



Wild Pigs and Ticks: Implications for Livestock Production, Human and Animal Health



Photo courtesy of Bill Frankenberger

Wild Pigs and Ticks: Implications for Livestock Production, Human and Animal Health

Introduction

Agricultural damage, habitat degradation, water quality issues, and potential for infectious and vector-borne disease transmissions associated with wild pigs (*Sus scrofa*) concern natural resource managers and agricultural producers in TX and the U.S. The problems we face today date back to early translocations of this animal. Domestic swine were introduced to North America in the 1500s as a reliable food source, and husbandry practices allowed pigs to range freely for forage, leading to the eventual establishment of feral populations (Wood and Barrett 1979). Intentional releases of Eurasian wild boar during the 20th century were done for recreational purposes, and these actions also contributed to feral populations in the U.S. (Wood and Barrett 1979). In Texas, Eurasian wild boar were occasionally released on hunting preserves in Aransas, Bexar, and Calhoun counties from 1930 to 1940. Some of these animals escaped and interbred with wild pigs originating from domestic stock (Whitaker 1988).

Today, wild pigs can be found in most regions of the U.S. and occupy 39 of 50 states (Fogerty 2007), as a result of intentional (illegal) and accidental releases. In Texas, an estimated 2.6 million wild pigs can be found in all 10 ecological zones (Rollins et al. 2007) and 234 of 254 counties in Texas (Timmons et al. 2012). A number of factors including high reproductive capacity, life expectancy, intelligence, and adaptability contributed to the continued population growth of wild pigs in TX and in the U.S. (Mungall and Sheffield 1994).

Wild pigs caused at least \$52 million a year in damages to agricultural production in Texas alone (Adams et al. 2005), while at the national scale they likely caused an estimated \$1.5 billion in annual damages (Pimentel et al. 2007). They compete with native wildlife for resources, degrade habitat, and threaten water quality by contributing to an increase in bacterial contamination (fecal coliforms) and cause damage to livestock pastures and crops. Recent studies confirmed that wild pigs can also be infested with ticks capable of transmitting tick-borne diseases to livestock, wildlife, and humans.

Ticks on wild pigs in Texas

Wild pigs from eight eco-regions of Texas were examined for ectoparasites from 2008-2011 (Sanders et al. 2013) in longitudinal and expanded surveys. Wild pigs were taken with box, corral, and panel traps over multi-year periods at stationary sites located in the Edwards Plateau, Post-oak Savannah, and South Texas Plains with additional samples taken from animals harvested by aerial gunning as part of the Texas A&M AgriLife Extension Service-Wildlife Services feral hog abatement program. Seven species of ticks in the family Ixodidae, or “hard” ticks, were identified as blood-feeding on wild pigs. The “hard ticks” are so described because of their hard exterior

surface (Figures 1-6). Sixty-two percent of the more than 800 animals examined were infested with one or more of seven species of ticks. Ticks were found infesting juvenile and adult male and female wild pigs year-round. Depending on species, evidence suggested that all tick life stages (larvae, nymphs and adults) infest wild pigs. Some medium sized wild pigs (100-150 lbs) were observed supporting more than 1000 ticks per animal. Seven species of ticks were collected from wild pigs during these studies [the Lone Star tick, *Amblyomma americanum* (Figure 1), the Cayenne tick, *Amblyomma cajennense* (Figure 2), the Gulf Coast tick, *Amblyomma maculatum* (Figure 3), the Winter tick, *Dermacentor albipictus* (Figure 4),

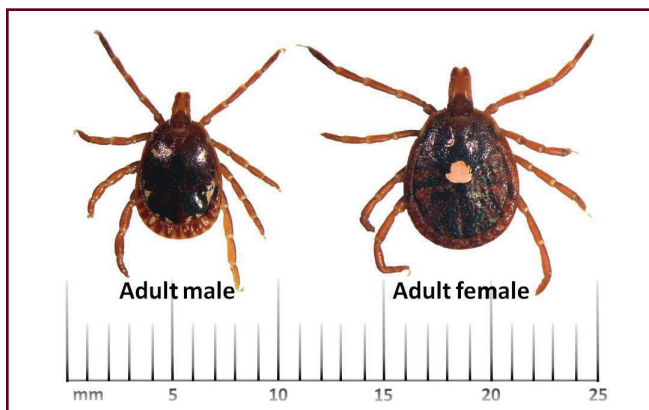


Figure 1. The Lone Star tick is well established in the eastern 2/3 of Texas, however recent collections from the Rolling Plains and High Plains ecoregions indicate possible range expansion into the Panhandle. This is a 3-host tick with a wide host range in all life stages and most active from spring to fall. (Source by permission: <http://tickapp.tamu.edu>)

