

**ECOLOGY AND MANAGEMENT OF WHITE-TAILED  
DEER IN FLORIDA**



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## INTRODUCTION

The white-tailed deer (*Odocoileus virginianus*) is widespread throughout Florida and provides considerable food, sport, pleasure, and economic benefits. It is the most popular game species in Florida; more than 100,000 hunters annually pursue this exciting quarry on both private and public lands. Hunting is a source of income to manufacturers and retailers of arms, ammunition, and hunting apparel as well as to those who provide food, lodging, and a place to hunt. Whitetails are also appreciated by many Floridians and tourists who value the opportunity to view deer. Wildlife viewing provides economic benefits in terms of sales of binoculars, photographic equipment, food, and lodging. In addition to the benefits for humans, deer are an important prey for animals such as the endangered Florida panther and are part of a healthy Florida ecosystem.

Proper management of Florida's deer population can provide for the long-term welfare of the species and their habitat and help ensure that people will continue to enjoy the recreational, aesthetic, and economic benefits of deer. The Florida Fish and Wildlife Conservation Commission (FWC) provides overall harvest regulations in the state by setting the hunting season and bag limits. To improve deer habitat, FWC also carries out land management practices designed to benefit deer on FWC administered lands. However, since deer are also found on private lands, landowners, hunters and managers play a crucial part in Florida's deer habitat and population management.

This guide has been prepared by the FWC to serve as a management aid and a reference on deer ecology in Florida. It provides a review of the available knowledge gleaned from scientific publications, popular literature, and the extensive experience of biologists, wildlife managers, and other scientists. The guide begins with the basic biology and habitat needs of deer, since understanding these aspects of deer ecology is important for successful management. The second part of the guide addresses both habitat and population management practices. Soil fertility in Florida is lower than in many other parts of the country, and this plays an important role in the characteristics and life history of deer. Therefore, throughout the guide we identify the unique qualities of Florida's deer herd and habitat and discuss how it affects management decisions.

### Taxonomy and Distribution

There are four subspecies of white-tailed deer in Florida (Figure 1). The endangered Florida Key deer (*O. v. clavium*) is found only in the Florida Keys and because of its unique status will not be discussed in this guide. Of the remaining three, the Florida coastal white-tailed deer (*O. v. osceola*) occurs in the panhandle, the Florida white-tailed deer (*O. v. seminolus*) in peninsular Florida, and the Virginia white-tailed deer (*O. v. virginianus*) in the extreme northeast. The differences among these

#### Cervids

White-tailed deer are ungulates, or hoofed mammals, belonging to the family Cervidae. The deer family, or Cervids, includes various types of antlered animals.

subspecies are negligible, and there are not subspecies-specific management concerns, therefore this guide will simply discuss Florida white-tailed deer in general.

## **BIOLOGY AND LIFE HISTORY**

### **DESCRIPTION**

#### **Size**

Adult male white-tailed deer in Florida weigh on average 125 pounds and stand approximately 36 inches tall at the shoulder. Female deer are smaller, averaging about 95 pounds and 32 inches in height. Florida deer are considerably smaller than those in most other states. There is also substantial variation in body size among deer within Florida.

Deer in Florida are well adapted to the climate and environment. The smaller body size is beneficial in warm climates because it allows for less energy to be expended for regulating body temperature. Smaller body size also may enhance survival in habitats where soil fertility is low.

#### **Pelage**

The whitetail's pelage color has evolved to allow it to blend with its surroundings. Fawns have white spots in a reddish-brown coat that enable them to blend in to broken patterns of sun and shade. Adult deer pelage on the back and sides is reddish brown in summer and changes to grayish brown in winter. Their namesake tail is stark white underneath, and the belly, throat, areas around the eyes and muzzle, and inside of the ears are also white.

#### **Glands**

Deer have numerous external glands that secrete pheromones used for scent communication. Tarsal glands are located on the inner surface of the hind legs and play an important role in communication during the breeding season. Deer urinate on their tarsal glands while rubbing them together, a behavior called rub-urination. This behavior increases as breeding season approaches and is thought to convey dominance and reproductive condition.

Metatarsal glands are located on the outer surface of the hind legs. The function of metatarsal glands is not well understood. Interdigital glands between the hooves are used for trail marking and have been implicated in alarm responses in whitetails. Preorbital glands in the corners of the eyes function as tear glands and also are used to mark trees and bushes. Forehead glands produce scent that is used to anoint antler rubs made during breeding (Atkeson and Marchinton 1982).

## Senses and Behavior

White-tailed deer have an acute sense of smell and they use it to avoid predators, find food, identify individuals, and gather information about sex and reproductive and social status of other deer. Deer also have excellent hearing; their large ears are constantly on the alert to detect movement and the whereabouts of other animals, including predators. They use a variety of vocalizations to communicate with each other. Fawns and yearlings bleat as a contact call to which mothers and sometimes other adult females respond. All age and sex classes use distress calls during trauma. Grunts are used as cohesive calls within social groups, between dominant and subordinate deer, and by males while pursuing females during breeding. Probably the most familiar deer sound is the foot stomp and snort that is used to signify an approaching intruder or predator.

White-tailed deer have a wide field of vision, and anyone who has spent time observing deer knows that they have an amazing ability to detect movement. Compared to humans, deer have much better nighttime vision. The nighttime vision is enhanced by a membrane called the tapetum that acts like a mirror, essentially doubling the available light. Daytime vision is not as good as that of humans.

One of the challenges for anyone trying to get close to deer in the wild is to be unnoticed by the deer. Their keen hearing, acute sense of smell and ability to see almost completely around them has evolved to help them to quickly detect the approach of potential predators. Understanding their physical capabilities and learning about deer behavior can be very rewarding for hunters and non-hunters alike.

### Field of vision vs. binocular depth perception

Deer eyes are *laterally-placed*, meaning they are located on the sides of the head. This gives deer the ability to scan both sides at the same time, thus giving them a wide field of vision. For prey species like deer, this is important because it allows them to detect threats from many directions at once. In contrast, predator species such as panthers have *front-facing* eyes. This means they have a smaller visual field, but more binocular vision. For predators, binocular vision is important because it gives them great depth and distance perception, allowing them to quickly coordinate their movement to catch prey. Binocular vision occurs where the visual field of the two eyes overlaps; the more overlap between the fields of vision of the two eyes, the more binocular depth perception. Animals like deer, with smaller binocular vision field, sometimes move their head from side to side or up and down, and this makes objects seem to change position relative to each other. Close objects seem to move more than objects that are far away, and the brain uses this to calculate relative distance between the objects.

## Antlers

Antlers are unique features of the deer family. They differ from horns in that antlers are grown and shed annually, while horns stay on permanently and in some species continue to grow throughout their lives. Among whitetails, typically only males grow antlers, although on rare occasions a female deer will grow antlers.

Antler growth begins in the early spring as the increasing day-length triggers hormonal changes within the deer. During growth, antlers are composed primarily of protein and are covered with skin and soft hair called “velvet.” Velvet is interlaced with blood vessels that transport antler-building materials to be deposited. While in velvet, antlers are well supplied with nerves, and injury during this time can cause deformations. As the antler matures it calcifies, its blood supply is reduced through hormonal action, and antler growth ceases. A buck then rubs trees and shrubs with his antlers to remove the velvet and to polish the hardened antler beneath. Hardened antlers are composed of 50-60% mineral (primarily calcium and phosphorus). Healthy males maintain polished antlers throughout the breeding season. At the end of the breeding season, antlers are shed and the cycle begins anew.

Antler characteristics are related to age, nutrition, and genetic qualities of both parents. Disease or injury to antlers during development can also influence their shape and size. During a buck’s first 18 months of life, body growth (skeletal structure) takes precedence over antler growth, and much of the nutritional intake is used for body-growth and development. As the buck ages, body-growth slows, and more nutrients are available for antler production. As a result, a buck’s second set of antlers is invariably larger than the first and the largest racks tend to occur once mature weight is achieved. Thus, bucks usually reach their greatest antler development after reaching physical maturity at 4-6 years of age. In later years, antlers can become simpler (e.g. fewer points) or develop abnormalities. Managers and landowners can

### Antler Trivia

The largest antlers among Cervids belonged to a prehistoric Irish elk, *Megaloceros*, whose antlers could span up to 12 feet.

In 1817, G. Cuvier was the first to establish that antlers were made of bone. This was a significant departure from the view of Buffon (1756) who thought antlers were made of wood.



*Damage during early antler development may have caused this asymmetrical formation. Remote camera photo by Jonathan Day.*

### Florida Buck Registry

In 1982, the Florida Buck Registry was established to provide hunters with a record of the quality of Florida white-tailed deer, based on antler characteristics.

The minimum Boone and Crockett antler score necessary to qualify is 100 for typical antlers and 125 for non-typical antlers.

To have your buck scored, contact your regional office or visit the buck registry website at:

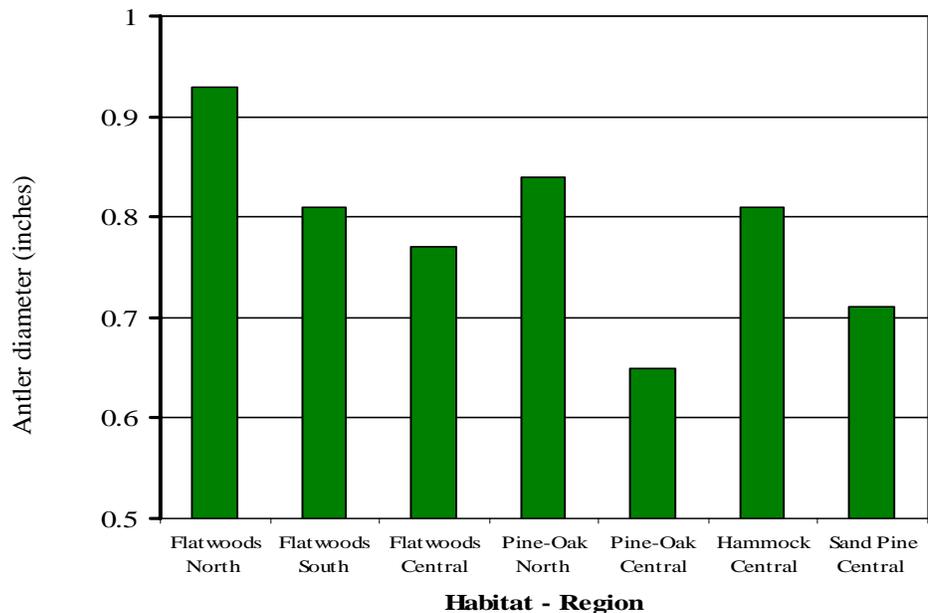
[www.myfwc.com/buckregistry/](http://www.myfwc.com/buckregistry/)

improve antler characteristics of their deer herd by simply not harvesting young bucks, thereby allowing them to mature.

One popular belief is that you can tell a deer's age by the number of points on each antler. Although the characteristics of antlers change as the deer ages, the number of points is not a way to age deer. For example, a yearling buck may have just 1 or 2 points on each side, but another yearling with better genetics and good nutrition may have as many as 3 or 4 points on each side. The proper way to age a deer is by examining their teeth, a subject that will be discussed later in the "Data Collection" section.

