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## *From the Field*

# An extraordinary patch of feral hog damage in Florida before and after initiating hog removal

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**Key words:** alien species, economic value, exotic species, feral hogs, human–wildlife conflicts, invasive species, *Sus scrofa*, wildlife damage

**FERAL HOGS** (*Sus scrofa*) are a particularly destructive exotic species in the United States (U.S. Department of Agriculture 1999), including Florida, which, along with Hawaii, is one of 2 states cited as having the most severe invasive species problems (U.S. Congress 1993) in the country. First introduced to North America by the European colonists (Conover 2007) hogs were one of the first invasive exotic species to take hold in Florida. They can transmit disease to livestock (Hartin et al. 2007) and humans (Conover and Vail 2007). They impose a variety of negative environmental impacts, including habitat degradation and predation on, and competition with, native species (Choquenot et al. 1996, Taft 1999, Engeman et al. 2003, Engeman et al. 2004b, Adkins and Harveson 2007, Kaller et al. 2007, and Mersinger and Silvy 2007).

Savannas Preserve State Park (SPSP) is located in southeastern Florida adjacent to the city of Port St. Lucie. The park is 2,115 ha of wildland surrounded by suburban and some low-density urban encroachment. It harbors and protects a unique set of natural communities, including mesic flatwoods, sand pine scrub, scrubby flatwoods, basin marsh, depression marsh, wet prairie, and marsh lake. Feral hogs were targeted for removal in order to protect these

habitats (Florida Department of Environmental Protection 2003). The U.S. Department of Agriculture/Wildlife Services (USDA/WS) was contracted to conduct the removal operation. The SPSP had not previously managed its feral hog population, either as an exotic pest or as a game species (Engeman 2007).

Prior to the feral hog removal contract, surveys were conducted in mid-winter 2002–2003 to identify sites for management actions by (1) locating areas of damage (Engeman et al. 2003, Engeman et al. 2004b) and (2) applying a passive tracking index methodology (Engeman et al. 2001). During these surveys, an extraordinary contiguous patch of uninterrupted hog damage was discovered. This paper describes the size and amount of vegetative cover on this patch before the initiation of hog removal and 1 year after.

Our study site was located in a 600-m-wide power-line corridor that existed prior to establishment of the park. The natural habitat for this right-of-way had been mesic flatwoods with wet prairies (Hartman 1978, Kautz 1987, Florida Department of Environmental Protection 2003) dominated by south Florida slash pine (*Pinus elliottii*) and saw palmetto (*Serenoa repens*) as the primary understory



**FIGURE 1.** View over a 9,027-m<sup>2</sup> patch of Savannas Preserve State Park in January 2003 that was damaged by feral hogs. Note the almost complete lack of standing vegetation. The depth of the rooting furrows can be judged using the size of the people as a scale.

species. The pines and palmettos had been cleared for a power line corridor, leaving a wide area dominated by approximately 40% forbs and 40% grasses.

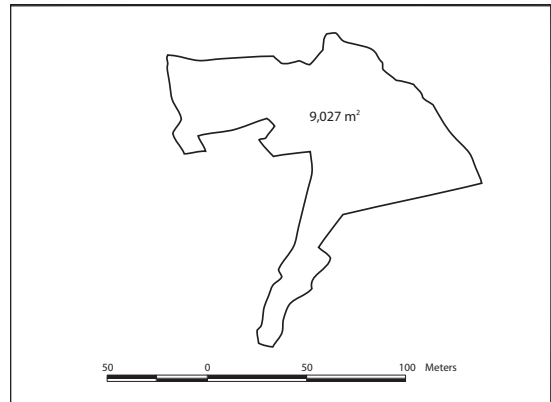
The damage patch was characterized by furrows of overturned soil up to 45 cm deep and entirely devoid of standing plants (Figure 1). There was a high prevalence of duck potato (*Sagittaria lancifolia*) in the power line corridor, and these appeared to be a primary target of hog rooting. In January 2003, we mapped the perimeter of the damage patch using the above characteristics of overturned soil without standing plants to define its edge. Mapping was carried out using a Global Positioning System (GPS), with ArcGIS 8.3 software used to calculate the area within the damage patch. The damage patch was irregularly shaped (Figure 2) and comprised 9,027 m<sup>2</sup>. There were also many smaller damage patches nearby, but these were not included in our measurements.

