



Wild pigs negatively impact water quality: Implications for land and watershed management



Introduction

Growing populations of wild pigs (*Sus scrofa*) pose a challenge to both landowners and wildlife managers by threatening crop and livestock production, as well as native wildlife and their habitat. While these concerns are commonly known, the impacts of wild pigs on water quality are less apparent.

Introduced to North America in the 1500s as a reliable food source by early European settlers, free-ranging domestic pigs established initial feral populations. Later, the Eurasian wild boar was released primarily onto hunting preserves in the early 1900s, but they escaped to hybridize with free-ranging pig populations. Intentional (illegal) and accidental releases since have further contributed to wide-ranging and growing wild pig populations. In Texas, these animals are classified as free-ranging exotic livestock and regulatory authority falls primarily under the jurisdiction of the Texas Animal Health Commission, who established rules regarding their transportation and release.

Today, wild pigs occur in 3 varieties: feral hogs (those originating of domestic stock), Eurasian boar, and

domestic-Eurasian hybrids. As of 2016, the National Feral Swine Mapping System (NFSMS) in collaboration with state natural resource agencies and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA-APHIS) reported that wild pigs occurred in at least 36 of 50 states including Hawaii⁵ (Figure 1). In 2007, the estimated economic toll of these animals in the U.S. exceeded \$1.5 billion³⁰; an economic impact likely to be much larger today. Factors including the adaptability, intelligence, high fecundity and popularity of wild pigs as an exotic game species have complicated control efforts²⁵ with rapid population growth and range expansion. While wild pigs negatively impact land quality in numerous ways, the behavior, biology and preferred habitat of these animals also contribute to the degradation of water quality in riparian systems.

Population modeling indicated that as many as 3-5 million wild pigs are scattered across nearly all counties in Texas³⁷. With so many on the landscape, wild pigs are causing noticeable and not-so-obvious problems. Wild pigs impact water quality directly through bacterial impairment and indirectly through the degradation

