)	
Subtotal	\$2,665,559		
<u>Administration</u>			
General administration	\$65,021	(1)	
<u>Support</u>			
Land Management Planning	\$210,171	(1)	
<i>Land Management Reviews</i>	\$49,353	(3)	
Training/Staff Development	\$39,242	(1)	
Vehicle Purchase	\$221,749	(2)	
Vehicle Operation and Maintenance	\$113,169	(1)	
Other (Technical Reports, Data Management, etc.)	\$39,036	(1)	
Subtotal	\$672,720		
<u>Capital Improvements</u>			
New Facility Construction	\$582,049	(2)	
Facility Maintenance	\$523,194	(1)	
Subtotal	\$1,105,243		
<u>Visitor Services/Recreation</u>			
Info./Education/Operations	\$237,302	(1)	
<u>Law Enforcement</u>			
Resource protection	\$34,105	(1)	
<u>Total</u>	\$4,779,950	*	

*Based on the characteristics and requirements of this area, 3 FTE positions would be optimal to fully manage this area. All land management funding is dependent upon annual legislative appropriations.

10 Analysis of Potential for Contracting Private Vendors for Restoration and Management Activities

The following management and restoration activities have been considered for outsourcing to private entities. It has been determined that items selected as “approved” below are those that the FWC either does not have in-house expertise to accomplish or which can be done at less cost by an outside provider of services. Those items selected as “conditional” items are those that could be done either by an outside provider or by the agency at virtually the same cost or with the same level of competence. Items selected as “rejected” represent those for which the FWC has in-house expertise and/or which the agency has found it can accomplish at less expense than through contracting with outside sources:

Approved Conditional Rejected

- | | Approved | Conditional | Rejected |
|---|----------|-------------|----------|
| • Dike and levee maintenance | ✓ | | |
| • Exotic species control | ✓ | | |
| • Mechanical vegetation treatment | ✓ | | |
| • Public contact and educational facilities development | ✓ | | |
| • Prescribed burning | ✓ | | |
| • Timber harvest activities | | | ✓ |
| • Vegetation inventories | ✓ | | |

11 Compliance with Federal, State, and Local Governmental Requirements

The operational functions of FWC personnel are governed by the agency's Internal Management Policies and Procedures (IMPP) Manual. The IMPP Manual provides internal guidance regarding many subjects affecting the responsibilities of agency personnel including personnel management, safety issues, uniforms and personal appearance, training, as well as accounting, purchasing, and budgetary procedures.

When public facilities are developed on areas managed by the FWC, every effort is made to comply with Public Law 101 - 336, the Americans with Disabilities Act. As new facilities are developed, the universal access requirements of this law are followed in all cases except where the law allows reasonable exceptions (e.g., where handicap access is structurally impractical or where providing such access would change the fundamental character of the facility being provided).

Uses planned for the FKWEA are in compliance with the Conceptual State Lands Management Plan and its requirement for "balanced public utilization," and are in compliance with the mission of the FWC as described in its Agency Strategic Plan (Appendix 13.7). Such uses also comply with the authorities of the FWC as derived from Article IV, Section 9 of the Florida Constitution as well as the guidance and directives of Chapters, 253, 259, 327, 370, 379, 403, 870, 373, 375, 378, 487, and 597 FS.

The FWC has developed and utilizes an Arthropod Control Plan for the FKWEA in compliance with Chapter 388.4111 F.S. (Appendix 13.13). This plan was developed in cooperation with the local Monroe County arthropod control agency. This plan is also in conformance with the Local Government Comprehensive Plan as approved and adopted for Monroe County, Florida (Appendix 13.14).

12 Endnotes

¹ 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.

² Wilhere, G. F. 2002. Adaptive management in Habitat Conservation Plans. *Conservation Biology* 16:20-29.

³ Walters, C. J. and R. Hilborn. 1978. Ecological optimization and adaptive management. *Annual Review of Ecology and Systematics* 9:157-188.

