Coping with Deer Damage in Florida[1]

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Introduction

The number of white-tailed deer (*Odocoileus virginianus*) (Figure 1) in the United States has increased dramatically during the past few decades. Deer are herbivores, known to feed on hundreds of different types of plants. In situations where natural, preferred food is scarce, deer may damage agricultural crops, horticultural plantings, and timber plantations. Deer feed upon many row crops, forage crops, vegetables, fruit trees, nursery stock, and ornamentals. They will even feed upon stacked hay during periods of food shortage. Many factors contribute to whether or not a particular plant is eaten, such as palatability, nutritional needs, and availability of alternative foods. Deer feeding causes not only immediate losses, but also reductions in future yield from fruit trees or perennial forages, and permanent disfigurement of ornamentals and nursery stock. In areas with high densities of deer, deer may severely impact native plant communities and undermine regeneration of some plant species.

Ideally, deer damage is controlled through management of deer populations (hunting). Unfortunately, effective management of deer is not always possible, particularly in urban and mixed rural-urban settings where the use of firearms to reduce deer populations is not a realistic alternative. Here we suggest other options that may be used to control or reduce damage from hungry deer. These options range in cost and permanency. We cover the following tactics: selective planting and harvesting strategies (modification of the resources the deer are consuming), frightening strategies, repellents, fencing, and lethal control. We strongly recommend using these methods to prevent deer damage before it begins or as soon as possible thereafter, because it is very difficult to break deer behavior patterns once they are established.

Additional information on white-tailed deer in Florida is available through the UF/IFAS Extension publication, Florida's White-tailed Deer (Schaefer and Main, WEC-133).

Figure 1. White-tailed deer, *Odocoileus virginianus.*
Credits: Schwartz and Schwartz. (1981)

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Identification of Damage by Deer

Deer browse on a wide variety of materials including leaves, stems, and buds of woody plants, forbs, fruits, nuts, grasses, fungi, and agricultural crops. Confirming that deer are in fact responsible for the damage you are experiencing is an essential first step to developing an effective strategy to reduce the damage. If the problem is being caused by some other wildlife species, you will want to consider tactics that match the habits of the animal causing the problem rather than following the guidelines presented here for deer.

Deer presence can be confirmed by their distinctive tracks (Figure 2), their droppings, and characteristic signs of deer browsing. Because deer lack upper incisors, they must tear or jerk plant tissues, leaving ragged ends of twigs, stems, and leaves. Rabbits and rodents, which possess upper incisors, leave a smooth, clean-cut surface. Also, the height of damage from the ground (up to 6ft [1.8 m]) often rules out any mammal other than deer. Observations during evening and early morning hours, or while using spotlights at night, can also help determine if deer are responsible for damage. See WEC324 [http://edis.ifas.ufl.edu/uw369] for additional tips on how to differentiate between damage from deer versus rabbits.

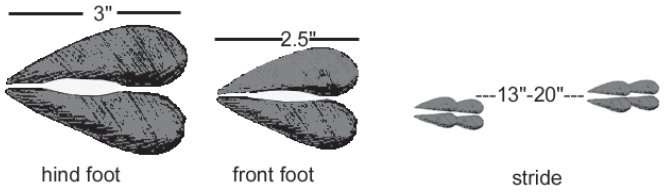

Figure 2. Deer tracks.
Credits: Cabrera (2000) Animal Tracks of Humboldt County

Damage Prevention and Control Methods

Selective Planting and Harvest Strategies

SELECTIVE PLANTING

You can minimize damage to ornamental plantings by selecting landscape and garden plants that are less preferred by deer. This is often a trial-and-error process because deer preferences vary from one location to another. Deer diet preferences are influenced by the availability and attractiveness of other food items in the area. In situations where deer numbers are high and browsing pressure has reduced the availability of native plants, deer may eat almost anything. Consultation with local nurseries and landscape architects may provide some assistance in selecting plants less preferred by deer in your area. At this writing, there is not yet a good, comprehensive list of landscape plants that are ranked for their susceptibility to damage from deer for Florida. See WEC315 [http://edis.ifas.ufl.edu/uw360] for information on deer preferences among wildflowers in north Florida.