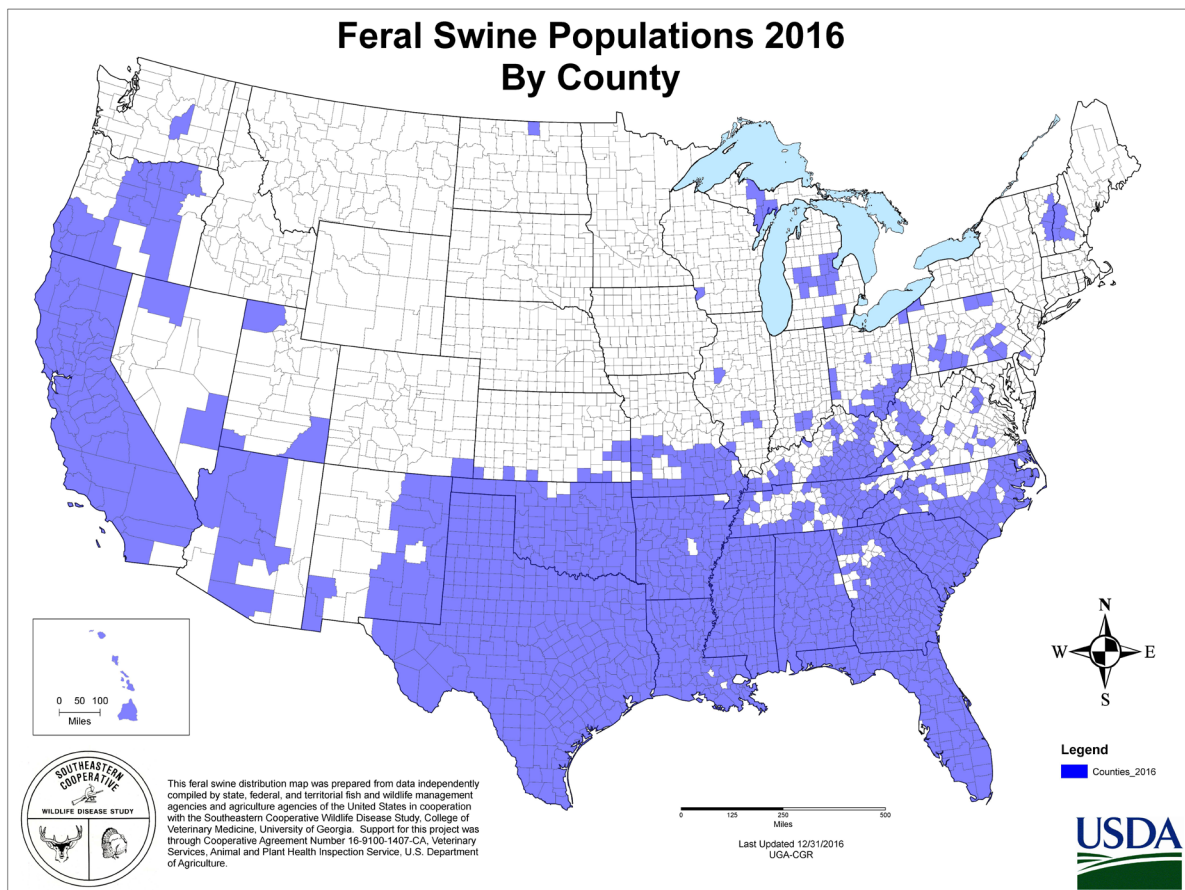


Figure 1. NFSMS data showing 2016 feral swine populations by county.
(Image Credit – USDA-APHIS in Corn and Jordan 2017)

of riparian habitat. This can contaminate water used for agricultural production, recreation, and consumption by humans and wildlife as well as reduce recreational opportunities. While other sources of bacterial impairment include humans, livestock and native wildlife, wild pigs have been shown to increase *E. coli* bacteria levels in creeks, streams, rivers, and other surface water bodies¹⁶.

Bacterial source tracking (BST) and other water quality monitoring data implicated various wildlife species, as contributors of *E. coli* to water sources depending on species density^{18,28}. In this study the authors included wild pigs with native wildlife; however, many natural resource professionals are quick to point out that wild pigs (exotic livestock) should have been evaluated separately from native wildlife. No matter how they are categorized, wild pigs have especially high average defecation rates (1,121 grams per day), one of the highest among both livestock and wildlife species^{22,27}.

In addition to direct *E. coli* deposition in stream systems, wallowing and rooting behavior damages ecological communities surrounding water bodies by destroying key vegetation and causing soil disturbance. This leads to increased sedimentation, turbidity, pH imbalances, high bacteria levels, and other water quality impairments⁸. Given the prevalence and wide distribu-

tion of wild pigs in Texas, bacterial loading and other water quality impacts associated with this species are a growing concern to land managers and regulatory authorities statewide.

Reproduction, ecology and habitat requirements of wild pigs

Interbreeding among feral domestic pigs and Eurasian wild boar resulted in the wild pigs now found in many states. With an average lifespan of 4-5 years, adult sows (females) are capable of producing 1-3 litters per year. Females are typically sexually mature at 1 year, but pregnancy has been documented as early as 6 months. As sows mature they can produce larger litters³³, but those of 4-6 offspring are most common (Figure 2).

Even when wild pigs represent a relatively high percentage of available prey, few predators risk their own well-being by attempting to take on formidable adult wild pigs. While coyotes (*Canis latrans*), bobcats (*Lynx rufus*), feral dogs (*Canis lupus familiaris*) and other smaller predators are known to kill and consume juvenile wild pigs, mountain lions (*Puma concolor*) and humans remain the primary predators of adult wild pigs in North America. The relatively low mountain lion population paired with home ranges that exceed 100 square miles or more²¹ prevent them from significantly



Figure 2. Mature sows are capable of having large litters, but most often they have 4-6 piglets per litter.



What is a Riparian Area?

“Riparian areas are the transitional zones regularly influenced by fresh water, normally extending from the edges of waterbodies to the edges of upland communities.”

(Naiman et al. 2005)

impacting wild pig populations. Even where wild pigs may be the most abundant prey available, deer (*Odocoileus sp.*) are found more frequently in the diets of mountain lions in Texas^{7,15,24}. The annual harvest rate of wild pigs by humans is estimated to be 29%, and population modeling indicated that a 66% removal rate would need to be sustained for 5 years or more in order to stabilize population growth³⁷. Put simply, this model suggests that if 2 out of every 3 wild pigs were removed annually, Texas would maintain the current estimated population of 3-5 million animals. The lack of significant predation, combined with the high reproductive output makes intentional management and sustained abatement programs essential to reducing wild pig populations.