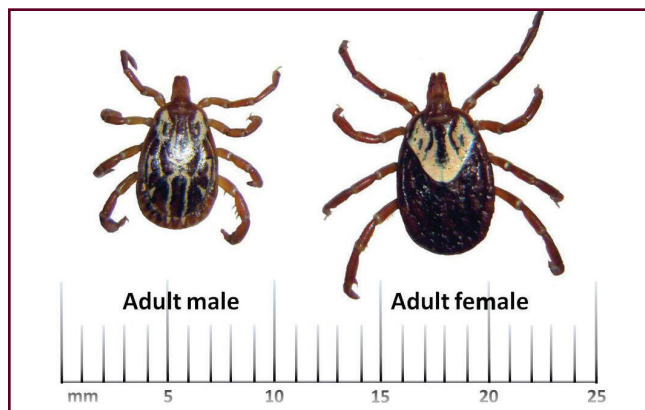


Figure 3. The Gulf Coast tick is well established within 100-150 miles of the Texas Gulf Coast, with expansions inland to Oklahoma. This is a 3-host tick whose adults prefer to attach to medium-to-large animals (e.g. cattle, horses, and dogs) most frequently encountered from May-October, peaking in August and September; immature ticks are active during late-fall and winter months found commonly on ground dwelling birds. (Source by permission: <http://tickapp.tamu.edu>)

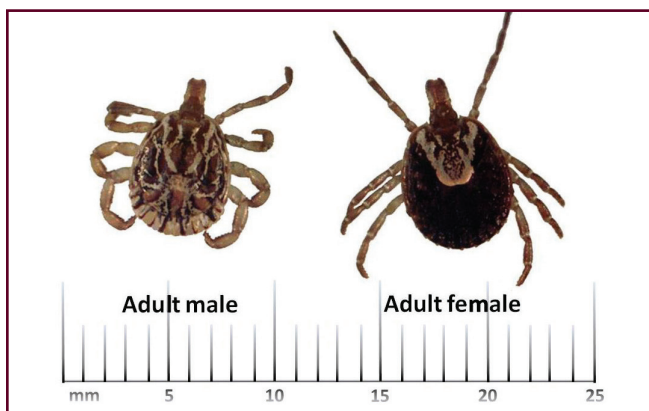


Figure 2. The Cayenne tick is well established in the Gulf Prairies and Marshes and South Texas Plains ecoregions. This is a 3-host tick with a wide host range in all life stages and can be active year round with highest activity during spring and summer. (Source by permission: <http://tickapp.tamu.edu>)

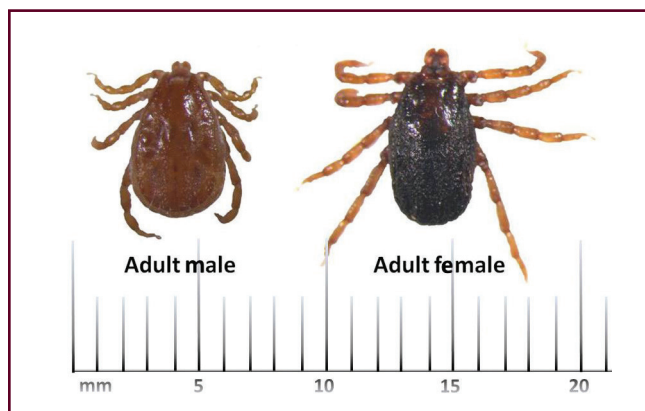


Figure 4. The Winter tick is encountered throughout TX, but it is most commonly encountered in a wide corridor stretching from the upper South Texas Plains and Edwards Plateau through the Rolling Plains and Cross Timbers and Prairies ecoregions. This is a 1-host tick that typically attacks large animals, especially cattle, horses, and deer during fall and winter months. (Source by permission: <http://tickapp.tamu.edu>)



Photo courtesy of Bill Frankenberger

a tick with no common name, *Dermacentor halli* (no figure available), the American Dog tick, *Dermacentor variabilis* (Figure 5), and the Black-legged or Deer tick, *Ixodes scapularis* (Figure 6)]. Six of these species are important to livestock producers whose animals may experience stress from tick parasitism due to irritation,

blood-loss, reduced growth potential, reduced reproductive potential, or illness resulting from the transmission of tick-borne pathogens. Five of these tick species are known to attach to humans and have the potential for transmission of tick-borne pathogens.