HARVESTING AND CROP LOCATION STRATEGIES

The timing of crop harvest is dictated primarily by economic decisions related to marketing windows and environmental factors. One strategy for reducing deer damage is to harvest crops as early as possible to reduce the period during which crops are vulnerable to deer. Another is to plant crops that are favored by deer as far from wooded cover as possible to reduce the likelihood deer would be willing to travel across highly exposed areas to access favored crops. A third option is to simply minimize expenses associated with crop maintenance activities in crop areas where deer damage is consistently high (i.e., set aside certain areas as sacrifice crop zones).

Frightening Devices

Deer can sometimes be scared away temporarily from areas where they have been causing damage using audio or biological tactics. Frightening strategies generally have higher success initially, followed by deer habituating to the point that these methods become ineffective. Frightening tactics should be deployed at the first sign of a problem because it is difficult to change the movements or behavioral patterns of deer once they have become established.

Propane Cannons/Gas exploders

These devices can be purchased for $300 to $500 from commercial sources to frighten deer. Cannons can be coupled with a timer so they are set to detonate at regular intervals. Results are often temporary (1 to 2 weeks) because deer become accustomed to the sounds once the novelty wears off. To maximize their effectiveness, move them every few days, switch the firing sequence regularly, and consider using these in combination with other tactics. The volume of sound produced can be increased by raising exploders off the ground. Due to the loud volume of sound produced by these devices, their use is not recommended in urban or suburban settings.

Pyrotechnics

Fireworks (such as shell crackers, screamers, and bangers), and gunfire provide quick, but only short-term relief from deer damage. They also incur high labor costs because they cannot be automated. Pyrotechnics are most effective when used at varied times of day and launched from varied locations. Use them along farm perimeters, in orchards,

nurseries, and along field roads at dusk and throughout the night during times of the year when valuable plants are most susceptible to damage.

Dogs

Dogs may be effective for small areas, such as gardens. For example, a dog on a long run or restricted by an electronic invisible fence system can keep deer out of a limited area, but care and feeding of the dog can be time-consuming. Also, ticks, fleas, and heartworm transmitted by mosquitos needs to be considered by dog owners in Florida. The use of free-running dogs to chase down deer is not effective, can be detrimental to other wildlife, and has legal ramifications.

Repellents

A wide variety of materials is currently available on the market to deter deer from foraging on crops and ornamental plantings. These materials vary considerably in cost, ingredients, and the length of time they remain viable. It is important to recognize that repellents can reduce but rarely eliminate deer damage, and that they may not work at all in areas where alternative sources of food are limited. Because deer feeding preferences change seasonally in response to food availability, a particular repellent may work at one time of year but not another. Application of repellents can be costly and time-consuming, so this strategy should not be considered a long-term solution to limiting deer damage.

Repellents are best-suited for use in orchards, gardens, and on ornamental plants, in areas where there are low to moderate deer numbers. They are not well suited to row crops, pastures, or other large areas due to high costs and use restrictions. Always follow label directions carefully when applying a chemical repellent, especially for those sprayed directly on plant parts because each repellent is labeled for use on a limited selection of plant species.

Two broad categories of repellents are available: "contact" or "area." Contact repellents, applied directly to the plants, repel by taste. Area repellents are applied near the plants to be protected and repel deer by odor. Area repellents are usually less effective than contact repellents but can be used in perimeter applications and in situations when no contact repellents are available on the market to protect a particular crop or ornamental.

Contact repellents are most effective when applied to trees and shrubs during their dormant period. New growth appearing after treatment is not protected. Because new growth is typically the most palatable to deer, repellents must be reapplied frequently during periods of active plant growth. Young trees should be treated completely, but it will be more economical to treat only the terminal growth of older trees. Be sure to treat up to a height of about 6ft (2m) above ground. Contact repellents may reduce the palatability of forage crops but should not be used on plant parts destined for human consumption unless specifically stated otherwise by the product label.