Wild pigs are not always the prey, instead they are opportunistic omnivores known to consume a wide variety of food items in competition with other livestock and native wildlife. While the vast majority (>80%) of their diet consists of vegetation², opportunistic predation by wild pigs in wetland and riparian areas is another area of concern. For example, one study found that an estimated 3.16 million reptiles and amphibians were consumed by approximately 3,000 wild pigs in one year¹⁷. Such impacts on wetland species are not by chance, as wild pigs have distinct biological requirements that cause

them to select wetland and riparian habitats.

Wild pigs frequent wetland areas because they do not have sweat glands. To cool themselves, they modify their behavior by occupying shaded places, restricting daytime activity, and wallowing in wet areas. They often use riparian zones and other habitats near water bodies more so than drier upland areas. These zones serve as travel corridors, concentrating wild pigs, which magnifies their pressure on water quality and surrounding habitat. As transitional zones between aquatic systems and upland areas, riparian communities are a vital component of overall water quality²⁶. Wild pigs can negatively influence these communities in a variety of ways. For instance, they have been shown to decrease the abundance of native oaks (*Quercus sp.*) and hickories (*Carya sp.*)³ which stabilize the soil, sequester carbon, and provide a valuable food source to native wildlife. Rooting activity and the removal of native mast (fruits and nuts) can then lead to the proliferation of invasive plant species. Water quality and riparian system degradation associated with wild pigs is often a direct result of their rooting, wallowing, and consumption of native plants and animals. These effects intensify as the wild pig population grows at an elevated pace.

Water quality and riparian ecosystem impacts

Water quality and riparian ecosystems are impacted by wild pigs in numerous ways (Figure 3). Research conducted on the water quality and riparian communities have shown that in areas where wild pigs are present they have:

- contributed fecal coliforms (*E. coli*) directly into water sources¹⁶;
- increased sedimentation and turbidity, altered pH levels, and caused prolonged anoxia (complete oxygen depletion)⁸;
- increased bacteria and nutrient loads including nitrogen, which can cause algae growth and reduce dissolved oxygen levels¹;
- caused major changes to plant communities and altered proportions of open water and bare ground⁸;
- reduced vegetative ground cover necessary for plant seedling establishment and invertebrate habitat⁴;
- reduced large-seeded tree abundance such as oak and hickory species through mast consumption³;
- disturbed soil and led to an increase in exotic and invasive plant species such as the Chinese tallow tree (*Triadica sebifera*)^{19,31};
- reduced the abundance of freshwater mussels and aquatic insects in streams¹⁸; and
- consumed the eggs of ground nesting birds such as northern bobwhite (*Colinus virginianus*) and wild turkeys (*Meleagris gallopavo*)^{14,35}.



Figure 3. Wild pig rooting and wallowing behavior can lead to a variety of habitat and water quality issues including increased erosion, water turbidity, and the deposition of fecal coliforms (*E. coli*) directly into surface water systems.