Nutrition plays an important role in antler development, particularly the amount of protein, calcium, phosphorus, and magnesium in the forage. Different habitats provide different amounts of nutrients; therefore, habitat type and quality can influence antler characteristics. For example, in Osceola National Forest, phosphorus levels in forage were well below a deer's estimated daily minimum requirement for antler growth during all months except April (Kilgo and Labisky 1995). This deficiency can severely limit antler growth.

A study by Harlow and Jones (1965) demonstrated how antler characteristics of yearling (1½ -year-old) bucks vary in different regions and habitats throughout Florida:



Although the benefits of providing mineral supplements to wild deer are questionable, good nutrition provided by quality forage is clearly important for antler development. Habitat management practices that improve the nutritional quality of forage, particularly during early spring and summer when antlers are growing, are important and will be discussed in the management section of this guide.

## **HABITAT REQUIREMENTS**

Suitable habitat should provide for a deer's survival and reproductive needs including adequate food, water, cover, and proper distribution of these elements. Adequate food implies that there is enough food for every deer (quantity) and that the food provides enough nutrients for each individual's energy and nutritional needs (quality). Energy and nutritional requirements of individual deer change with age, reproductive condition, and season. Nutritional requirements are greater during pregnancy, lactation, and antler growth.

### **Soil Fertility, Plant Nutrients, and Deer Nutrition**

The nutritional quality of plants depends largely upon the fertility of the soil they grow in. Because white-tailed deer receive essential nutrients from plants, it is not surprising then that there is often a correlation between soil fertility and deer body weight, antler development, and productivity. Studies suggest that forage containing 6-10% protein is adequate for maintaining adult deer, but this increases to 13-16% for optimal growth (French et al. 1956), 10-16% for antler development (Asleson et al. 1996; Ullrey 1983), and 13-22% for maintaining lactation and supporting fawn growth (Ullrey et al. 1967).

Much of Florida's soils are coarse-textured and sandy, and nutrients are quickly leached and not available for plant intake. The mean protein content of browse in Florida pine flatwoods has been estimated as 7.7% (Tanner and Terry 1982); sufficient for adult growth, but less than optimum for reproduction and antler development. In addition, phosphorus levels of forage have been found to be consistently at low levels where growth, milk yield, and fertility of deer may be compromised (Tanner and Terry 1982, Kilgo and Labisky 1995). In central Florida flatwoods, inadequate levels of Cobalt were thought to partially explain low reproductive rates (Harlow 1965).

Although most Florida deer range produces forage lower in protein, phosphorus and other minerals than more northern ranges, variation in the soil characteristics at a local level can be important. For example, clay in the soil can improve soil's ability to retain nutrients and water, thereby enhancing the plants' opportunity to obtain them from the soil (Figure 3). In addition, habitat management practices such as prescribed burning can enhance the availability of nutrients to plants and therefore to deer.

### **Food**

White-tailed deer have a diverse diet that includes the leaves and twigs of woody plants, stems, leaves, and flower heads of forbs (herbaceous plants with broad leaves), grasses, acorns, fruits, berries, mushrooms, sedges, and aquatic plants. Harlow (1965) analyzed stomach contents of deer from seven different habitats throughout the state and identified 192 different species including 43 that were heavily and consistently used by deer (Table 1). Food items vary according to season, habitat, and availability. Mast, such as acorns or palmetto berries, is undoubtedly one of the most important deer foods in Florida; however, its availability is highly seasonal. For example, saw palmetto berries in

flatwoods and oak acorns in scrub oak habitats tend to be mostly available only in the fall. Outside of mast season, a higher proportion of woody plants and winter-killed forbs and grasses are consumed by deer. In fresh water marshes in south Florida, the most heavily utilized forages by deer were water-loving forbs (Loveless 1959). If availability of preferred forage diminishes, deer will gradually shift their diet to less palatable species which are often less nutritious.

#### **Carnivorous Deer?**

Although unusual, white-tailed deer occasionally stray from their vegetarian diet. Researchers in North Manitou Island in Lake Michigan observed deer eating dead and dying fish washed up on the beach. In North Dakota, video cameras placed near ground nests of birds documented deer visiting at night to eat young nestlings.

### **Cover**

Cover refers to physical features that provide deer with concealment and protection during fawning during extreme weather conditions, and while resting. Deer also use cover as concealment during hunting seasons. It is an important component of deer habitat. Much of Florida's deer range has abundant cover. Preferred cover types include thickets, young forest stands, oak hammocks, and other dense vegetation.

### **Water**

Deer obtain most of their water requirements from the forage they consume, but they also use water from ponds, lakes, streams, and wetlands when it is available. Deer can survive without surface water for extended periods when rainfall, humidity, and plant succulence are relatively high (Marchinton 1968). Although overall Florida has relatively high rainfall, the sandy, porous soils combined with patchy rainfall distribution can result in periods of drought. In Florida, monthly variations in rainfall have been shown to influence weight and antler characteristics of yearling male white-tailed deer (Vanderhoof 1992).

### **Space: Home range**

Home range refers to the total area that a deer occupies during most of its life. A deer's home range must contain suitable areas of cover, appropriate habitat for breeding and fawning, and a sufficient supply of food and water. In general, the better the habitat, the smaller the home range, but deer density, sex, and season also influence the size and shape of home ranges. Bucks typically have larger home ranges than does because of increased mobility during rut. Does may stay their entire lives within close proximity to where they were born, while yearling bucks usually disperse from their mother's home-range. A typical deer home range in Florida is slightly less than 1 square mile (500 to 600 acres) for an adult female and 1-2.5 square miles for an adult male deer (750 to 1,600 acres).

## REPRODUCTION

### Breeding

Female white-tailed deer can reach sexual maturity at 6 months; however, few conceive before their second year (Nowak 1999). Males reach sexual maturity at 1.5 years, and age at first breeding depends on the numbers of does and competing bucks present. All bucks participate in courtship, but generally only those who successfully outcompete other bucks gain the opportunity to breed a doe.

In the southeastern states, the breeding period, or rut, is typically not as synchronized as it is in northern states. However, Florida is the only state where the breeding season can vary as much as 6 months from one region to another (Figure 4, Richter and Labisky 1985). This is partly due to the long growing seasons and mild winters which allow fawning to occur almost year round. In south Florida, an area of high rainfall, breeding is likely timed to synchronize birth with the driest period of the year (February/March).



Rubs serve as signposts of a buck's breeding territory.

### Gestation and Production

Throughout most of the eastern U.S., after a gestation period of approximately 200 days (6.5 months) does usually give birth to one to three fawns. Singletons are common for first-time mothers (yearlings) and for does in poor nutritional condition. Does in good nutritional condition typically produce twins, and even triplets are not uncommon in some areas (e.g. in the farmland regions of Pennsylvania). In general, females from ranges with high soil fertility produce more fawns than those from ranges exhibiting low soil fertility.

White-tailed deer are **polygamous** breeders; one male mates with several females during the breeding season.

Productivity of white-tailed deer populations in Florida are lower than those reported for other eastern states (Richter and Labisky 1985). Although pregnancy rates are similar to other states (approximately 90%), reproductive rates (number of fetuses/adult doe) and productivity (number of fetuses/pregnant doe) are lower. Harlow and Jones (1965) reported a mean reproductive rate of 1.15 fetuses/doe in Florida and mean productive rate of 1.28 fetuses/pregnant doe (Richter and Labisky, 1985). However, as in other states, there is considerable variation in deer productivity within Florida depending on local conditions (e.g. agricultural areas, local forage nutrition) and state wide collections of hunter harvested deer show productivity rates to ranging from 1.0 fawn/pregnant doe to 1.7 fawns/pregnant doe.

The low productivity of Florida deer is largely attributed to low soil fertility. For example, in northern Florida pine flatwoods, protein and phosphorus levels are extremely low during spring and summer (Kilgo and Labisky 1995). This is believed to affect adult

females during gestation and lactation, resulting in reduced productivity and fawn survival. In addition, trace elements Selenium and Iodine, which are typically at low levels in sandy soils, have also been correlated with low reproduction (MacPherson 2000). Florida's deer forage is also low in Cobalt (Kretschmer et al. 1954), which is known to negatively affect reproductive performance (Smith et al. 1956).

## MORTALITY

The primary cause of adult deer mortality in Florida is hunting; approximately 120,000 deer are harvested annually. Other mortality factors include predation, disease, parasites, vehicle collisions, malnutrition, poaching, and adverse weather (e.g., flooding). Fawns on average have higher mortality rates than adults. Knowledge of the common mortality factors in your area, and understanding the effects on the deer herd, can help you refine your management strategies.

### Hunting

Where data is available, legal hunting is estimated to account for a 10-15% reduction of a deer herd in hunted populations. In addition, mortality from unretrieved harvest (i.e., wounding loss) and illegal hunting can be considerable. Estimates of illegal kills are unknown, but may be as high as 50% of legal harvest (Eberhardt 1960), and wounding loss can vary from "negligible" to as much as 175% of legal harvest (Nettles et al. 1977). The amount of wounding loss depends upon a variety of factors including the type of weapon used.

### Predation

In much of the southeast, viable populations of large predators no longer exist. The endangered Florida panther (*Felis concolor coryi*) occurs only in south Florida, and therefore is generally not an issue for deer management in most of the state. However, panther predation can be a significant factor affecting deer populations where panthers occur. On average, panthers eat one deer (or other similar sized animal such as a hog) every nine days.



Florida panther. Photo by David Shindle.

Bobcats (*Felis rufus*) also cause mortality in south Florida deer populations; in Big Cypress National Preserve, bobcats accounted for 10 of 22 radio-collared adult doe mortalities (Land et al. 1993). Another Everglades study utilizing radio-collars, found that bobcat predation accounted for at least 60% of 52 fawn deaths (Boylay 1992), and at least 17% of 36 adult deaths (Labisky et al.,



Bobcats do not appear to be a major predator on deer in much of Florida. Photo by David Shindle.

1995). However, in the rest of the state, bobcats apparently are not important predators of deer. Examination of 413 bobcat stomach contents collected throughout Florida found that deer accounted for only 2% (Maehr and Brady 1986).

The coyote is a predator that has the potential to influence deer herd dynamics in the southeastern United States (Blanton and Hill 1989). Several studies in Oklahoma reported that coyotes were responsible for 88 to 97% of fawn mortality (Bartush 1978; Garner 1976; Garner et al. 1976). However, coyote predation on deer tends to be site-specific (Stout 1982) and is influenced by factors such as habitat type, deer density, and alternative prey abundance. Coyotes hunt primarily by sight and therefore have greater hunting success in open areas (e.g., grassland, agricultural) or forested areas with a low density understory. Managing for increased cover to provide protection for fawns could reduce coyote predation during fawning season. A study conducted in northwest Florida by Stratman and Pelton (1997) showed that the peak occurrence of deer in coyote diets (29%) coincided with fawning season (early fall) and fawns represented 95% of deer consumed. Coyotes have significantly expanded their range into peninsular Florida over the past 2 decades. However, the dense understory and abundant supply of alternate foods should alleviate any serious impact coyotes may have on deer populations.