Hog removal from the park began in January 2003 with removal of 11 hogs—6 males and 5 females—that were trapped on the edge of the damaged plot that month. Removal efforts resumed from October to December 2003, with another 12 hogs (6 males and 6 females) trapped within 130 m of the damaged plot.

During January 2004, the area within the original damage patch that was still devoid of vegetation was remeasured. An area of only 6 m<sup>2</sup> had overturned soil and was devoid of plants. The rest of the damage patch was visibly indistinguishable from the surrounding undamaged area due to complete cover by forbs

and grasses up to 150 cm in height (Figure 3). By 2004, the damaged patch had a composition of approximately 40% grasses, 40% forbs, 10% woody shrubs, and 10% bare ground that was similar to adjacent, undamaged areas. However, despite having a substrate of very sandy soils (i.e., Waveland and Lawnwood sands; Florida Department of Environmental Protection 2003) and being in a wet, subtropical climate, little smoothing of the hog-damaged topography occurred over the intervening year between observations. The area underneath the vegetative cover of the original damage patch was still densely and deeply furrowed from the prior hog damage.

Vegetative cover within and nearby the damage patch was to be assessed for species composition in late summer 2004, when the maximum variety of plant species would be apparent. However, 2 highly destructive hurricanes (Frances and Jean) made landfall nearby within 3 weeks of each other. The storms greatly affected vegetative cover throughout the park and also made access difficult and hazardous. The impact of the storms



**FIGURE 2.** A GIS map of a 9,027-m<sup>2</sup> patch of feral hog damage in Savannas Preserve State Park in January 2003.

also made it difficult to distinguish between damage to vegetation due to hogs and damage caused by the hurricanes.

It would be difficult to place a cost on this single patch of hog damage. The property is in the right-of-way of a power line and therefore has no commercial value. It is also not a truly natural habitat like those in adjacent areas where expenditure data for permitted wetland mitigation projects in the United States were used to obtain a value for habitat damaged by



**FIGURE 3.** Photo taken of the same damage patch shown in Figure 1, a year after initiation of hog control. Note the coverage of vegetation after removal of hogs, which had reduced the area to bare ground.

hogs (Engeman et al. 2003, Engeman et al. 2004b). Such expenditure data represent an empirical demonstration of willingness-to-pay value and can be used to place a per-ha value on habitats (King 1998, Engeman et al. 2004a). However, the damage patch was within protected wildland, and hog damage to the adjacent basin marsh in SPSP was valued at \$247,742 to \$807,226/ha (Engeman et al. 2004b) while hog damage to nearby wet pine-flatwoods in the park was valued at \$355,429 to \$675,884/ha (Engeman et al. 2003).

The cost of the hog removal contract for the entire park was \$7,500. Assuming that where the damage patch would be valued at a fraction of the above habitat values, the amount of the hog removal contract was substantially less than the habitat value lost to this single damage patch. However, only approximately 10% (23 of 229) of the hogs removed from SPSP were taken from the vicinity of the damage patch, implying that the proportional cost for removing those hogs was \$750, further increasing the relative benefit-costs for the removal of hogs from around the damage patch. Thus, a single site of severe hog damage can make hog removal from a larger area economically justifiable.