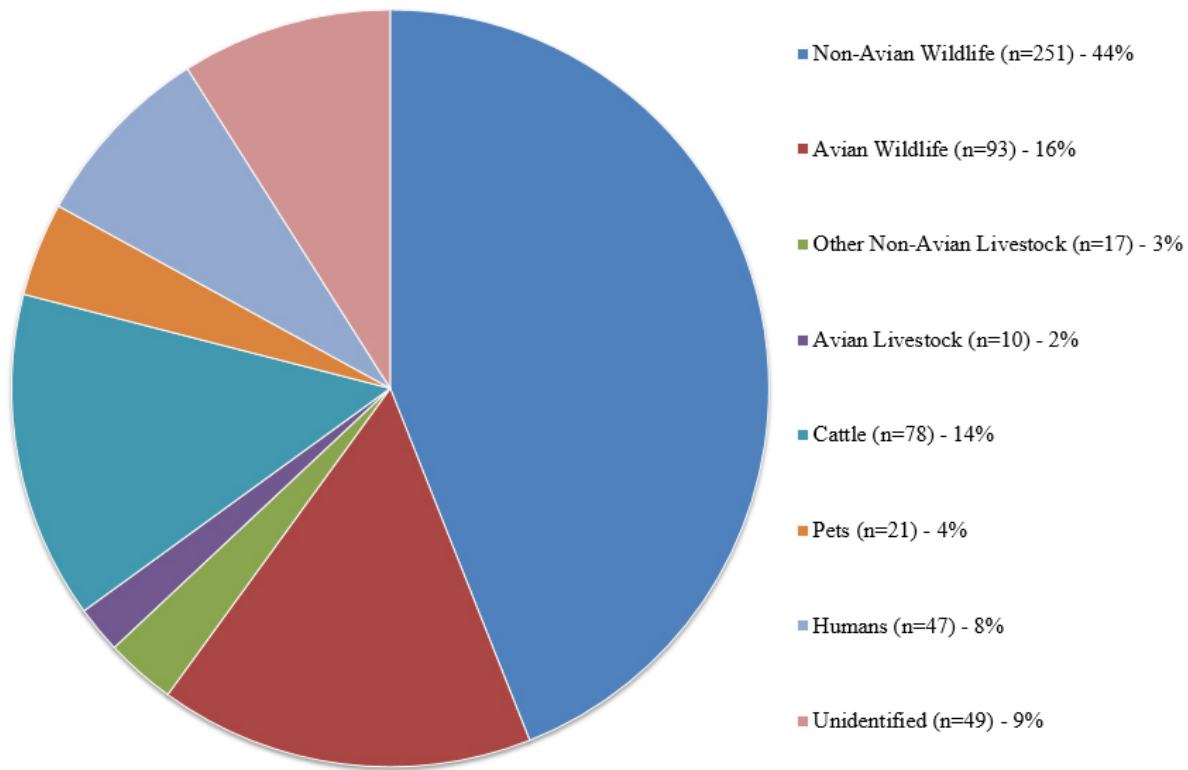


Figure 4. Bacterial source tracking efforts in the Leon River watershed of Texas found non-avian wildlife including wild pigs to be the greatest contributor of fecal pollution¹².

Tracking wild pig water quality impacts

Monitoring protocols including BST can help to identify and distinguish between human, livestock, or wildlife sources of fecal coliforms. This process, also known as fecal typing or Microbial Source Tracking (MST), is a relatively new means of sampling fecal bacteria in order to determine origin. One BST study conducted in the Buck Creek watershed in Texas found that as much as 50% of the *E. coli* bacteria samples it collected were from wildlife sources, which included wild pigs, while only 20% originated from domestic animals or livestock¹³. Another recent BST effort conducted in the Leon River watershed (Figure 4) observed similar results albeit during a drought year¹².

Many BST studies group wild pig bacterial contributions in with total wildlife sources, while others have concentrated on developing a means of isolating swine

and other bacterial sources individually by species¹⁸. While more research is needed in order to reliably isolate the specific *E. coli* contributions of native wildlife species and exotic livestock - wild pigs²⁸, current methods can help provide valuable insight on the relative degree to which wild pigs bacterially impair surface water systems in areas where they are present.

Implications for impaired aquatic systems

Impaired water bodies and degraded riparian systems threaten agricultural production, livestock productivity, wildlife, and limit human use (Figure 5). Fecal contamination of water bodies can transmit pathogens and in extreme cases, potentially result in livestock, wildlife or even human mortality. One study found that livestock with continuous and adequate access to high quality water produced as much as 20% more animal gain compared to livestock with access to low quality or



Figure 5. Impaired water bodies negatively affect riparian zones, native plants and animals, crop production, livestock productivity, and human recreational uses.

impaired water³⁸. Increased *E.coli* levels are commonly used as indicators of unsanitary or bacterially impaired water in restricting human water contact and recreational activities including swimming, wading, fishing, and others. The low dissolved oxygen and/or high nutrient levels associated with impaired water sources can reduce aquatic species abundance and diversity, and are known to lead to algal blooms that reduce available oxygen, resulting in fish kills.