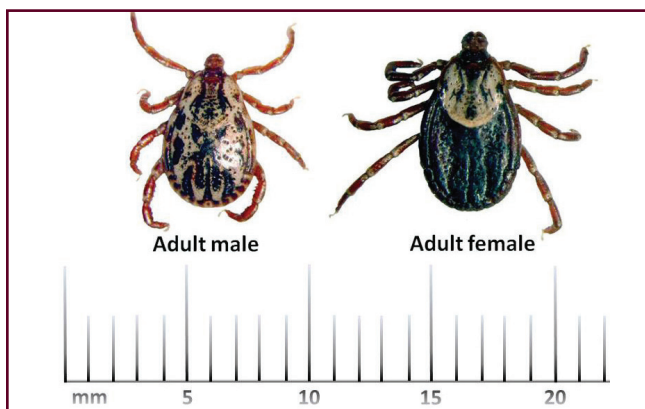


Figure 5. The American Dog tick is well established in the eastern 2/3 of Texas, and recent collections, including those from wild pigs, indicate range expansion through the Rolling Plains and High Plains ecoregions to encompass the Panhandle to New Mexico. This is a 3-host tick with a wide host range in all life stages and is most active from spring to fall. (Source by permission: <http://tickapp.tamu.edu>)

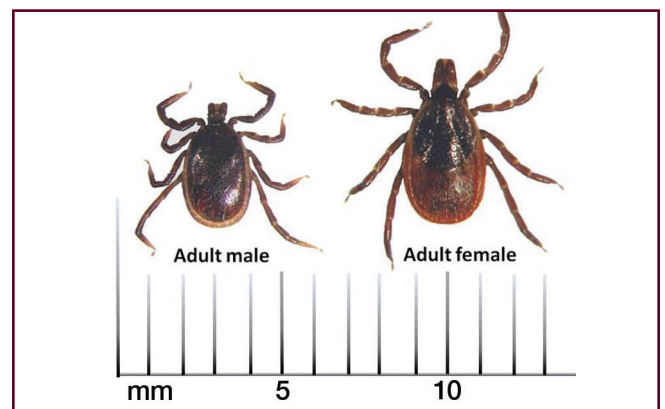


Figure 6. The Black-legged tick or Deer tick is most frequently encountered in the eastern 1/3 of Texas, and less so moving west through the Cross Timbers and Prairies and Edwards Plateau ecoregions. This is a 3-host tick with a fairly wide host range on small-, medium-, and large-hosts in the adult stage; adult ticks are most active from October to March. (Source by permission: <http://tickapp.tamu.edu>)

Tick life cycles

The species of hard ticks found on wild pigs complete their life cycles in one of two patterns, either by obtaining blood meals from 3 hosts separated by periods off-host (Figure 7), or by obtaining all 3 blood-meals on one host (Figure 8). The potential role of wild pigs on tick populations and tick dispersal can be explained in the dynamics of these life cycles.

The life stages of all hard ticks include the larvae, nymphs and adults (Figure 12). In the 3-host life cycle, the larvae which are 6-legged tiny objects (sometimes referred to as “seed” ticks) emerge from eggs, attach to a host for about 3-5 days for blood-feeding and drop into the host’s habitat to molt to 8-legged nymphs. Nymphs ascend vegetation or hide in leaf litter awaiting a second host. Nymphs attach and blood-feed for about 4-6 days and drop into the habitat to molt to 8-legged adults. At this point the male and female ticks look different (See Figures 1 - 6). Adult ticks will

await the passage of the third host used in the cycle. On the 3rd host adult ticks will blood-feed for about 8 to 14 days and mate. The large blood-fed female ticks drop into the habitat of the 3rd host to lay from 2,500 to 20,000 eggs, depending on the tick species, and then die. Male ticks remain on the host to mate with other female ticks until they die. There is a tendency for some 3-host tick species to select progressively larger hosts with each stage feeding, beginning with larvae selecting small animals as depicted in Figure 7. However many tick species are indiscriminate regarding host selection and will use larger animals for each of the 3 separate blood feedings. Three-host ticks typically produce one generation per year and exhibit different seasonal activity patterns by life stage. There are active ticks in Texas year-round.