Black bears are not considered an important predator of Florida's deer. Maehr and Brady (1984) examined 187 bear stomachs and scats collected throughout Florida and found deer in only one sample. Moreover, there was no evidence of deer in 36 bear stomachs examined from Osceola National Forest (Maehr and Brady 1982) and in a cursory examination of several hundred bear scats from Ocala National Forest (J.W. McCown, personal communication).

### **Vehicle Mortality**

Considering Florida's rapidly growing human population, it is not surprising that vehicle-deer collisions are a significant source of deer mortality. Most attempts to prevent vehicle-deer collisions have proven ineffective. However, some mitigation strategies have been successful, such as properly constructed and maintained deer fencing that restrict movement of deer onto roadways. Roadway overpasses and underpasses can allow deer to safely cross thoroughfares that bisect their normal use areas.

### **Inclement Weather and Malnutrition**

Flooding is an annual occurrence in southern Florida and can be significant in some years. For instance, in 1995, heavy flooding resulted in the death of 25 of 51 radio-collared deer in the Everglades (MacDonald 1997). Indirect mortality from flooding can result as deer congregate on higher ground. This overcrowding can lead to malnutrition due to exhaustion of the food supply, greater susceptibility to predation, and increased disease transmission. Although adult deer deaths from flooding are primarily due to indirect mortality, fawns may drown.

Malnutrition is the result of a severely inadequate food supply (i.e., quantity and/or quality) and is a cause of mortality wherever white-tailed deer occur. In many parts of North America, high deer densities can lead to poor nutritional status through overbrowsing. In Florida, this seldom occurs because of the relatively low deer densities; however, the low nutritional quality of forage can predispose deer to nutritional stresses (Shea and Osborne 1995). By the time clinical signs of malnutrition are apparent, improving available food resources may not affect recovery, as severely emaciated deer have limited capacity to quickly assimilate nutrients. Fawns are most susceptible to malnutrition, requiring a greater supply of nutrients for their rapid growth.

## **Diseases and Parasites**

The southeastern United States is noted for having the most varied and heavy parasite concentrations in North America. Despite being exposed to and supporting a diverse community of diseases and parasites, Florida's deer are relatively unaffected by these organisms, however, there are some notable exceptions. As a part of a sound deer management program, landowners should be aware of the presence and significance of some of the most common deer diseases and parasites.

*Hemorrhagic disease* (HD) is one of the most important infectious diseases of white-tailed deer in Florida. It is transmitted by biting midges carrying hemorrhagic disease virus or bluetongue virus. HD viruses appear to be present throughout Florida, but outbreaks of the disease have only been documented in the panhandle (Forrester 1992). Initial signs of HD usually occur during late summer to early fall, coinciding with peak populations of the biting midges. Advanced chronic stages are most often observed in late fall and into winter. Symptoms include extreme emaciation, weakness, loss of appetite, reduced activity, and lameness, which ultimately can lead to increased susceptibility to predation and malnutrition. Managers can monitor for chronic HD by looking for signs of hoof growth interruptions or sloughing. A study conducted in Mississippi demonstrated that deer with northern origins were less resistant to HD than those from the south (Jacobson and Lukefahr 1993) and should be a warning for those who have the notion of illegally transplanting northern deer into Florida in an attempt to improve genetics.

*Haemonchosis* is another important disease of Florida deer. It is caused by high concentrations of nematode worms in the gut. Symptoms (e.g., weakness, emaciation, and anemia) become apparent when the deer is infected with close to 1,000 worms or 75 or more worms per kilogram of body weight (Davidson et al. 1980). Fawns are particularly susceptible to the disease, especially those that are malnourished or have heavy loads of other parasites. Although immunity develops with repeated exposure, resistant individuals continue to act as sources of infection. Haemonchosis can be exacerbated by heavy rainfall, as flooding and overcrowding can cause nematode numbers to increase to hazardous levels. Therefore, presence of nematodes is generally higher in southern Florida (85%), than in northern peninsular Florida (73%) and the panhandle (59%) (Forrester and Roelke 1986).

*Lungworm pneumonia* results from heavy infestations of nematode worms in the lungs and infects a high proportion of deer in Florida. Like haemonchosis, clinical symptoms are not usually apparent in deer with light infestations. Heavy loads, however, can lead to loss of weight, weakness, and severe respiratory distress. Fawns are most susceptible to this disease, particularly those suffering from malnutrition or severe parasitism. Lungworm pneumonia combined with poor nutrition can lead to substantial losses of deer, especially in winter and early spring.

*Ticks* can impact the health and well-being of deer and are by far the most important ectoparasite, or external parasite, of white-tailed deer in Florida. Harmful effects of ticks include local irritation, blood loss, skin wounds with resultant secondary infections, and disease transmission. Occasionally, ticks can accumulate on deer in such large numbers that they produce overt disease due to blood loss. In fawns, damage from tick bites around the eyes can lead to blindness. Moreover, deer with large tick infestations under nutritional stress are more susceptible to haemonchosis, lungworm infection, and other diseases (Forrester 1992).

Diseases and parasites of deer rarely pose a threat to human safety; however, ticks may act as vectors of Lyme disease. This tick-borne illness of humans can cause flu-like symptoms, and if left untreated, may lead to chronic disease. Despite deer being reservoirs for this disease, rodents are the primary reservoir hosts, and there are few known cases where Lyme disease was transmitted to humans from deer. Although human cases of Lyme disease have been diagnosed in all of the southeastern states, the Center for Disease Control and Prevention describes Florida as a low risk area.

*Nasal or pharyngeal bots* are large, grub-like organisms living within the nasal cavity. Deer become infected when adult flies from the genus *Cephenemyia* deposit eggs in and around the nostrils. When the eggs hatch, the larvae crawl into the nasal cavity and begin development. They are a frequent occurrence in Florida deer, particularly in the north-central and southeastern regions (Cogley and Forrester 1991). Other than being a source of annoyance for the deer, it is doubtful that nasal bots cause any harm, even in large numbers (Davidson and Nettles 1997). Occasionally when hunters are field dressing a deer, the bots can be seen in the throat or crawling out of the deer's nose. Although unsightly, nasal bots are harmless to humans and the venison is safe for consumption.

There are two diseases that, although not detected in Florida at the time of publication, have received much public attention and warrant mention. *Chronic wasting disease* (CWD) is a fatal, rare neurological disorder that some believe can have a significant impact on deer populations. Pathogens can remain active in the soil and therefore, once present in a population, have the capacity for extensive spread. As the agents of CWD infiltrate the nervous system, deer begin to demonstrate reduced appetite, increased drinking and urination, and unusual behavior such as excessive drooling, nervousness, teeth grinding, and drooping head and ears.

Although there is no scientific evidence suggesting that consumption of meat from CWD-infected animals can infect humans, as a precaution, *you should not consume meat that has tested positive for CWD*. Furthermore, research indicates that CWD agents (prions) accumulate in the brain, eyes, spinal cord, lymph nodes, tonsils, and spleen, and consumption of these parts should always be avoided.

*Heartwater* is another potentially devastating disease of ruminants not known to occur in Florida, yet it is the target of an active monitoring program. It is caused by the bacterium *Cowdria ruminantium* and transmitted by *Amblyomma variegatum* and *A. maculatum* ticks. There is no vaccine for heartwater, and treatment is ineffective once clinical signs are observed. Symptoms include respiratory distress, human fearlessness, circling, and lack of coordination, and it is nearly always fatal. The only effective management of heartwater is through control of the tick that transmits it. It is thought that the disease might gain entry into Florida through the exotic tick, *A. variegatum*. Although tick collections in Florida have been conducted for decades, in 2003, Southeastern Cooperative Wildlife Disease Study began a year-round, statewide collection of ticks from harvested deer and other wildlife.

For more information on diseases and parasites of deer in Florida refer to “Parasites and Diseases of Wild Mammals of Florida” by Forrester (1992) and “Diseases and Parasites of White-tailed Deer” by Davidson and Nettles (1997).

## MANAGEMENT OF WHITE-TAILED DEER

### HABITAT MANAGEMENT

Providing quality habitat for deer is an essential part of a deer management program. Deer, like all wildlife, have basic needs in terms of food, water, cover, and space. Quality deer habitat provides the nutritional basis necessary for reproductive success, antler development, and overall herd health.

### Chronic Wasting Disease

Chronic wasting disease (CWD) has not been found in Florida or any southeastern state. In an effort to quickly *determine if CWD gets into the state* FWC has taken action by conducting an extensive monitoring program. Thousands of samples have been tested since the program began in 2002; all test results have been negative. FWC has also taken action to *prevent* CWD from entering the state by prohibiting importation of cervids from herds that have not been certified as CWD-free for at least five years. In addition, it is illegal to import the carcass of any deer, elk or other species from the family Cervidae from any state or province where CWD has been documented *except* boned-out meat or processed meat cuts, a hide with no head attached, antlers with a clean skull plate, finished taxidermy mounts, and upper canines.

We all take part in keeping this fatal disease from impacting Florida’s deer herd by being well informed, taking precautions, and acting quickly when necessary. Any illegal importations of cervids should be reported to:

**1-888-404-FWCC**

If you see or harvest a sickly, extremely skinny deer, do not handle it but call toll free:

**1-866-CWD WATCH**  
(1-866-293-9282)

Management for timber and wildlife are often seen as competitive, and therefore landowners are sometimes reluctant to consider habitat management for wildlife if the primary purpose of their land is for timber production. However, with proper guidance, wildlife habitat management can be successfully integrated into the management of forestlands. Compromises have to be made; however, owning or managing a property that provides quality wildlife habitat in a healthy and sustainable forest ecosystem can be very rewarding. Signs of increased deer use, such as scrapes or bedding sites, are evidence that you have created preferred deer habitat. Better forage quality can result in increased body-mass, improved health, and antler characteristics of deer. Habitat management for deer can also benefit other wildlife. For example, clearing forest openings and implementing prescribed burning on your land can provide increased food resources to various songbirds, quail, turkey, and rabbits.

Developing, or contracting a biologist to develop, a well-structured habitat management plan is time and money well invested. Without proper planning or appropriate choices, habitat management can get expensive in a hurry. For example, providing deer with supplemental food via feeders in an attempt to increase fawn production can end up costing more than one hundred dollars per deer. The cost/benefit ratio should be kept in mind when making management decisions.

The first step in a habitat management plan is to set attainable goals. The goals should be based on evaluation of the existing condition of your land. Unless the property is very large, it is important to also consider your neighbor's properties when evaluating your land for deficiencies. With a good understanding of what you are starting with and where you would like to end up (goals), creating a plan of how to get there is easier. There are several habitat management practices designed to attract and benefit deer. Planting food plots is one intensive way to enhance quantity and quality of deer food. Managing native vegetation is also crucial for long-term and larger scale habitat improvement.

Recommendations for habitat management are typically site-specific because local conditions such as the soil can influence the outcome. Objectives, budget, and past land-use also play an important part in the choice and intensity of management practices. However, there are some general guidelines for improving deer habitat and the following section lists some of the techniques used in Florida. For questions about habitat management specific to your area, contact a representative from a program listed in "Technical and Financial Assistance for Landowners." Phone numbers and addresses of FWC regional offices are listed at the end of this guide.