The effectiveness of repellents depends on several factors such as the availability of other food items, the stage of growth of the plants, local deer abundance, how much time deer have had to become accustomed to consuming the plant before it was treated, and the frequency of reapplication of the repellent. Highest success is likely when a combination of repellents is used, when application is started before damage has begun, and in areas where abundance of deer is fairly low. During periods of low food supply, deer are likely to consume preferred plants regardless of the amount or type of repellent applied. Areas that are frequently wetted by irrigating devices or by frequent rainfall will require regular reapplication of repellents. The following list of common repellents, grouped according to their primary ingredient, is incomplete and provided simply as an overview of the wide range of repellent formulations available. *Note: This list is not an endorsement, and many of these repellents may or may not work depending on site conditions.*

- Salts/fatty acids of ammonia—Hinder®
- Bitrex—No Deer Zone®, Ropel®, Tree Guard®
- Bloodmeal—Plantskydd®
- Capsaicin—Miller's Hot Sauce Animal Repellent®, Repellex Deer and Rabbit Repellent®, Scoot Deer and Rabbit Repellent®
- Egg solids—Buck Off®, Deer-Away Big Game Repellent®, Deerbusters Deer and Rabbit Repellent®, Liquid Fence®, Not Tonight Deer, Plotsaver®
- Fish or beef byproducts—Bobbex®
- Garlic—Deer Pharm®, Shake Away Deer Repellent®
- Thiram (tetramethylthiuram disulfide)—Defiant®, Spotrete F®

Other materials reported to provide varying levels of effectiveness at repelling deer include human hair, bars of soap, and tankage (putrefied meat scraps obtained from slaughterhouses). All three can be hung in fine mesh bags from branches of plants experiencing deer damage. Biosolids (milorganite, or processed human sewage) is another repellent recommended as a deer deterrent under certain circumstances. More detailed comparisons among

the mode of action, application methods, and label recommendations for many repellents are provided in WEC 326 [http://edis.ifas.ufl.edu/uw371].

Exclusion Devices

Fences serve as physical and/or psychological barriers, providing more reliable protection from deer than frightening devices or repellents because they can prohibit access to areas where deer have caused damage. In locations where deer are abundant or persistent, fencing may be the only way to effectively minimize deer damage. It is important to recognize that fences may shift deer damage to nearby unprotected areas, potentially concentrating deer foraging activities in smaller areas where damage levels may increase.

Although fencing options vary a great deal in cost, fencing is generally an expensive solution to preventing or reducing damage from deer. If you intend to build a fence yourself, we recommend you consult a fencing contractor. Detailed fencing manuals are also available from most fencing manufacturers and sales representatives. Points to consider prior to investing in fencing to reduce deer damage include:

- The greater the local abundance of deer, the greater the likelihood that tactics other than fencing will be ineffective. In areas with high deer densities, fencing will probably be far more effective than frightening devices or repellents.
- Crops and ornamentals whose future yield and growth could be affected by damage at a young age may need the protection that only fencing can provide.
- Fencing is typically not a feasible option for protecting large areas from deer. Also, because the corner and end systems comprise the majority of the cost of materials for most fences, efforts should be made to minimize these. Protection of square areas tends to be the most economical in terms of cost per unit area.
- If deer damage is limited to a fairly short period of time each year, temporary fencing may be more suitable than permanent.
- Fences should ideally be installed before damage begins. The longer the period of time deer have to become accustomed to feeding in the area to be protected, the more difficult it will be to break their habits. More permanent, expensive fencing may be required to protect areas deer are already accustomed to feeding.
- The cost and life expectancy of the fence should be evaluated in relation to the value of the crop or resource being protected to determine if the fence will pay for itself. Expensive, permanent fences are best suited for protecting valuable, long-lived crops.

The following sections will describe an assortment of fencing options, ordered from least to most expensive.

Temporary Electric Fences

Temporary electric fences are simple to construct and provide a relatively inexpensive way to seasonally protect gardens and other small areas. In some circumstances, temporary electric fences may be effective in protecting field crops for relatively short periods of time. An advantage to these fences is that you could take it down temporarily to plow and prepare the protected area prior to each growing season. The disadvantages of temporary electric fences are that they have a shorter lifespan, require more frequent maintenance, and typically provide less protection from deer than permanent fences.