While wild pigs are not the only contributor to watershed impairments, abatement efforts to reduce wild pig populations remain an important practice to safeguard water quality. As of 2012, the majority of waterbodies in Texas were listed as bacterially impaired³⁴. Texas has wild pigs in nearly every county and the population is growing. There are many reasons to integrate wild pig removal techniques and stream health should be primary among them with the goal of delisting impaired water systems.

The benefits of wild pig abatement to water quality

Without consistent and widespread abatement efforts, wild pigs will likely increase their numbers; thus compounding their impacts on water quality in the future²⁸. Reducing wild pig populations has been shown to improve water quality and riparian system processes, thus benefiting local ecosystems by:

- reducing relative bacterial impairment and thus decreasing the potential for disease transmission to humans and livestock¹¹;
- reducing the spread of invasive species^{6,19};
- increasing plant cover by as much as 80 percent and decreasing bare ground by nearly 90 percent³²;
- increasing forest leaf litter, thereby facilitating nutrient cycling³²;
- decreasing erosion and nutrient loss³²; and

- decreasing surface water turbidity and sedimentation; leading to an increase in the health and function of watersheds⁶.

Wild pig control and management

Legal methods for reducing wild pig populations in Texas currently include trapping, aerial gunning, shooting, snaring and the use of trained dogs. Effective abatement often involves a combined approach²³, and landowners should consider working cooperatively with adjacent landowners to gain increased success and more widespread benefit. This can be accomplished by sharing traps, head gates, snaring sites (i.e., fence crossings), aerial gunning costs, property access for the use of trained dogs and other collaborative efforts.

It is important to understand that not all abatement strategies are independently capable of reducing wild pig populations. While techniques such as corral trapping (remote, suspended and animal-activated) as well as aerial gunning can effectively reduce populations, other techniques such as shooting, snaring, and the use of trained dogs can alter the movements of wild pigs and force them to abandon areas where they are causing damage. For example, one study found that agricultural damage in areas that allowed the shooting of wild pigs was less than half than in areas where this practice did not occur⁹. Studies have also shown that successful abatement efforts often follow a defined sequence, where large-scale population reduction practices are followed up by other techniques such as snaring and shooting, with the use of trained dogs being employed as a final measure to remove wild pigs missed by previous strategies^{23,29}.

Conclusion

Wild pigs contribute to water quality and bacterial impairment through direct fecal deposition, altering native plant and wildlife communities, degrading riparian and wetland habitat, increasing sedimentation and erosion, and in numerous other ways. Impacts associated with wild pig rooting and wallowing behavior within and near surface water negatively affect agricultural production, livestock productivity, and other human related uses. Emerging water quality testing and monitoring protocols including BST can help to better quantify wild pig *E. coli* contributions into water systems. More research is needed in order to reliably determine the relative abundance of wild pig bacterial depositions within

aquatic systems statewide. Even so, reducing populations has been shown to benefit riparian ecosystems and overall water quality. Consistent and widespread abatement efforts remain necessary to reduce the impact of wild pig populations, foster functioning aquatic ecosystems and ensure water quality.

See other wild pig resources at <http://agrilifebookstore.org>.

- L-5523 Recognizing Feral Hog Sign
- L-5524 Corral Traps for Capturing Feral Hogs
- L-5525 Box Traps for Capturing Feral Hogs
- L-5526 Placing and Baiting Feral Hog Traps
- L-5527 Door Modifications for Feral Hog Traps
- L-5528 Snaring Feral Hogs
- L-5529 Making a Feral Hog Snare
- ESP-419 Feral Hogs Impact Ground-nesting Birds
- ESP-420 Feral Hog Laws and Regulations
- ESP-421 Feral Hogs and Disease Concerns
- ESP-422 Feral Hogs and Water Quality in Plum Creek
- ESP-423 Feral Hog Transportation Regulations
- L-5533 Using Fences to Exclude Feral Hogs from Wildlife Feeding Stations
- SP-467 Feral Hogs Negatively Affect Native Plant Communities
- WF-030 Reducing Non-target Species Interference While Trapping Wild Pigs
- EWF-033 Wild Pigs and Ticks: Implications for Livestock Production, Human and Animal Health

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