## **Forest Management**

The key component of forest management for deer is diversity of plant species and communities (combinations of species). Diversity, or variety, is necessary for deer to fulfill their nutritional and cover requirements during all seasons and all weather conditions.

*Among-stand diversity* refers to the mixture of different forest types and other natural communities (pine, hardwoods, wetlands, streams, etc.) present in a landscape.

*Within-stand or structural diversity* refers to the distribution of trees and other plants in a stand by characteristics such as age, size, vertical and horizontal arrangement, and species composition (the type of plants present within the stand).

Ideally, 50 to 150 acres of land would consist of 70-80% of relatively small pine stands intermingled with 20-30% of mature mixed hardwood. Generally hardwoods that contain both white and red oaks for hard mast production are preferred. Persimmon, blueberry, blackberry and American beautyberry are good sources of soft mast. As already mentioned, part of a good management plan is an inventory of stands and plant communities present. Naturally, the soil, topography, and other physical and biological features of the land largely dictate types of trees and other plant communities present. However, management techniques such as prescribed fire or creation of forest openings can temporally alter the stage of succession. Over time, whole forest communities can be altered as has been done with repeated use of prescribed fire and other disturbances to restore longleaf pine stands.

In Florida, prescribed fire is often the preferred and most economical method of improving understory diversity and growth. However, there are other very useful methods including thinning, creating forest openings, mowing, and disking. Herbicide treatment is also an option, particularly when trying to eliminate certain species while protecting others. When using herbicides, proper herbicide selection, rate, and application are important. Read and follow instructions

### Succession of Forest Vegetation

A forestland that has been cleared by natural (flood, tornado, wildfire) or artificial (timber harvest, land clearing) *disturbance* progresses from one plant community to another over time. This sequential process is known as *succession* and it is an important concept governing habitat management for deer. In early successional stages, forbs, shrubs, and young seedlings provide important forage for deer. Later as trees shade out the herbaceous plants, deer forage diminishes. In the last stage, known as the climax community, understory (grasses, forbs, low shrubs) is well developed but patchy. By manipulating the habitat with disturbance managers can “select” the successional stage that best meets needs of deer and other wildlife.

### Technical and Financial Assistance for Landowners

There are a number of programs that can assist a private landowner in habitat management including:

- FWC: *Florida Landowner Incentive Program (LIP)*. Contact the Technical Service Biologist at your regional office or visit the Commission’s LIP website at: <http://www.wildflorida.org/lip/>
- Florida Division of Forestry: *Forest Land Enhancement Program (FLEP)* and *Forest Stewardship Program*. Contact your local county forester or log onto: <http://www.fl-dof.com/>
- US Department of Agriculture Natural Resources Conservation Service: *Wildlife Habitat Incentives Program (WHIP)*. Contact your local NRCS Service Center or log onto: <http://www.fl.nrcs.usda.gov/programs/>

carefully to avoid poisoning unintended species. Typically a combination of techniques is used to get the desired results.

### *Thinning*

In general, dense forest with a thick canopy does not allow a sufficient amount of sunlight for growth of mid- and understory plants and, therefore, the amount of deer forage is limited. Also, when trees are spaced close together, competition for nutrients and water can limit understory development. Stands should be thinned when the crowns of the trees begin to touch and with intensity necessary to create a patchy stand. A good rule of thumb is to thin so that 30% of the ground is in direct sunlight at midday (Kammermeyer and Thackston 1995). In Florida, pine (slash, longleaf and loblolly) stands should be thinned to a basal area of 50-60 square feet per acre to open the overstory and encourage production of desirable understory vegetation. Sand pine is typically used for pulp wood and therefore clearcut. Studies have also demonstrated the benefits of thinning in other Florida habitat types, like hammock and cypress swamp (Harlow 1963). Use of prescribed fire after thinning can further enhance the growth and palatability of understory growth.

### **Forest Openings**

Establishing and maintaining openings is another way to allow sunlight and rain to reach the forest floor, stimulating understory growth of forbs, grasses and other young plants. It is recommended that approximately 5% of the total property consist of some type of permanent openings. Openings include both areas that provide native vegetation and areas with supplemental plantings (food plots). Planting food plots typically requires more time, effort, and money than maintaining native forage openings.

### *Shape, size and location*

Openings should be small (minimum of 1, maximum of 5 acres) and irregular or linear in shape thus maximizing *edge*. Edge, or ecotone, is a zone where two different habitats meet. Edge is beneficial for deer because it typically provides higher vegetative diversity. Maximizing edge also provides less distance from forage area to cover and therefore is likely to increase the use of the opening by deer. Circular or square plots have the least amount of edge.

Good sites to create or maintain openings include woods roads, and firebreaks that can be widened, idle fields, natural forest openings, and old logging roads and logging decks. Also, old house sites that are surrounded by fruit trees and vines can provide good foraging sites. Openings near wildlife travel routes (called corridors) such as rivers or drainages are preferable to placing them in large uniform tracts of pines. Although access with large equipment such as a tractor is likely necessary, openings should not be visible from public roads to avoid poaching. If the purpose of the opening is to encourage native food production, select sites that have plants such as greenbriar or native legumes already present to provide the seed source.

### *Maintaining openings for native forage*

Disking during winter months encourages growth of native legumes such as partridge pea, while summer disking encourages growth of grasses. Prescribed fire, mowing, hand clearing, tilling, and using herbicides can also be used to control woody vegetation and to increase herbaceous vegetation growth. Mowing should be conducted during winter (September through February) or after nesting season (July) of ground-nesting birds such as turkey and quail.

### **Food Plots**

Leaving openings in native vegetation is less expensive than food plots and native plots are easier to establish and maintain. However, planting deer forage can provide high-value supplemental food, especially when native vegetation is scarce or of poor nutritional quality. Although 3 to 5% is recommended, planting on as little as 1% of the property has the potential to improve deer diet and enhance condition, reproduction, and antler development (Johnson et al. 1987). Establishing a successful food plot requires proper site and plant selection, site preparation, and knowledge of when and how to plant.

Florida's sandy soils, hot and humid summers, and seasonal droughts can present challenges in establishing food plots. However, you can alleviate some of the challenges by choosing plants adapted to your area. Also, testing the soil is extremely important, as most of Florida's soils are acidic and require liming.

#### *Purpose*

There are two distinctive categories of food plots; foraging plots and attractant plots. Foraging food plots are designed to provide food to improve deer diets, whereas attractant plots are for viewing and harvesting. Attractant plots can be small; however, foraging plots should be larger and more numerous. In general, food plots should range in size from 1 to 5 acres.

#### **Cooperative Extension Service**

Your county *Cooperative Extension Service (CES)* agent can assist with every aspect of growing plants, including soil testing and plant choice. CES is an information network linking the U.S. Department of Agriculture, land-grant universities, county governments, and individual extension agents. In Florida, the Cooperative Extension Service is administered by the Institute of Food and Agricultural Sciences of the University of Florida. Your county CES office is listed in the local government section of your phone book — under the name of your county.



*Preparing a seedbed with a harrow.*

### *Land preparation*

Proper seedbed preparation is vital for a successful food plot. The seedbed should be clean-tilled, well-pulverized, level, and firm. Disking helps to pulverize seedbeds, improving soil to seed contact and seed germination. A cultipacker or some other roller can be used to firm a seedbed. If the food plot is planted on a logging road or old logging ramp, the soil may be too compacted and should be broken up.

### *Soil test, fertilization, and liming*

Soil samples should be collected at least two and preferably six months in advance of planting to allow enough time for testing and following recommendations. Recommendations on lime are typically given as tons per acre and fertilizers as pounds per acre. Therefore it is important that you know accurately the size of the plot (measure, don't guess!) to be able to follow the recommendation closely. Broadcast lime well in advance of planting (two to six months) to allow time for it to affect the soil chemistry. Proper pH of the soil, achieved with the correct amount of lime, is essential for optimum plant growth and to maximize the quality of nutrition available. Fertilizer can be added at planting.



*A seed drill is used to plant seeds in a prepared seedbed.*

### *Plant selection*

Choose plants that are well adapted to the site (soil type, climate, drainage and amount of shading), easy to establish, affordable, and that provide abundant forage at the appropriate time of year (cool-season vs. warm-season forage). For example, cowpeas and soybean are valuable warm-season forages, while clovers and wheat are valuable during the cool season (Tables 2a and 2b).

Legume seeds require inoculation with a proper mixture of live *Rhizobium* bacteria before planting. Some commercial mixtures of legumes already have bacteria added, if not, bags of inoculant specific to the seed type can be purchased from local farm supply stores.

#### **Plants for Florida**

Before spending large sums of money on commercial seed mixes that promise to “grow” monster bucks, remember that Florida’s soils are unique. Many of the ready mix seeds will not grow well in Florida soils. Opt for native plants or plants that have been tested in Florida. Your county extension agent can assist you in plant selection. In addition, University of Florida IFAS extension provides lists of recommended plants and mixtures.

Visit the IFAS website at:

<http://edis.ifas.ufl.edu>



*Planting a blend of species, such as this rye, oat, wheat, rape, and arrowleaf clover mixture can extend the foraging period.*

### *Planting dates and seeding rates*

Timing of planting is important for a successful food plot. Follow recommended planting dates and ensure that soil moisture is adequate. Planting during dry periods with no rain in the forecast is risky and may result in complete failure of the food plot. Broadcasting seeds just before or during rain (heavy downpours excluded), not only ensures adequate seed moisture, but can also help to push the seed to the right depth, compact the soil, and remove air pockets.

If seeding rates are too low, weed competition and germination problems can cause the food plot to fail. Typically, food plots are seeded at a rate higher than recommended for commercial production of the same plant; however, extremely heavy seeding can be a waste of money.

### **Importance of Inoculation**

Legumes such as clover “fix” nitrogen by taking it from the air and changing it chemically to make protein and other components important for plant growth. For the fixation to occur, legume roots must be “infected” with Rhizobium bacteria. Bacteria may naturally be present in the soil; however, inoculation of the seeds prior to planting may be critical for the success of the food plot. Some of the key considerations when purchasing/using inoculants:

- Inoculants are seed species specific - check the package to make sure the legume type is listed.
- Expiration date – the inoculant package has an expiration date and after that date many bacteria are likely dead. Use only fresh inoculant.
- Sun, heat, and drying out can kill the bacteria – best storage for inoculant is in a refrigerator in a well-sealed bag.
- For the inoculant to be effective it must stick to the seed. Commercial “stickers” are the best, but sugar water or soda can also be used.

### *Maintenance*

When selecting the plants for your food plot, consider the maintenance and management requirements. Most cool season plants are annual, which means they need to be planted every year. Perennial plants may persist for several years without need to reseed and typically require the least amount of effort. However, summer droughts can prevent perennial species from returning from existing root systems. Therefore, if your food plots attract a high number of deer, or the conditions (climate, pests) are not ideal, be prepared to renovate and reseed food plots annually. Mowing between plantings can encourage new growth and therefore extend the forage production. Make sure mowing is conducted after ground-nesting season of turkeys and quail, typically after July.