In the 1-host life cycle all blood-feedings are completed on a single host in sequence: larvae, nymphs and then adults without leaving the host. This life cycle takes

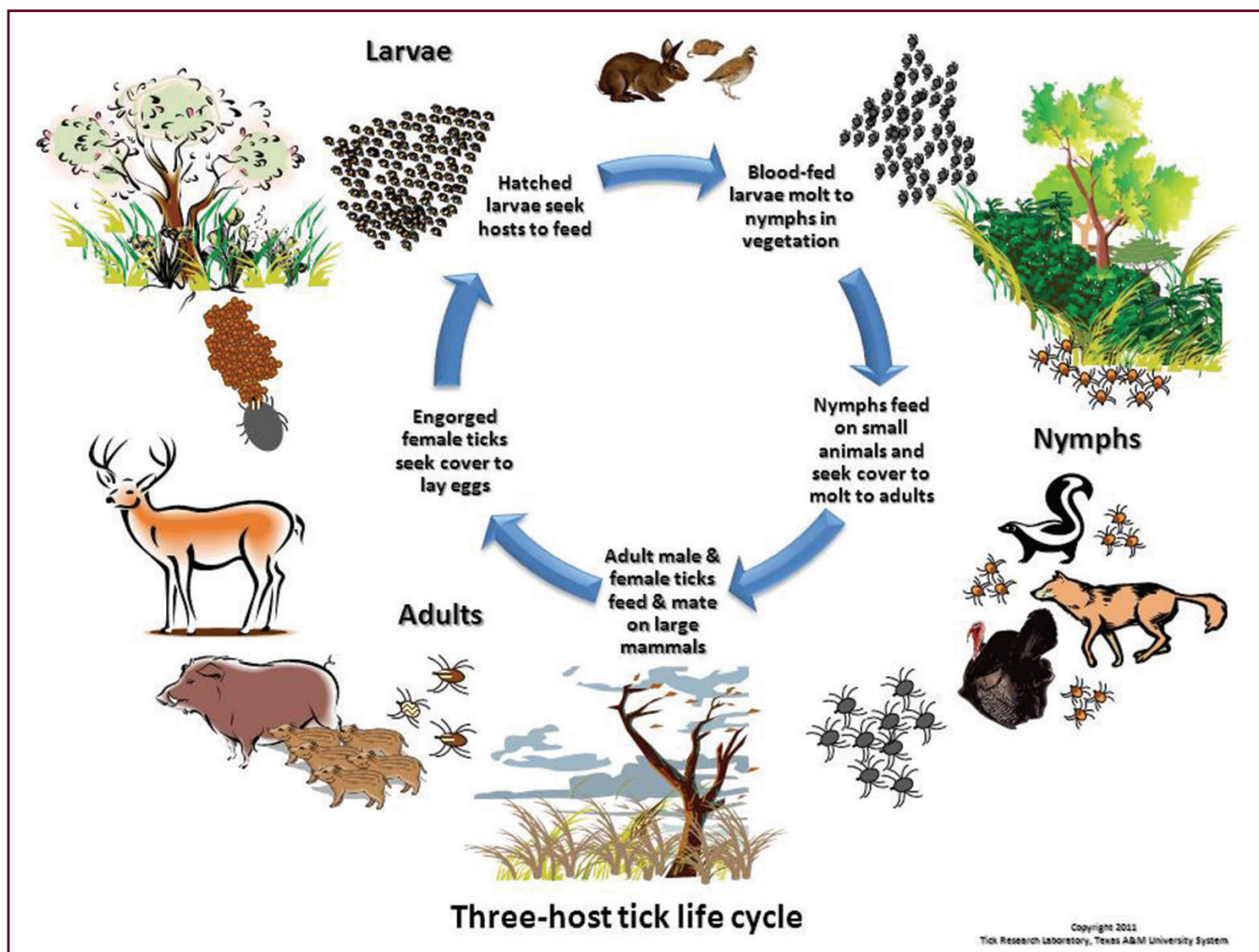


Figure 7. Diagram of the progression of a three host tick life cycle. (Credit Dr. Pete Teel)