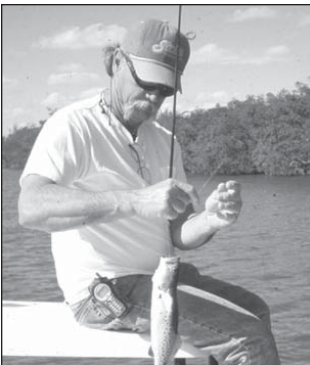
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**RICHARD M. ENGEMAN** is a research biometrician at the USDA/APHIS/Wildlife Service's National Wildlife Research Center. He also is affiliated with a number of universities in the United States and abroad. His research interests include developing practical, yet quantitatively valid wildlife indexing and ecological sampling methods. He also has authored numerous papers on invasive species, conservation of rare species and habitats, and the bioeconomics of human–wildlife conflicts.



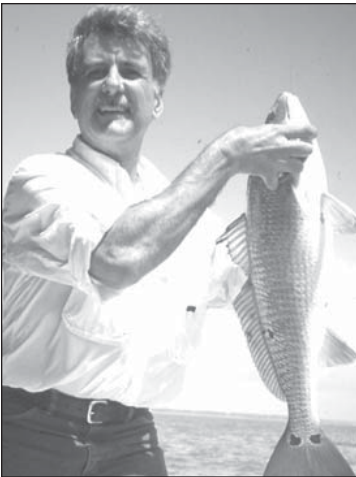
**JOHN WOOLARD** is a wildlife specialist for USDA/APHIS/Wildlife Services. He is noted for developing animal control technologies, including sturdy portable pen traps for feral hogs and bait stations for invasive rodents that exclude native species. He has participated in many groundbreaking research studies in such areas as protection of sea turtle nests from predation and protection of rare habitats from feral hog damage. He also is a licensed alligator trapper and oversees the removal of many nuisance and potentially dangerous alligators each year.



**HENRY T. SMITH** is the district biologist for wildlife resources with the Florida Park Service in Hobe Sound. His region encompasses 24 state parks extending from Fort Pierce to Key West. He is an assistant professor of biology and environmental studies at Florida Atlantic University and Wilkes Honors College, where he supervises student research, internships. His more than 70 research publications include topics such as the ecology of colonial water birds, the effects of human disturbance on wildlife resources, bioeconomics of wildlife management, and exotic herpetofauna colonization dynamics in Florida.



**JEAN BOURASSA** served 2 years active duty in the U.S. Air Force and 10 years active duty in the Colorado Air National Guard as a microwave radio technician. During that time he studied electrical engineering at the University of Colorado. Currently, he works for the USDA/APHIS/Wildlife Services' National Wildlife Research Center. He designed and produced original electronic instrumentation for use in wildlife research, including original telemetry designs for manatees in Florida, condors in California, and green sea turtles in the Gulf of Mexico. His time is shared between electronic engineering and design for all wildlife research applications and managing the GIS function.



**BERNICE U. CONSTANTIN** has an M.S. degree in wildlife management from Louisiana State University (LSU). While at LSU, he conducted research on the effects of forest regeneration on wildlife, the success of various types of wood duck nesting boxes, dietary studies on certain species of fish, and repelling fire ants from small mammal trapping stations. He has been employed with the USDA/APHIS/Wildlife Services for the past 23 years and is now state director for Florida and Puerto Rico. In recent years he has become very involved with protecting threatened and endangered species from predators and has coauthored several papers on the subject. His main interests are spending time with his family and helping others. However, he does occasionally enjoy scuba diving, fishing, hunting, bird watching, and working with endangered species.

**DANIEL GRIFFIN** (photo not available) graduated from Ball State University with a B.S. degree in resource management. He has been employed by the Florida Park Service for over 30 years, during which time he has worked as a park ranger at Pahoee State Recreation Area and Jonathan Dickinson State Park. He also served as an assistant park manger at Fort Pierce Inlet State Recreation Area and been promoted to park manager at Lighthouse Point State Recreation Area. He recently transferred to the Savannas Preserve State Park. After finishing his career with the Florida Park Service he plans on retiring to the mountains of western North Carolina.