### **Prescribed Fire**

Fire is an integral component of Florida’s ecosystems, and many of the state’s animal and plant species have evolved under a regime of fire. Prescribed or controlled burning is a deliberate use of fire to achieve specific objectives. It is probably the most economical and beneficial deer habitat management tool in Florida. Prescribed burning can greatly improve habitat by stimulating the growth of grasses, forbs, and other herbaceous plants that provide both food and cover for deer. Fire can also act as a catalyst that releases nutrients from bound-up organic matter on the forest floor. These nutrients then become

available for plants, which increases their palatability, digestibility, and nutritional value. An added benefit of prescribed fires may also be a reduction in parasite populations, particularly immature stages of ticks and internal parasites.

One example of how fire can enhance nutritional quality of deer forage in pine flatwoods is the increase in levels of protein and phosphorus following a prescribed burn. Researchers demonstrated that April burning of pine stands led to a 43% increase in protein and a 78% increase in phosphorus in vegetation by July, and the vegetation on burned range maintained a 30% higher protein content than on unburned areas into the following year (Lay 1956). Also, in the pine flatwoods of southwestern Florida, deer use increased significantly in recently burned areas (Main and Richardson 2002). However, the increase in nutrients is temporary and requires repeat burnings to maintain effect. In pine flatwoods, deer use declined considerably 4 years post-fire; therefore a 3 to 4 year burning rotation is recommended (Main and Richardson 2002).



*Prescribed fire is an important habitat management practice that stimulates the growth of deer forage. Photo by Jim Garrison.*



*Just a week after a prescribed burn, new growth provides deer with nutritious forage.*

In Florida, burning is typically employed during winter dormancy. These fires can benefit pregnant does by improving forage quality in the late stages of gestation; however, resulting habitat enhancement can be short-lived (2-4 months) (Grelen and Lewis 1981; Wood 1988). Growing season fires (spring/summer), which mimic natural lightning fires, offer improved forage quality for fawns and does in summer, a time of peak energy requirements due to lactation (Kilgo and Labisky 1995). Summer fires also benefit bucks during antler growth. A combination of dormant and growing season fires will provide enhanced levels of nutrition during active growth periods of both sexes and all age classes.

Based on their objectives, land managers can make choices regarding burning frequency (years) and season in which burns will be conducted. Burn plans should be prepared with the help of a forester or other certified prescribed burn manager prior to the burning season.

### **Before Burning**

Florida laws require the landowner or manager to obtain a *burn permit* prior to conducting a prescribed fire. Using fire to manage habitat takes training and expertise and should only be conducted by or under supervision of a certified burn manager. A *certified burn manager* is an individual who has successfully completed a Division of Forestry (DOF) certification and possesses a valid certification number. Contact your DOF District Office for a burn permit and for information on local burning regulations.

## Supplemental Feeding

Providing supplemental food with feeders is another way to increase nutrition available to deer and assist in harvest. Distributing food during the deer's most stressful periods (e.g., fawning, winter, rut/post-rut) can serve to improve condition and may subsequently lead to an increase in productivity. Corn is a common supplement, which is high in fat and carbohydrates, but low in protein. For spring and summer, when doe lactation and antler development are a priority, foods that are higher in protein would be preferable (e.g., pelleted ration, soybeans). When abundant native forages are available, deer consumption of supplemental feed will vary according to season, rainfall, and range conditions.

An important consideration when supplemental feeding is the *cost-benefit ratio*. That is, is it economically viable to provide enough feed over a long enough period of time, to enhance herd quality and reproductive success? Zaiglin and DeYoung (1989) found that deer provided with pelleted ration exhibited considerably higher fawn survival than those without; however, the cost was estimated to be several hundred dollars per surviving fawn. Other annual cost estimates of supplemental feeding of deer have ranged from \$19/deer (Easton 1993) to as much as \$150/ deer (Kroll 1991).

## POPULATION MANAGEMENT

Population management is often referred to as harvest management. Deer populations in the historic past were controlled by predators; however, in most of Florida, predators have been extirpated from their historical range. Without predation, a deer population that is protected from hunting typically increases rapidly, exceeds carrying capacity, and damages its own range (McCullough 1997). Regulated deer harvest is

### Supplemental Feeding – Things to Keep In Mind

- Deer can crowd together at feed sites, and this can create ideal conditions for breakouts of infectious diseases and spread of parasites. Many states have banned supplemental feeding due to disease and other concerns such as habitat destruction near the feeders.
- Rain and humidity can cause molding or spoiling of the feed. Deer may either ignore the spoiled feed (thus feed is wasted), or they may inadvertently ingest dangerous toxins. Other wildlife, particularly birds, can get fatally ill from eating spoiled feed.
- Keep the feed clean and fresh. Deer will eat approximately 1lb/deer of supplemental feed per day. Seasonally changing the location of feeders can alleviate some of the concerns (see below).
- Deer will typically avoid feeders if hogs or bears are present. Both bears and hogs can also destroy feeders.
- Hunting deer in the proximity of feeding stations that have been continuously maintained throughout the year is legal provided that each station has been established *at least six months prior* to hunting season.
- As with any management practice, thorough knowledge of the benefits and drawbacks, relative to the costs of the management action can help you decide whether it is the correct action to take.

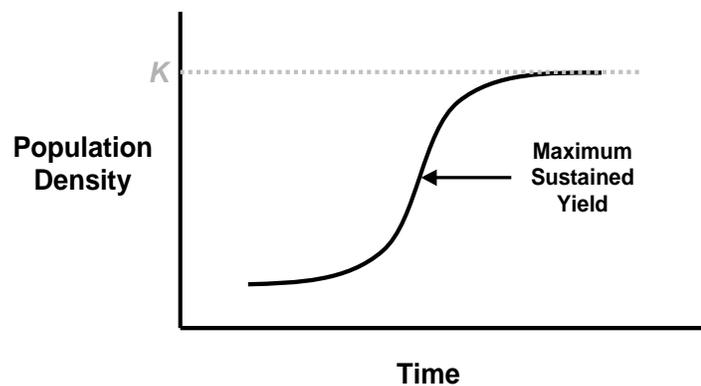
considered essential and the most economically practical method of sound management for white-tailed deer.

## Elements of Population Dynamics

Successful management of a deer herd requires a basic understanding of the factors that influence population changes. Deer populations are constantly changing as new individuals replace older animals. The elements of population dynamics include reproduction, mortality, immigration, and emigration. Although obtaining accurate reproductive and mortality rates (particularly mortality due to natural causes) can be difficult, managers can use a variety of techniques to detect changes in the size and health of the population. Estimates of population size, sex ratio, and age distribution are population descriptors that provide valuable information for managers.

## Population Growth Curve

The graphical display of a typical growth pattern for a deer population is a *logistic or S-shaped growth curve*. Although actual populations are unlikely to follow the curve exactly, it illustrates the general principles of population growth and can provide guidance for population management. The initial, small population grows relatively slowly because there are fewer individuals reproducing. As the population increases, there are more reproductive individuals, and the population grows more rapidly. The maximum rate of population growth occurs at the midpoint of the curve, at a point referred to as the *maximum sustained yield*. However, the increased numbers of individuals, all of which require food and space, contribute to a decline in habitat quantity and quality. Eventually, if allowed to progress, the rate of population growth falls to zero, as there is only enough forage for an animal to replace itself. The maximum number of individuals that a particular habitat can adequately support is called the *environmental or biological carrying capacity* denoted by  $K$  in the above graph. If a deer population increases beyond carrying capacity, the environment can no longer sustain the population, the habitat degrades, herd health declines, and the population suffers. In other words, the deer herd is overpopulated. The carrying capacity is extremely difficult to estimate and it varies from area to area according to soil type and fertility, climatic conditions, and other factors that determine the quality and quantity of food. Even within a given area, carrying capacity can vary from one year to the next depending on weather conditions and the resultant food production.



Logistic growth curve for a density-dependent population.

## Density-dependence

The growth curve in the logistic model is based on a density-dependent response, in which health and productivity of a deer herd are related to the number of deer found in a given area. For example, reducing the number of deer through hunting may result in improved forage quality (i.e., by allowing heavily-browsed vegetation to recover) and quantity (less individuals are foraging). Therefore as the number of deer is reduced, more quality forage becomes available for each deer and physical condition and reproduction can improve. In other words, there is *competition* for quality forage and the number of deer influences the level of competition, which in turn can have an effect on the availability of nutrition for each deer.

### Density-dependent vs. density-independent

Population growth is limited by different types of factors. A factor that causes higher mortality or lower birth rate as the population density increases is considered a density-dependent factor. Examples include food supply, disease, predation, parasites, and space.

Density-independent factors are factors that limit population growth regardless of the density of the population. For example, flooding can just as easily wipe out 10 deer as 50 deer in the same area; the probability of an individual dying from flooding would not change depending on how many deer are present. Density-independent factors are typically related to weather.

The relationship between density and physical condition has been well established in studies of white-tailed deer populations. For example, a study that encompassed a wide range of densities and a variety of habitats throughout the southeastern United States, found yearling male body weights to be most consistently related to density (Keyser et al. 2005a). Antler points, yearling female body weights, and fawn recruitment were also related to density (Keyser et al. 2005a, Keyser et al 2005b).

Density-independent factors, such as rainfall and hard mast production, may also exert tremendous influence on herd nutrition. For example, in Blackbeard Island, Georgia, variations in mast crops affected both hunter success and deer nutrition and accounted for most of the variation in deer numbers (Osborne et al 1992). The authors concluded that the availability of acorns overrode the effects of deer density on the nutritional status of the Blackbeard Island deer population (Osborne et al. 1992).

In areas where the intrinsic rate of increase of the population is low due to low nutrition, populations may rarely reach levels where density-dependent effects become evident. In northwest Florida, Shea et al. (1992) measured physiological indices (mass, antler beam length, and number of antler points) of yearling males in flatwood habitats. Spotlight counts indicated that the population abundance decreased during the 10-year study approximately 75%; however, improvements in deer physiological indices were not detected. Petrick et al. (1994) compared the number of fetuses per doe between an area closed to hunting to an area with intense hunting pressure in longleaf pine and scrub habitats in the northwest part of the state. Although population indices (track counts)

suggested that the difference between the relative abundance between the two areas was great, the productivity values did not differ.

Although Florida's deer herds, similar to other areas where habitats are considered marginal, may be less sensitive to changes in density than deer herds in higher quality habitats, more research is warranted. Long term studies that capture a wide range of habitats and densities are needed.

## **Population Trends**

Obtaining the actual count of deer in an area is nearly impossible. Furthermore, a head count of every deer at a given time would be of little value unless all ensuing births and deaths were also known. Therefore, rather than a complete head count, wildlife surveys typically obtain a *population index*. Examples of deer population indices include the number of deer observed per mile of survey route or total bucks harvested each year. Indices are proportionally related to population abundance and are invaluable in that, when done correctly, they may reflect changes in the population. For example, if a population increased by 20%, we should see a 20% increase in the index. In the real world, the indices seldom reflect the actual population perfectly because factors such as weather conditions during survey, observer skill, and vegetation density, can affect the number of animals seen. However, many of these factors can be minimized by conducting the survey at the same time of year, using the same routes, and by avoiding extreme weather conditions. For any index, having a standard protocol for the data collection is required to produce statistically acceptable results that can be compared between years. When surveys are conducted year after year, population trends (i.e. an increasing, decreasing, or stable population) in the data can emerge. Population trend data allows managers to assess the effectiveness of their management plans and make necessary adjustments.