- ⁴ Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas, Final Report (1999).
- ⁵ Karl, T. R., J. M. Melillo, and T. C. Peterson (Eds.). 2009. *Global Climate Change Impacts in the United States*. Cambridge University Press. New York, NY.
- ⁶ McCarty, J. P. 2001. Ecological consequences of recent climate change. *Conservation Biology* 15:320-331.
- ⁷ Walther, G. R., E. Post, P. Convey, A. Menzel, C. Parmesan, T. J. . Beebee, J. M. Fromentin, O. Hoegh-Guldberg, and F. Bairlein. 2002. Ecological responses to recent climate change. *Nature* 416:389–395.
- ⁸ Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. *Annual Review of Ecology, Evolution, and Systematics* 37:637-669.
- ⁹ Logan, J. A., and J. A. Powell. 2009. Ecological consequences of climate change altered forest insect disturbance regimes. In *Climate Warming in Western North America: Evidence and Environmental Effects* (F. H. Wagner, Ed.). University of Utah Press, Salt Lake City, UT.
- ¹⁰ Stevenson, J. C., M. S. Kearney, and E. W. Koch. 2002. Impacts of sea level rise on tidal wetlands and shallow water habitats: A case study from Chesapeake Bay. *American Fisheries Society Symposium* 32:23-36.
- ¹¹ IPCC. 2007b. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, UK.
- ¹² Emanuel, K.A. 1987. The Dependence of Hurricane Intensity on Climate. *Nature* 326: 483-485.
- ¹³ Emanuel, K.A. 2005. Increasing Destructiveness of Tropical Cyclones Over the Past 30 Years.
- ¹⁴ Webster et al. 2005; Webster, P. J., et al. 2005. Changes in Tropical Cyclone Number, Duration, and Intensity, in a Warming Environment. *Science* 309: 1844–1846.
- ¹⁵ Mann, M.E. and K.A. Emanuel. 2006. Atlantic Hurricane Trends Linked to Climate Change. *Eos Trans. AGU* 87: 233-244.
- ¹⁶ Stanton, E.A. and F. Ackerman. 2007. *Florida and Climate Change: The Costs of Inaction*. Tufts University Global Development and Environment Institute and Stockholm Environment Institute–US Center, Tufts University, Medford, MA.

¹⁷ Clough, J.S. 2008. Application of the Sea-Level Affecting Marshes Model (SLAMM 5.0) to Crystal River NWR. Warren Pinnacle Consulting, Inc. for U.S. Fish and Wildlife Service. 46 pp.

13 Appendix

The appendix to the FKWEA Management Plan is not included in this online version, due both to the size of the appendices for this management plan, which total more than 1,200 pages, as well as the fact that many of the appendix documents are not currently ADA compliant. Any individual appendix document, as well as the entire compiled appendix, is available upon request. Please contact FWC at (850) 487-7063 to request copies of the appendix documents.

Below is a list of the Appendix to the FKWEA Management Plan:

13.1 Lease Agreements

13.2 Definitions of Management Plan Terms

13.3 Public Input

13.3.1 Management Advisory Group Meeting Results

13.3.2 Public Hearing Notice, Advertisements, and Press Release

13.3.3 Public Hearing Report

13.3.4 Management Prospectus

13.4 Land Management Review Report

13.5 Soil Series Descriptions

13.6 FNAI Element Occurrence Data Usage Letter

13.7 FWC Agency Strategic Plan

13.8 FWC Apiary Policy

13.9 Management Procedures Guidelines - Management of Archaeological and Historical Resources

13.9.1 Historical Resources of the FKWEA

13.9.2 DHR Guidelines for Ground Disturbing Activities

13.10 WCPR Species Management Strategy

13.11 FKWEA Recreation Master Plan

13.12 Land Management Uniform Accounting Council Categories – Operation Plan Fiscal Year 2014 – 2015

13.13 Arthropod Control Plan

13.14 Monroe County Letter of Compliance with Local Comprehensive Plan