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Groups Affected By These Problems:

- Consumers
- Livestock producers and farmers
- Meat processors
- Sporting organizations
- U.S. citizens and landowners
- Wildlife and natural resource managers

Major Cooperators:

- Animal Control Technologies Australia
- Archbold Biological Station
- Invasive Animals Cooperative Research Centre
- MacArthur Agro-ecology Research Center
- Mississippi State University, Center for Resolving Human-Wildlife Conflicts
- Mississippi State University, College of Veterinary Medicine
- Mississippi State University, Department of Wildlife, Fisheries and Aquaculture
- Sul Ross State University
- Texas A&M University-Kingsville
- Texas Department of Agriculture
- Texas Parks and Wildlife Department
- University of Florida
- USDA/APHIS/Veterinary Services
- USDA/APHIS/Wildlife Services

National Wildlife Research Center Scientists Provide Basic Ecological Information to Reduce Feral Swine Damage

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and socially responsible methods, tools, and techniques.

As increased urbanization leads to a loss of traditional wildlife habitat, the potential for conflicts between people and wildlife increases. Such conflicts can take many forms, including property and natural resource damage, human health and safety concerns, and disease transmission among wildlife, livestock, and humans.

The high reproductive rate and adaptability of feral swine has resulted in populations that have dramatically increased in size and distribution. This invasive animal now occurs across much of the United States, where it causes a range of agricultural and environmental damage through depredation, rooting, and wallowing activities. Furthermore, feral swine compete with native wildlife and livestock for habitats, are carriers of exotic and endemic diseases, and transmit parasites to livestock and humans. Feral swine in the United States are estimated to cause more than \$1.5 billion in damages and control costs each year. NWRC research supports activities of the APHIS National Feral Swine Damage Management Program by developing new methods and strategies for monitoring and reducing feral swine damage. Current activities focus on toxicant development and registration, economic assessments, and new methods to improve the effectiveness of damage management programs.

Applying Science and Expertise to Wildlife Challenges

Feral Swine Damage to Archaeological Sites. — Feral swine are an invasive species well known for degrading native habitats, damaging agricultural crops, and spreading disease. However, until now little was known about their impacts on archaeological sites. NWRC scientists and colleagues from the Avon Park Air Force Range (Avon Park) recently documented the potential for feral swine to disturb and destroy archaeological sites in south-central Florida. The study was conducted at Avon Park, a base comprising more than 98,000 acres and containing hundreds of archaeological sites. Scientists examined potential feral swine impacts to 36 Avon Park sites eligible for registration with the National Register of Historic Places. Of the 36 sites, 20 are prehistoric, 8 are historic, and 8 have both prehistoric and historic components. Researchers found widespread potential for artifacts to be damaged or displaced by feral swine rooting and wallowing. Seventy-nine percent of the sites had artifacts within 8 inches of the surface, making them highly vulnerable to feral swine damage. Even more troubling was the discovery that 42 percent of the sites already showed signs of swine damage. Soon after the study concluded, a fence was erected around a site of extraordinary archaeological importance. However, researchers note this is not a feasible remedy for all locations. A combination of methods, including the lethal removal of feral swine, likely will most benefit archaeological site preservation. The study is the first to quantify swine impacts on archaeological sites over a wide area. Its findings shed light on how feral swine affect archaeological resources and aid managers in their efforts to protect the sites.

Brucellosis in Feral Swine. — Feral swine populations have spread across the United States through natural expansion, intentional translocation, and accidental release. The increasing number of feral swine not only damages public and private property, but also poses disease threats to native ecosystems, livestock, and humans. Brucellosis is one of the many diseases that can be carried and transmitted by feral swine to humans, livestock, pets, and wildlife. In 2014, NWRC National Wildlife Disease Surveillance Program biologists collected and analyzed samples from 183 feral swine in areas with high brucellosis prevalence. Twenty-two samples tested positive for brucellosis and were genotyped as *B. suis*. Interestingly, only 52 percent of samples that tested positive via cultured tests also tested positive via antibody tests. This indicates that standardized serum tests do not effectively identify all brucellosis-positive animals. The researchers noted that improved serologic tests are needed to more accurately determine feral swine exposure to *Brucella* spp. and to monitor disease trends in feral swine populations.

Consequences Associated with the Recent Range Expansion of Feral Swine. — Aided by both an adaptable biology and deliberate introductions by people, the range of invasive feral swine in the United States has expanded from 17 to at least 39 states over the past 30 years. Feral swine's generalist diet combined with high population densities complicate efforts to conserve threatened and endangered species and losses to crop damage in the United States alone are estimated to be more than \$800 million. In addition, feral swine can be a reservoir for multiple pathogens, some of which can be transmitted to people, livestock, and pets. NWRC researchers reviewed previous management and control efforts for feral swine and found that a combination of approaches over a long and sustained period can be effective at reducing feral swine populations and damage. However, researchers note that the diversity of stakeholders interested in feral swine issues, including those who value feral swine for subsistence and sport hunting, can make management efforts divisive and difficult even if eradication is not the ultimate goal.

Selected Publications:

Bevins, S.N., K. Pedersen, M.W. Lutman, T. Gidlewski, and T.J. DeLiberto. 2014. Consequences associated with the recent range expansion of nonnative feral swine. *BioScience Online* 64(4): 291-299. doi: 10.1093/biosci/biu015.

Feng, Z., J.A. Baroch, L.-P. Long, Y. Xu., F.L. Cunningham, K. Pedersen, M.W. Lutman, B.S. Schmit, A.S. Bowman, T.J. DeLiberto, and X.-F. Wan. 2014. Influenza A Subtype H3 viruses in feral swine, United States, 2011-2012. *Emerging Infectious Diseases* 20(5):843-846. doi:10.3201/eid2005.131578.

Campbell, T.A., J.A. Foster, M.J. Bodenchuk, J.D. Eisemann, L. Staples, and S.J. Lapidge. 2013. Effectiveness and target-specificity of a novel design of food dispenser to deliver a toxin to feral swine in the United States. *International Journal of Pest Management* 59(3): 197-204. doi: 10.1080/09670874.2013.815830

Engeman, R.M., K.J. Couturier, R.K. Felix Jr., and M.L. Avery. 2013. Feral swine disturbance at important archaeological sites. *Environmental Science and Pollution Research* 20:4093-4098. doi: 10.1007/s11356-012-1367-1.

Engeman, R.M., G. Massei, M. Sage, and M.N. Gentle. 2013. Monitoring wild pig populations: a review of methods. *Environmental Science and Pollution Research* 20(11):8077-8091. doi 10.1007/s11356-013-2002-5.

Major Research Accomplishments:

- Forty-two percent of 36 archeological sites studied by WS researchers in south-central Florida showed signs of feral swine damage.
- Twelve percent of 183 feral swine samples tested positive for brucellosis, a bacterial disease that causes weight loss, infertility, loss of young, and lameness in cattle, bison, deer and elk, as well as fever, fatigue, and headaches in people.
- A WS research review of previous management and control efforts for feral swine found that a combination of approaches over a long and sustained period can be effective at reducing feral swine populations and damage.
- WS research found that rhodamine B is an effective biomarker for use in feral swine.

- WS disease surveillance showed that feral swine have been periodically infected with influenza A virus subtype H3N2 in the United States and are a potential transmission risk to domestic swine and humans.