## **Index of Deer Density**

Selection of a survey method depends on management objectives, nature of the habitat and terrain, deer density, and availability of time, money, and personnel. All methods have limitations, and none can be guaranteed to be absolutely reliable. In this section we review the most common methods that have been used in Florida for monitoring deer populations.

### *Track counts*

In Florida, pre-hunting season track counts can provide an indicator of deer population trends among years. A track count survey is based on 2 assumptions: (1) an individual deer typically returns to the same general location to spend the day, and (2) the nightly movement of an individual deer is confined to a range of about 1 mile or 640 acres (Tyson 1952). Recent radio-telemetry studies have shown that these assumptions are not always accurate (Fritzen et al. 1995), and the use of track counts to estimate population size has been questioned. However, yearly track counts can provide a useful index that can

allow the manager to determine if the population is increasing, decreasing, or remaining stable.

Track counts are conducted along transects that are free of vegetation and have surfaces that allow easy detection of tracks (e.g. sandy roads). The number of transects should be proportional to the amount of habitat type in the area. As a general rule, for areas that are over 100,000 acres, 1 mile of transect should be established for each 10,000 acres. For smaller areas, transect densities should be greater. Therefore, track counts should only be considered on areas that have a road system that is conducive for the technique. Once established, transects should not be moved.

Tracks are counted in the morning on a transect that 24 hours earlier had been cleaned, usually by dragging heavy brush, or section of fence. In Florida, track counts are usually conducted in July and August to take advantage of the afternoon thunderstorms. As a general rule, a minimum of 12 to 18 hours should have passed since rainfall for the track count to be accurate. FWC biologists recommend 11 replications per transect to minimize the effects weather and other factors may have on deer movement. The index is calculated by dividing the total number of tracks by the total number of miles.

### *Spotlight counts*

Spotlight surveys typically start one to two hours after sunset and are conducted on established routes that can be safely driven at night and cover the main habitat types. Initially, the route should be carefully planned to avoid changes in subsequent years (e.g., roads that may occasionally flood). A driver and at least 2 observers equipped with spotlights and binoculars are required. At each deer sighting, observers should be capable of determining the number, sex, and age (fawn, yearling, adult) of deer observed. Since visibility is the premise for this technique, spotlighting should be performed in areas with a sufficient proportion of open habitat, and surveys during poor weather (e.g., rain, fog) should be avoided.

Spotlight surveys can be used to estimate population density, fawn crop, and sex ratio. Observer bias exerts more influence than with track counts (i.e., spotting deer requires greater vigilance than detecting deer tracks), and there is a risk of "double counting" deer that were disturbed by observers and pushed further ahead on the transect. Because a high number of deer may be observed during a spotlight count conducted one night, while the same transect on the next night may yield very low numbers, several surveys should be conducted to achieve reliable results.

Ability to tell button bucks from does in the field can be difficult; however, it is important for obtaining accurate estimates of sex ratio. A good source for this technique is a "How to Sex and Age Live Antlerless White-tailed Deer" poster published by the Quality Deer Management Association.

### *Camera surveys*

Use of infrared-triggered cameras can be a great way to estimate population density and herd characteristics. In addition, cameras can produce interesting photos and provide a permanent record of observations that can be later thoroughly reviewed. Cameras can be used in variety of conditions, including areas of dense cover that could not be surveyed by spotlight counts. However, the cost of implementing a camera survey, including cameras, film and film developing, and time spent on initial set-up and examining the photographs is high.



The cameras should be evenly distributed and set in places frequented by deer (i.e., deer trails, scrapes, logging roads, edges of food plots, or agricultural fields). Clear an area within 10 feet of the camera to minimize false events due to wind blown vegetation. Pre-bait the site with corn, or other bait, for a minimum of 5 days before operating the cameras. Set cameras on sturdy trees, facing north or south. Locks and cables may be necessary for security. Although the initial set-up can be time consuming, once established, camera stations are relatively easy to maintain.

*Remote cameras can be a great way to get a closer look at your deer herd. However, be prepared to share the bait and film with other wildlife. Remote camera photos by Jonathan Dav.*

Individual branch-antlered bucks can often be identified from a set of photographs. Then in a subsequent set of photographs, populations may be estimated from the ratio of known to unknown individuals. Because it may be difficult to distinguish individual does and spike-antlered bucks, populations must be estimated from doe to branch-antlered buck and spike-antlered buck to branch-antlered buck ratios. The compilation of photographs can also reveal important information on deer distribution. Biases can arise from variability among sex and age classes in their attraction to bait sites. Furthermore, the inability to positively identify individuals without branched antlers (e.g., does, fawns, spike-antlered bucks) can limit the usefulness of this method.

### *Aerial surveys*

Assuming an unobscured view of the ground and a very high budget, aerial surveying is great way to estimate deer abundance and herd characteristics over vast and inaccessible areas. This method entails either flying transects in a fixed-wing aircraft while recording deer observations, or using a helicopter to flush deer and document sightings. Although both techniques are expensive, helicopter surveys cost more, but can provide a total deer count in a defined area. Moreover, they also offer information on deer

distribution, buck age classes, and buck quality. Alternatively, fixed-wing surveys are less expensive and have the advantage of allowing very large tracts of land to be covered in a short period of time. Under suitable conditions aerial surveys can provide population estimates with greater accuracy than other survey methods.

There are several books and other publications concerning wildlife survey techniques and population estimation. We have listed a few in the “Further Reading” section at the end of this guide.

## Data Collection and Record Keeping

Collecting information from harvested deer and keeping good records is an essential part of herd management. Without it, deer management is based on guesswork. Record keeping allows you to detect changes, evaluate management success, and predict future needs. Basic record keeping begins with a date and sex for each harvested deer, along with age, weight, and antler development. Checking for lactation and examining reproductive tracts can provide important production data.

Age is the most important piece of information you collect; the meaning of all other measurements depends upon accurate aging. Deer teeth are replaced in a predictable age-related sequence, and age can be estimated based on the tooth development and wear. With a little practice, three main categories; fawns (6 months of age), yearlings (1.5 years of age) and adults (2.5 years of age and older) are easy to recognize. Most outdoor supply stores carry deer aging kits with detailed descriptions of tooth wear for each age class. One side of the lower jaw of all harvested deer should be using the jawbone extractor collected, tagged, and saved for later inspection.

### Data Collection – Basic Tools

- Scales
- A mechanism to hoist a deer
- Long handled pruning shears
- Jawbone extractor
- Permanent marker and/or jawbone tags
- Collapsible fish-basket for storing jawbones
- Steel measuring tape (¼-inch wide)
- Data sheets



Weight can be taken as a live weight (body completely intact) or field-dressed weight (internal organs removed). Make sure the definition of “field-dressed” is the same for all the hunters in your area, as techniques for field-dressing a deer can vary. Spring scales are typically used, but any accurate scale works. Check for accuracy at the beginning of each hunting season and calibrate if necessary. Weights should be recorded to the nearest pound.

Antler measurements should include the total number of points, maximum inside or outside spread, basal circumference, and main beam length.

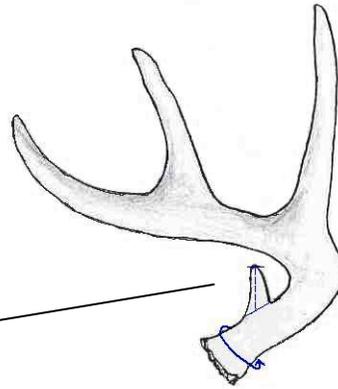
Be consistent and thorough and note broken antlers or other deformities. Use a flexible ¼-inch wide steel measuring tape and record all measurements to the nearest 1/8-inch as follows:

### **Basal circumference**

Measure around the main beam between the burr and the first point, but no greater than 3 inches above the burr. Measure both antlers.

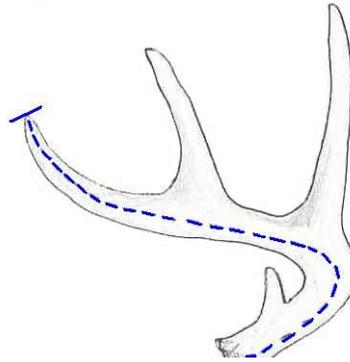
### **Points**

Record only the points that are at least 1- inch long.



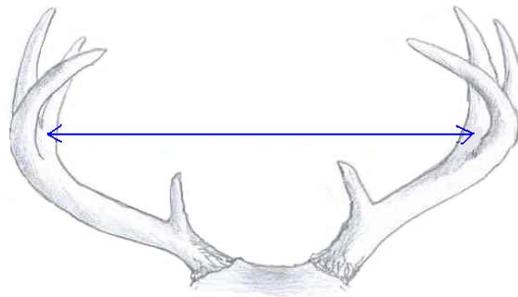
### **Main beam length**

Measure along the outside curve of the main beam from the burr to the tip of the antler. Measure both antlers.



### **Inside spread**

Measure the straight-line distance at the widest point between the main beams.



For more detailed scoring, contact FWC regional office for a list of employees trained to do Boone and Crockett scoring. Instructions for Boone and Crockett and Pope and Young scoring can also be obtained from the organizations.

### **Harvest Strategies**

Hunting is the primary tool for managing deer populations throughout much of Florida. There are a number of harvest strategies available, and deciding which one is best for your deer herd depends on your ultimate goals and objectives. Basic objectives, such as maximizing buck harvest, reducing deer numbers, or increasing the proportion of mature

bucks all require different harvest strategies. Currently, in most of Florida, FWC allows for some of the most liberal buck hunting in the country and relatively conservative doe hunting strategies. However, several FWC Wildlife Management Areas (WMAs) have initiated programs such as the Special-Opportunity Deer Hunts that offer high-quality hunts with limited access, low hunter numbers, and more restrictive point-rules (one antler must have at least four points) and bag limits. In addition, a number of WMAs have adopted rules restricting harvest of bucks with small antlers in an effort to allow bucks to reach older age classes.

Similar to habitat management, the first step of population management is to define management objectives or goals for the deer on your property. Once you have set objectives, the next step is to develop a plan of how to achieve them. It is important to set goals that are practical, and perhaps most importantly, in accordance with the limitations of the habitat. Unless you control large tracts of land, it is also important to consider your neighbor's management practices. As previously discussed, Florida's soils and habitat can make some management goals a challenge because of the lower nutritional content available for deer. However, equipped with knowledge and patience, managing for healthy deer populations with quality bucks is possible.

#### *Traditional deer management*

Traditional or restoration deer management is a strategy in which bucks from all age classes are harvested liberally, while doe harvest is very limited. Harvesting bucks, while protecting the does which produce the next crop of deer, can work well for those trying to maximize their buck harvest. This strategy may produce a bountiful harvest, but the harvest generally consists of younger, smaller-antlered deer. Moreover, limiting hunting to mostly bucks can eventually lead to skewed sex ratios favoring does.

