Feral Swine Disease Surveillance – National Targets and Pilot Projects

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ABSTRACT: The National Feral Swine Damage Management Program (NFSP) in collaboration with the National Wildlife Disease Program (NWDP) and USDA APHIS Veterinary Services works to identify the diseases of national concern in feral swine. The current national disease surveillance program includes classical swine fever (CSF), swine brucellosis (SB), and pseudorabies (PRV). CSF is a foreign animal disease and feral swine samples collected and tested serve as part of Veterinary Services surveillance stream for this pathogen. Both SB and PRV have been eradicated from U.S. commercial swine operations; however, as they are endemic diseases in feral swine populations, monitoring of feral swine for SB and PRV is deemed important to inform the swine industry as well as other livestock entities of the potential risk of reintroduction. Wildlife Services routinely removes feral swine and collects serum (approximately 2,800 samples annually) to conduct serologic tests on these three diseases. Sampling is distributed over both space and time and is currently undertaken in 37 states of the U.S. with counties being ranked high, medium, and low priority based upon risk factors. In addition to the diseases of national concern, the NFSP supports a number of pilot projects to address disease issues that arise at a local level. In close collaboration with Wildlife Services field personnel and others on the ground, the NFSP is able to quickly and robustly identify and sample for additional pathogens of zoonotic, domestic livestock, or companion animal concern. These projects are often multi-agency collaborative efforts and include diseases such as bovine tuberculosis and chronic wasting disease.

KEY WORDS: disease transmission, domestic livestock, feral swine, national surveillance, targeted pilot projects

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INTRODUCTION

Feral swine are an invasive species that roam the landscape of much of the United States with populations that are believed to exceed 6 million animals (USDA APHIS National Feral Swine Damage Management Program, 2018). Their rooting behavior in addition to their varied,

omnivorous, and opportunistic diet cause significant agricultural crop loss as well as disease transmission and depredation to domestic livestock, native flora and fauna, and threatened and endangered species (Engeman *et al*., 2010; Bevins *et al*., 2014; Baroch *et al*., 2015; Engeman *et al*., 2016; Jones *et al*., 2017). Furthermore, they are capable of carrying and transmitting a number of pathogens to humans, wildlife, domestic livestock, and companion animals (Hutton *et al*., 2006; Meng *et al*., 2009).

The USDA APHIS National Feral Swine Damage Management Program (NFSP) was established in 2014 and works to reduce damage caused by feral swine by removing animals from the landscape. While the operational component is the highest programmatic priority, the NFSP works collaboratively with USDA APHIS Veterinary Services and the National Wildlife Disease Program to identify diseases of national concern and sample and test accordingly. Approximately 2,800 serum samples are tested for classical swine fever (CSF), pseudorabies (PRV), and swine brucellosis (SB) annually (Brown *et al*., 2019). The samples collected for national surveillance are opportunistically collected, however; the numbers of samples collected from each county are weighted based on high, medium, and low risk. This prioritization is based on a number of criteria, including existing feral swine populations, proximity to domestic hog production, and presence of landfills and international air and seaports. Table 1 depicts the total number of samples tested, the number that came back positive, and the percent positive from 2016-2018.

Table 1: Results from serological diagnostics for national surveillance pathogens in feral swine, 2016-2018.

Year	Disease*	Total samples tested	Total sero-positive samples	Percent sero-positive
2018	CSF	2,868	0	0
	PRV	3,002	558	18.6
	SB	3,000	186	6.2
2017	CSF	2,997	0	0
	PRV	2,979	530	17.8
	SB	2,955	207	7.0
2016	CSF	2,993	0	0
	PRV	2,986	537	18.0
	SB	2,981	164	5.5

*CSF = classical swine fever, PRV = pseudorabies, SB = swine brucellosis

In addition to the diseases of national concern, a number of small pilot projects on specific pathogens have been undertaken jointly by the NFSP and the NWDP and their partners, including *Leptospira spp* (Pedersen *et al*., 2015; Pedersen *et al.*, 2017a; Pedersen *et al*., 2017b), *Toxoplasma gondii* (Pedersen *et al*., 2017b), *Trichinella spiralis* (Pedersen *et al*., 2017b), influenza A virus (Pedersen *et al*., 2017b), *Mycobacterium bovis* (Campbell

et al., 2011; Pedersen *et al.,* 2017c), hepatitis E virus, Seneca Valley Virus, porcine epidemic disease virus, and porcine reproductive and respiratory syndrome virus. Currently, five additional pilot projects are ongoing.

Targeted Pilot Projects

Described below are programmatic pilot projects that are ongoing. No results are yet available for these studies; thus, only a basic proposed study design is provided.

Chronic wasting disease

The cervid population in Newton County, Arkansas is estimated to have a prevalence of chronic wasting disease (CWD) of nearly 25% (Arkansas Game and Fish Commission, 2019). A large number of feral swine inhabit this county and their scavenging behavior, including on carcasses of deer and elk that have succumbed to CWD infection, led to concerns over inter-species transmission of this prion. Furthermore, an experimental challenge of domestic swine with CWD demonstrated that pigs are susceptible to infection (Moore *et al*., 2017). Samples from feral swine in this region have been collected and diagnostics are underway.

Tuberculosis and hepatitis E virus in archived samples

Archived samples collected at two feral swine slaughterhouses in Texas (Pedersen *et al*., 2017d) will be tested for antibodies to *Mycobacterium bovis*, the causative agent of bovine tuberculosis, and hepatitis E virus. These serological diagnostic results are anticipated to provide insight on additional pathogens of public health concern.

Tuberculosis and swine brucellosis in feral swine along the Texas-Mexico border

Anecdotal evidence suggests that some feral swine cross back and forth between Mexico and the United States along the southern border. Given the differential incidence in bovine tuberculosis (United States – Mexico Joint Strategic Plan for Collaboration on Bovine Tuberculosis, 2013-2018) and swine brucellosis (OIE, 2019) between the two countries, samples from feral swine in Texas counties that are adjacent to the border are being collected and will be tested for antibodies against *Mycobacterium bovis* and *Brucella suis*, which cause bovine tuberculosis and swine brucellosis, respectively.

Brucella suis experimental challenge

Numerous studies have demonstrated that the typical serological diagnostics used to detect exposure to, or infection with, *Brucella suis* under-represent true exposure or prevalence (Pedersen *et al*., 2017d). An experimental challenge has been designed with university collaborators that seeks to better understand infection kinetics and immune dynamics of swine infected with *B. suis.*

Tuberculosis in feral swine on Molokai Island, Hawaii

Historical challenges with bovine tuberculosis in cattle on the Hawaiian Island of Molokai (Acevedo *et al*., 2013) has led to the development of this study which will pair both culture and serum to evaluate the role, if any, of feral swine in the maintenance of *Mycobacterium bovis* on the landscape.

CONCLUSION

The NFSP and the NWDP as well as other Federal, state, and university collaborators, samples and tests feral swine for a number of pathogens, both those included in national surveillance as well as targeted pilot projects. This work serves to maximize the information that can be obtained from feral swine that are removed for damage management purposes and allows for policy and management decisions to be made that are informed by an understanding of disease dynamics and pathogen

transmission across the landscape. The scale of the NFSP allows for access to a large number of samples annually as well as field personnel that can be readily harnessed to collect samples as different disease needs arise.

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