Temporary electric fences are a psychological rather than a physical barrier. Deer are baited into contacting the fence with their noses to receive a shock, which is a strong negative stimulus that may cause deer to avoid the fenced area thereafter. Temporary electric fences should be installed just prior to the time damage is expected to occur, or at the first sign of damage to prevent deer from establishing feeding patterns that are difficult to break later. Weekly inspection and maintenance of these fences are required. In addition to moderate cost, these fences are easy to construct and light-weight, and materials are readily available. One of the following two designs may work for you.

PEANUT BUTTER-BAITED TEMPORARY ELECTRIC FENCE

This fence is useful for small gardens, nurseries, and small orchards (< 5 ac or 2 ha) subject to moderate deer pressure. A 17-ga smooth steel wire can be mounted with plastic insulators on light-duty steel or fiberglass posts, and charged with a simple energizer. The electric wire is baited at the height of a deer's nose with peanut butter to attract deer and promote nose-to-fence contact. The use of an attractant (peanut butter) increases the likelihood of deer avoiding the fence in the future because they quickly learn to associate a shock with the fencing. Check the fence weekly for deer damage and grounding by vegetation, and apply peanut butter at least once a month. This fence costs less than $2 per meter to construct, and is reported to be 80–90% effective.

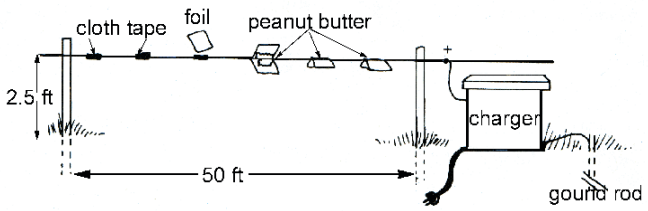

Figure 3. The peanut butter fence with foil flags.
Credits: Craven and Hygnstrorn (1993), "Controlling Deer Damage in Wisconsin," University of Wisconsin Extension publication G3083

POLYTAPE TEMPORARY ELECTRIC FENCE

Polytape or polywire is an effective choice for fencing because it is more visible than traditional wire, strong, durable, and lightweight. This material incorporates wires into synthetic ribbons or ropes, which provide more surface area to apply an attractant such as peanut butter. Polytape and polywire is well-suited for temporary fencing that is re-installed for limited periods each year because it is easy to install, easy to tighten, and easy to rewind. Polytape fences are recommended for use to protect relatively small vegetable and field crops under moderate deer pressure. The reduced conductivity of the polytape limits the ability of the charge to travel through a fence longer than 0.4 km (a 15 ha plot). Bait the polytape to make it attractive to deer so that they receive shocks through nose-to-fence contact when they investigate. Check the fence weekly for deer damage and grounding by vegetation, and apply peanut butter at least once a month. This fence costs less than $2 per meter to construct, and is reported to be 60–70% effective.

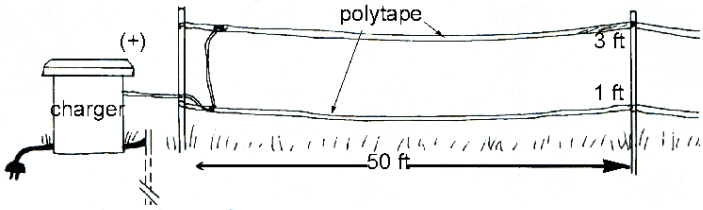

Figure 4. The polytape fence.
Credits: Craven and Hygnstrorn (1993), "Controlling Deer Damage in Wisconsin," University of Wisconsin Extension publication G3083

Permanent High-Tensile Electric Fencing

Permanent high-tensile electric fencing can provide year-round protection from deer damage. Different types of high-tensile electric fences are available: all require rigid corner assemblies and strict adherence to fence construction and configuration guidelines. We describe three designs. With frequent inspection and maintenance, high-tensile fences can last 20 to 30 years, providing adequate protection from moderate deer pressure.

OFFSET OR DOUBLE PERMANENT HIGH-TENSILE ELECTRIC FENCE

This fence consists of 2 simple electric fences set up parallel to each other with wires at staggered heights. It is suitable mostly for relatively small gardens, farms, or nurseries that experience moderate deer pressure. Deer are repelled both by the shock and by the three-dimensional nature of the fence. Deer are wary of fences that have both height and depth. Additional wires may be added to increase protection. Weekly maintenance of the fence and checking of the voltage is recommended, as are seasonal tensioning of the wires and removal of weeds beneath the fence. This fence costs $2–$5 per meter to construct, and is reported to be 60–70% effective.