#### **Special-Opportunity Deer Hunts**

In 1999, FWC established Special-Opportunity Deer Hunts (SODH) in several Wildlife Management Areas. The goal of SODHs is to provide Florida hunters a high quality hunt with a lot of game, low numbers of hunters, and a chance to bag a quality buck. Additional information and permit applications are available online and in FWC offices.

#### **Antlerless Deer Permits**

To apply for an antlerless deer permit contact your regional FWC office (listed in Contacts). Permit applications are also available online in "Licenses/Permits" on the FWC website:

**[www.myfwc.org](http://www.myfwc.org)**

An individual landowner or a group of landowners may apply jointly, provided the combined adjoining land is *at least 640 acres*. Individual landowners or groups of landowners with a minimum of 150 acres, may apply for antlerless deer permits if their land is adjacent to land already receiving antlerless deer permits. Landowners who cultivate agricultural crops are exception to the above rule and are exempt from these minimum acreage requirements if they have been permitted within the past year to take deer for crop depredation purposes.

### *Quality deer management*

In 1975, Al Brothers and Murphy E. Ray, Jr. outlined in their book, *Producing Quality Whitetails*, the management concepts for what has been widely termed "quality deer management" (QDM). The Quality Deer Management Association describes QDM as "the voluntary use of restraint in the harvest of young bucks combined with an appropriate antlerless deer harvest to maintain a healthy deer population in balance with the habitat." It is not trophy deer management, but practitioners of QDM find they see and harvest older bucks, especially 2.5- and 3.5-year-old animals.

The concept of QDM has been received with mixed popularity among Florida hunters. According to a 2002 FWC survey of hunters in Florida, 80% of deer hunters said it is important for them to hunt higher quality bucks, and 77% said there are too few quality bucks where they hunt. However, when presented with various statewide hunting regulation options, including more restrictive point-rule and bag-limits necessary for QDM to work, the majority (57%) did not want any rule changes. Landowners and managers desiring to increase the availability of older bucks must go beyond state regulations and impose more restrictive harvest criteria to meet their goals. These criteria may include limits on the number of bucks that may be harvested and antler restrictions, such as point or spread rules. Such restrictions can increase the number of older, larger-antlered bucks on a property. However, it is important to have realistic goals that recognize the sometimes limited potential of the habitat found in Florida.

Increasing the proportion of older bucks in the population can produce larger antlers in the harvest, but expectations must be tempered by biological potential. Low productivity in much of Florida means that herd increases will occur at slower rates. *Doe harvest needs to be conservative to guard against over-harvesting* this segment of the population. A doe harvest of 20% or less of the total harvest may be enough to maintain population density on poor-quality habitats (Shea and Osborne 1995). Button bucks are often mistaken for does late in the hunting season. Hunters should learn to distinguish buck fawns from does and avoid harvesting them as antlerless deer. Furthermore, fewer bucks should be harvested from poor-quality habitats. Over-harvest of bucks can adversely affect long-term age structure of the herd, thereby reducing the number of older bucks available. Increasing the availability of large antlered bucks in Florida is no different than on more fertile habitats; young bucks must be allowed to mature. With small acreages, voluntary restraint may not work if a young buck passed up on one property is harvested as soon as it arrives on another. With little acreage, a cooperative management program among neighbors may be necessary to influence significant changes in an overall deer population and to successfully implement antler restriction strategies.

There is a wealth of knowledge available concerning QDM, including a Quality Deer Management Association website ([www.QDMA.com](http://www.QDMA.com)), a semi-monthly Quality Whitetails journal, and various books and videos.

### *Reducing deer numbers*

The traditional buck-dominated hunting strategy is ineffective when the goal of the landowners and managers is to reduce deer numbers. Even with the low productivity of Florida's deer herds, does can easily produce replacements for the harvested bucks. In this situation, a more aggressive harvest strategy is needed, including increasing the number of does being harvested. In areas where crop damage from deer is a concern, the issuance of deer depredation permits can often temporarily relieve localized overpopulation problems. Where land managers feel the deer population is too high, they can apply for antlerless deer permits from FWC (see box above). Farmers who received deer depredation permits for crop damage within the previous 12 months can receive antlerless permits regardless of the amount of acreage owned.

### **SUMMARY**

White-tailed deer occur widely in Florida; they are found in every county where suitable habitat occurs. They are Florida's most important game species, from a perspective of both economics and a cultural tradition. Florida deer are well adapted to our soils and climate and despite being generally smaller than their northern counterparts, Florida produces some very impressive deer. There are many factors that favor deer in Florida, including a year-round mild climate, abundant rainfall, and a seemingly unlimited supply of forage.

The basis for any management action, habitat or population management, should be a clear understanding of the ecology, life-history, and habitat needs of the white-tailed deer. Information on some of the unique qualities of Florida's deer habitat and population characteristics will enhance your ability to tailor management actions that are appropriate for Florida. Florida's infertile soils affect the nutritional quality of plants and ultimately the productivity, growth, and antler characteristics of the deer dependent upon that forage. By manipulating native habitats and/or adding quality food sources, landowners can improve deer habitat and therefore benefit the deer herd. There are many habitat management techniques available, and a combination of techniques may be necessary for long-term improvements. Understanding your property's capability and limitations and developing a habitat management plan with clearly identified goals will save time and money in the long run.

The second part of comprehensive deer management is population or harvest management. Harvest strategies differ depending on whether the goal is to maximize the number of bucks available for harvest or to improve the quality of the deer herd. The liberal buck-harvest policies in our state provide many opportunities for the Florida hunter. Managing for older age-class bucks has become an increasingly popular approach for hunters interested in improving antler quality and the overall health of the deer herd. Florida's deer productivity is naturally low, and deer managers must have patience, since it can take some time to realize improvements in their herd. Alternatively, it can take even longer for a population to recover from the consequences of mismanagement. With any

harvest strategy, keeping good records is crucial as this is the only way you can evaluate the progress of your management plan and make informed choices for any needed adjustments. FWC or other professional biologists can provide important assistance in the development and maintenance of a proper population management plan.

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<http://www.nrcs.usda.gov/>

#### Additional Websites:

Quality Deer Management: <http://www.qdma.com>

Information on chronic wasting disease: <http://www.cwd-info.org/>

## FIGURES

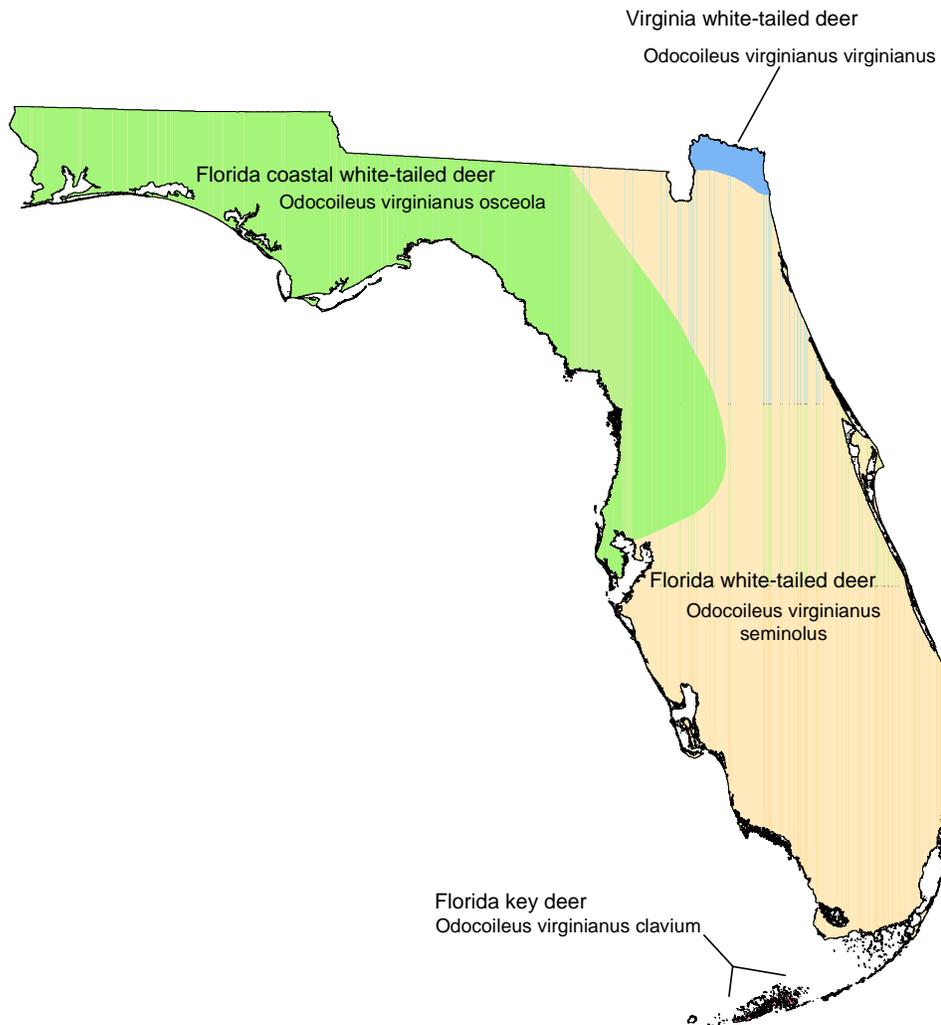


Figure 1. Subspecies of white-tailed deer (*Odocoileus virginianus*) in Florida (Ellsworth et al. 1994).