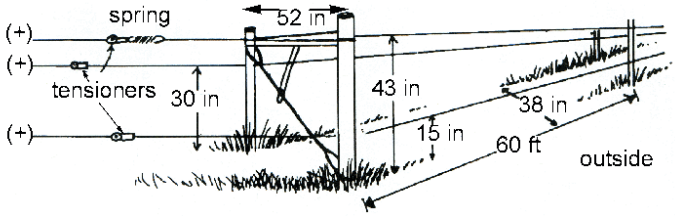

Figure 5. The offset or double fence.
Credits: Craven and Hygnstrorn (1993), "Controlling Deer Damage in Wisconsin," University of Wisconsin Extension publication G3083

SEVEN-WIRE VERTICAL HIGH-TENSILE ELECTRIC DEER FENCE

Vertical fences can be effective at protecting large vegetable gardens, orchards, and other fields from moderate to high deer pressures. Because of the prescribed wire spacing, deer either are shocked attempting to go through the fence, or physically impeded from going under or over. Vertical fences use less ground space than the offset three-dimensional fences described previously or the slanted fence described next, so they are a good option for locations where limited ground space is available to devote to fencing.

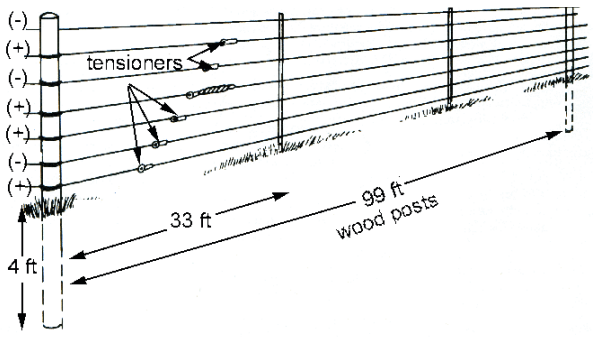

Figure 6. The seven-wire vertical deer fence.
Credits: Craven and Hygnstrorn (1993), "Controlling Deer Damage in Wisconsin," University of Wisconsin Extension publication G3083

There is a wide variety of fence materials, wire spacings, and specific designs available. We recommend you consult a fence contractor. Weekly inspections of the fence and voltage checks are recommended, as are seasonal tensioning of the wire and suppression of weeds beneath the fence. When constructed with only 5 wires, this fence is reported

to cost $2–$5 per meter to construct, and be 70%–80% effective; with 7 wires the cost and efficacy would both be slightly higher.

SLANTED SEVEN-WIRE HIGH-TENSILE ELECTRIC DEER FENCE

This fence is used where high deer pressures threaten moderate- to large-sized orchards, nurseries, and other high-value crops. It presents a physical and psychological barrier to deer because of its electric shock and three-dimensional nature. Maintenance includes weekly inspection and voltage checks, as well as seasonal tensioning of the wires and suppression of weeds beneath the fence. This fence costs $2–$5 per meter to construct, and is reported to be 70–80% effective.

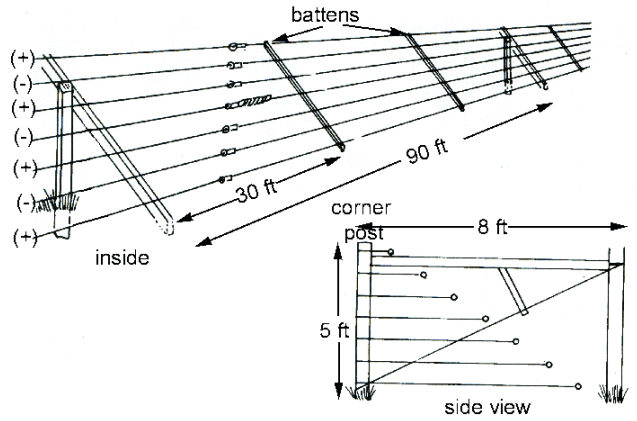

Figure 7. The slanted seven-wire deer fence.
Credits: Craven and Hygnstrorn (1993), "Controlling Deer Damage in Wisconsin," University of Wisconsin Extension publication G3083

Permanent Woven-Wire Fencing

Woven-wire fences are used for year-round protection of high-value crops and orchards subject to high pressure from deer, and also for preventing deer access to highways and runways. Although these fences are expensive to construct, they can last more than 30 years with minimal maintenance, so annual costs over the life of the fence are actually quite reasonable. These fences should be periodically inspected for locations where deer may crawl under. With frequent inspection and maintenance, these fences can last 30 to 40 years, providing substantial protection from high deer pressure. This fence costs $10–$15 per meter to construct, and is reported to be 90–99% effective.

General Fencing Tips and Information

CONSTRUCTION GUIDELINES FOR ALL FENCES

Fences must be properly constructed to be effective. We recommend consulting with an experienced fencing contractor if you are considering a more expensive design. Do not buy cheap materials to reduce costs because this will only reduce the effectiveness and life span of the fence.

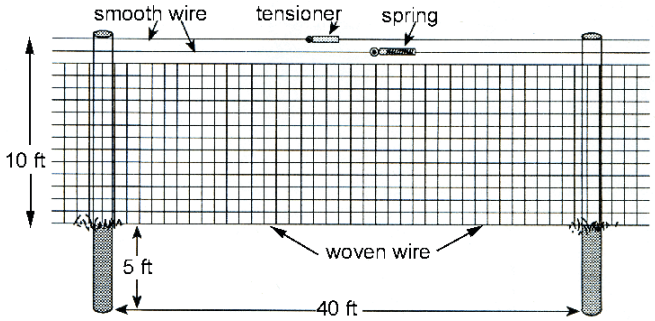

Figure 8. The deer-proof, woven-wire fence.
Credits: Craven and Hygnstrorn (1993), "Controlling Deer Damage in Wisconsin," University of Wisconsin Extension publication G3083

Most deer will try to squeeze through or under a fence rather than jump over, so be sure the bottoms of your fences do not get compromised.

ELECTRIC FENCE MAINTENANCE

The key to the success of electric fencing is to install it before routine damage from deer begins. Deer will test the fence shortly after it is installed: you want to encourage a shock early on to train the deer to avoid the area before the desired plants become most attractive. Regular control of vegetation near fences by mowing or applying herbicides is needed to avoid fence grounding by weeds. Always keep the fence charger on, both day and night. Check the fence voltage weekly with a voltmeter and maintain at least 3,000v at the furthest distance from the fence charger. Protect the safety of others by posting warning signs on all electric fences every 300 ft (90 m) or less. Once a year, adjust the fence tension (150 to 250lb [68 to 113kg]) on high-tensile fences.

SELECTING THE RIGHT FENCE

What type of fence to use? There is no easy answer to this question because every situation differs. You must evaluate the costs (and aggravation) caused by damage from deer, versus the level of protection needed to solve the problem and the cost to construct and maintain fences that will prevent damage. A temporary electric fence may be adequate for situations where deer pressure is moderate and seasonal protection is needed. A high-tensile electric fence may be sufficient in situations where year-round protection is desired yet complete exclusion of deer is not necessary and cost is a consideration. Lastly, a permanent woven-wire fence would be best in a situation where even light damage from deer is unacceptable.

A summary comparison (Table 1) shows the three general types of fences described here and their characteristics.

Because there are no state-subsidized programs for controlling deer damage in Florida, it is advisable to calculate an

estimate of the cost versus the benefit of various control measures. We recommend using the formulas below to determine which strategy is feasible for reducing the damage you are experiencing from deer.

To determine an estimate of the cost of deer damage to you, add the following 3 costs:

- Value of immediate loss = Value of crops/plantings (per acre) X size of area to protect (acres) X estimate of extent of damage (% of crop/plants)
- Estimated replacement value or loss associated with decline in future productivity
- Labor (cost of time associated with replacing or tending damaged crops/plants)

To determine an estimate of the cost of each potential solution, add the following 2 costs:

- Cost of solution (per acre) X area to be protected (acres)
- Labor (cost of time associated with implementing the solution, including maintenance)

Lethal Methods

Herd management through harvest is an important tool to reduce damage from deer. However, deer may be legally shot in Florida only during designated hunting seasons, by persons holding a valid license, and in areas where the use of firearms is allowed by law. Hunting regulations are readily available at all sporting goods outlets and also can be viewed on the Florida Fish and Wildlife Conservation Commission (FWC) website (http://myfwc.com).