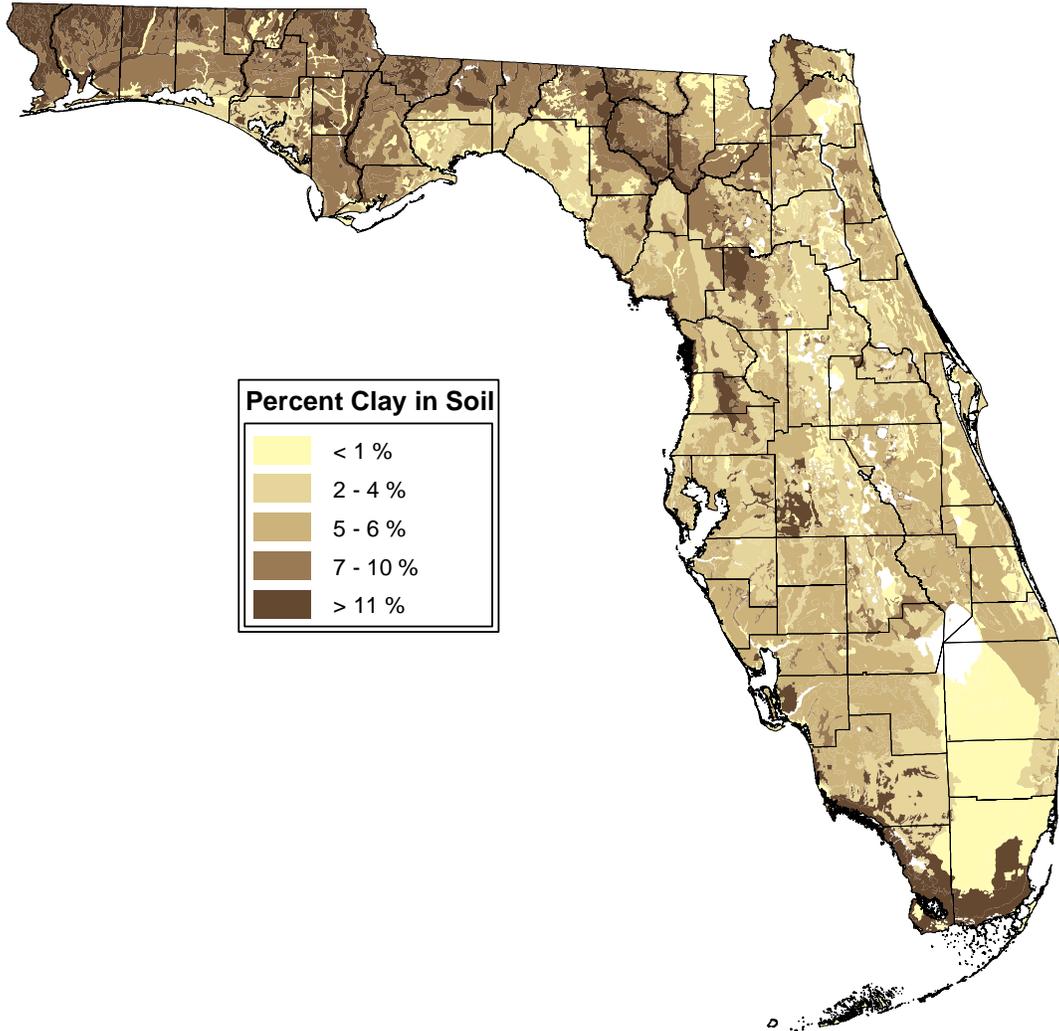


Figure 2 – Percent of clay in Florida’s soils (based on data from STATSGO (1994)).

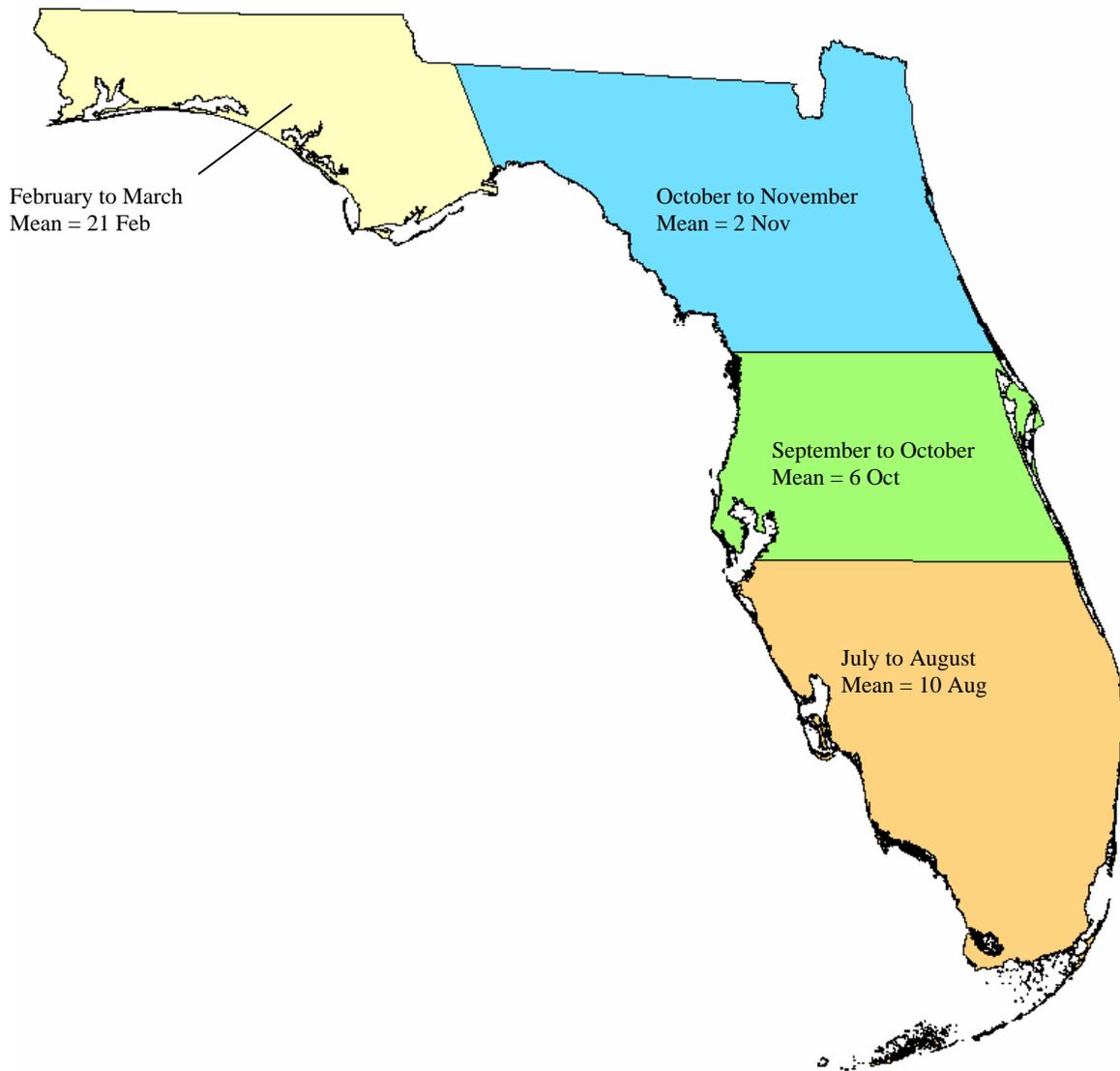


Figure 3. Breeding dates for white-tailed deer in Florida (95% of breeding occurred during the given months) (Richter and Labisky 1985).

## TABLES

Table 1. Preferred forages of white-tailed deer (*Odocoileus virginianus*) in seven habitats in Florida (F = flatwoods; POU = pine – oak uplands; S = swamps; H = hammocks; P = prairies; SPSO = sand pine – scrub oak; FWM = fresh water marshes) (Harlow and Jones 1965).

Scientific Name	Common Name	Plant Part	F	POU	S	H	P	SPSO	FWM
<i>Quercus</i> spp.	oak	leaves/acorns	X	X	X	X		X	
Basidiomycetes	mushrooms	entire	X	X		X		X	
<i>Serenoa repens</i>	saw palmetto	berries	X					X	
<i>Sabal etonia</i>	scrub palmetto	berries						X	
<i>Sabal palmetto</i>	cabbage palm	berries				X			
<i>Trilisa odoratissima</i>	vanillaleaf	leaves/acorns	X						
<i>Ilex glabra</i>	bitter gallberry or inkberry	leaves/twigs/berries	X			X	X		
<i>Ilex coriacea</i>	sweet gallberry	leaves/twigs/berries	X		X	X			
<i>Ilex cassine</i>	dahoon holly	leaves/twigs/berries			X	X	X		X
<i>Ilex vomitoria</i>	yaupon holly	leaves/twigs			X	X			
<i>Itea virginica</i>	Virginia willow	leaves/twigs			X	X			
<i>Smilax</i> spp.	greenbrier	leaves/vine/berries	X	X	X	X		X	X
<i>Cliftonia monophylla</i>	black titi	leaves/twigs			X	X			
<i>Kalmia hirsuta</i>	hairy laurel or wicky	leaves/twigs	X	X					
<i>Vaccinium myrsinites</i>	blueberry	leaves/twigs	X	X				X	
<i>Osmunda regalis</i>	royal fern	fronds			X	X			X
<i>Rhus copallinum</i>	winged sumac	fruiting heads	X	X					
<i>Magnolia virginiana</i>	sweet bay	leaves/twigs			X	X			
<i>Gelsemium sempervirens</i>	jessamine	leaves/vine/berries				X			
<i>Nyssa</i> spp.	black gum and sweet tupelo	fruits			X				
<i>Taxodium</i> spp.	bald and pond cypress	leaves/twigs			X				
Gramineae	broadbladed grasses	stems/blades	X	X		X	X		
Leguminosae	legumes	leaves/stems	X	X					
<i>Juncus effusus</i>	soft rush	stems/blades	X		X		X		
<i>Rubus</i> spp.	blackberry and dewberry	leaves/twigs	X		X	X			
<i>Acer rubrum</i>	red maple	leaves			X	X			
<i>Pinus</i> spp.	pine	needles	X	X				X	
<i>Viburnum</i> spp.	virburnum and haw	leaves/twigs			X	X			
<i>Diospyros virginiana</i>	common persimmon	fruits		X		X			
<i>Vitis</i> spp.	grape	leaves	X			X			
<i>Centella repanda</i>	spadeleaf	stem/leaves	X		X	X			
<i>Nymphaea odorata</i>	American white waterlily	leaves			X		X		X
<i>Drinum americanum</i>	swamp lily	leaves			X		X		X
<i>Salix</i> spp.	willow	leaves/twigs			X		X		X
<i>Hymenocallis tridentata</i>	spider lily	leaves							X
<i>Ludwigia natans</i>	creeping primrose willow	leaves	X						X
<i>Jussiaea peruviana</i>	Peruvian primrose willow	leaves			X	X			X
<i>Monotropa brittonii</i>	Indian pipe	entire	X	X		X			
<i>Garberia fruticosa</i>	garberia	leaves/twigs						X	
<i>Brasenia</i> spp.	water shield	leaves			X				X
<i>Berchemia scandens</i>	rattan vine	leaves/twigs				X			
<i>Hypericum</i> spp.	St. John's wort and sandweed	leaves/twigs	X			X			

Table 2a. Planting dates, seeding rates and favorable soil types for selected warm season crops for deer.

Species	Planting Period	Planting Rate	Soil Type
Jointvetch or Aeschynomene	March to June	15-20 lbs./acre	Sandy, damp or moderately drained; tolerant to temporary flooding
Corn	Mid-March to mid-April	8 lbs./acre	Widely adapted
Clover – Alyce	May to June	15-20 lbs./acre	Moderately to well-drained
Cowpeas	Mid-May to mid-June	60-90 lbs./acre	Well-drained, fertile
Soybeans	Mid-May to mid-June	8 lbs./acre – drill 25 lbs./acre - broadcast	Moderately drained

Table 2b. Planting dates, seeding rates and favorable soil types for selected cool season crops for deer.

Species	Planting Period	Planting Rate	Soil Type
Clover - Crimson, Red	September to October	15-20 lbs./acre	Moderately to well drained
Clover – Ladimo, Osceola, White	September to October	7-10 lbs./acre	Moderately to well drained
Oats	Mid-September to mid-October	3-4 bushels/acre	Widely adapted
Wheat	Mid-September to November	90-120 lbs./acre	Widely adapted
Clover – Subterranean	October to mid-November	20 lbs./acre	Moderately to well drained
Clover – Arrowleaf	October to mid-November	15-20 lbs./acre	Widely adapted
Rye	October to November	2 bushels/acre	Widely adapted
Ryegrass	Mid-October to mid-November	20-30 lbs./acre	Widely adapted