In some cases, FWC may issue depredation permits to farmers allowing them to kill deer out of season to reduce severe or persistent damage to valuable crops. Inquiries for obtaining depredation permits should be directed to the regional biologist serving your area, who may be contacted through your FWC Regional Wildlife Office (Table 2).

Economics of Damage and Control

A national survey conducted by USDA's National Agricultural Statistics Service in 1992 identified deer damage as the most widespread form of wildlife damage. No estimate exists of nationwide annual crop losses to deer, but damage estimates have been made for some states. In Wisconsin, a 1984 survey of farmers suggested minimum statewide deer damage of $36.7 million annually. A similar study in Pennsylvania estimated the annual crop loss at $16 to $30 million. There are no documented estimates of costs associated with damage to crops or fruit trees in Florida, but damage to ornamental plantings, young citrus, and a variety of vegetable crops is known to occur. Although deer sometimes cause damage, they are still a highly valuable public resource and contribute in important ways to ecosystem processes. State-funded subsidies for damage control materials or direct compensation for crop losses are costly. As an example, the Wisconsin Wildlife Damage Program expended $2.25 million in 1992 for abatement materials, claims, and administration. One reason why no such programs exist in Florida at this writing. Finally, habitat modification is not recommended as a solution to deer damage. Destruction of wooded or brushy cover in hopes of reducing deer use would destroy valuable habitat for other wildlife, reduce the availability of native forages to deer, and might ultimately increase damage to crops from deer that have been deprived of adequate native forage.

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Acknowledgments

Figure 1 adapted from Schwartz and Schwartz. (1981); Figure 2 adapted from Cabrera (2000) Animal Tracks of Humboldt County; Figures 3 through 12 adapted from Craven and Hygnstrorn (1993), "Controlling Deer Damage in Wisconsin," University of Wisconsin Extension publication G3083.

Table 1. Comparison of three major types of fences.

Factors to consider when choosing among fence options	Temporary Electric	High Tensile Electric	Permanent Woven
Deer pressure	Low-moderate	Moderate-high	High
Size of area	Small-medium	Medium-large	Medium-large
Cost of materials and labor per linear meter	<$2.00/m	$2.00–5.00/m	$10.00–15.00/m
Ease of installation	easy	complex	intermediate
Maintenance	frequent	frequent	low
Life expectancy	5–20 years	20–30 years	30–40 years
Efficacy	60–90%	60–80%	90–99%

Table 2. Florida Fish and Wildlife Conservation Commission Regional Offices (FWC)

Region	Counties	Wildlife Regional Office
Northwest	Bay, Calhoun, Escambia, Franklin, Gadsen, Gulf, Holmes, Jackson, Jefferson, Leon, Liberty, Okaloosa, Santa Rosa, Wakulla, Walton, Washington	Northwest Regional 3911 Highway 2321 Panama City, FL 32409-1658 (850) 265-3676
North central	Alachua, Bradford, Citrus, Clay, Columbia, Dixie, Gilchrist, Hamilton, Hernando, Lafayette Levy, Madison, Suwanee, Taylor, Union	North Central Regional 3377 E. US Highway 90 Lake City, FL 32055-8795 (386) 758-0525
Northeast	Brevard, Duval, Flagler, Indian River, Lake, Marion, Nassau, Orange, Osceola, Putnam, Seminole, St. Johns, Sumter, Volusia	Northeast Regional 1239 SW 10th St. Ocala, FL 34474-0323 (352) 732-1225
Southwest	Charlotte, DeSoto, Hardee, Highlands, Hillsborough, Lee, Manatee, Pasco, Pinellas, Polk, Sarasota	Southwest Regional 3900 Drane Field Rd. Lakeland, FL 33811-1207 (863) 648-3200
South	Broward, Collier, Dade, Glades, Hendry, Martin, Monroe, Okeechobee, Palm Beach, St. Lucie	South Regional 8535 Northlake Blvd. West Palm Beach, FL 33412-3303 (561) 625-5122