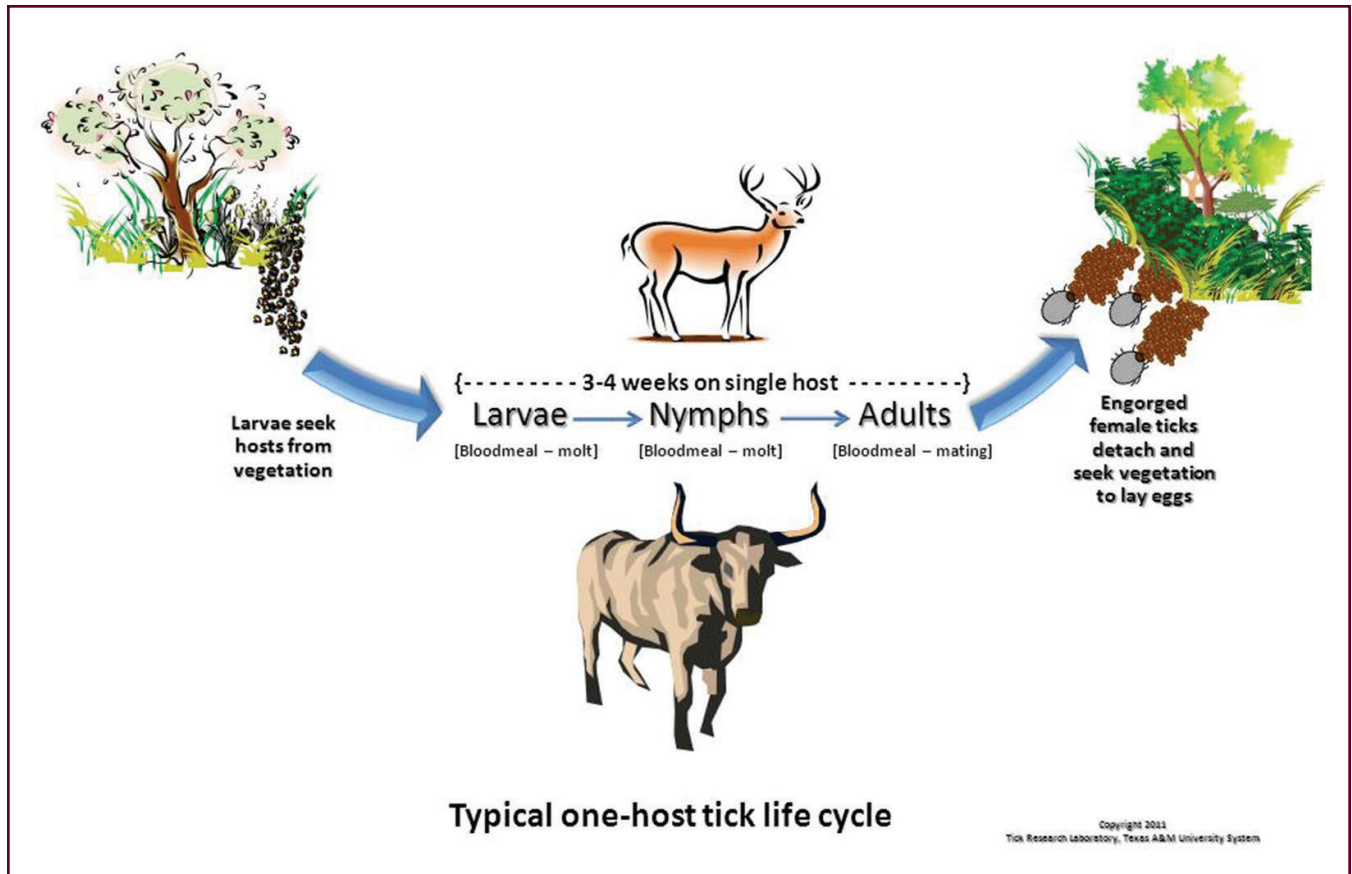


Figure 8. Diagram of the progression of a typical one host tick life cycle. (Credit Dr. Pete Teel)

from 20-30 days to complete and is restricted to medium-to-large sized animals. As above, blood-fed engorged females drop into the habitat of the host to lay eggs and begin the cycle anew, while male ticks remain on the host to mate with additional females.

Wild pigs and tick habitat

The distribution and abundance of ticks on a landscape depends upon the interactions of the type of hosts and habitat. Figures 7 and 8 highlight the off-host portions of the 3-host and 1-host life cycles, respectively. The quality and quantity of good habitat-type where ticks drop determines how many ticks successfully emerge from eggs, or molt to the next stage. Habitats with abundant leaf-litter and woody plant over-story often have beneficial microclimate temperature and moisture conditions for tick development and survival, and thus often have the greatest tick abundance. Optimal microclimatic conditions permit some adult ticks to live up to 3 years without a host. The type of optimal habitat for ticks is often also optimal habitat for wildlife and livestock.

Vegetation communities that provide wildlife and livestock with cover, food, water, and relief from heat-stress not only increase opportunities for ticks to find their next host, but support off-host tick survival. The diversity of hosts that rely upon these vegetation-communities help sustain tick populations. Wild pigs add to tick host diversity and fit this cycle perfectly. Wild pigs lack the ability to sweat to cool themselves. Instead, they regulate body temperature by wallowing, increasing activity at night, and occupying shaded areas near water and food resources. Wild pig affinities for riparian zones, their use of creeks and dry stream-bed corridors, with foraging excursions to more upland zones, make them a good conduit for sustaining and moving ticks on and around Texas landscapes. In addition, high wild pig reproductive rates ensure host densities favoring increased tick host-finding and tick abundance.

A growing concern

Increasing populations of wild pigs could facilitate the expansion of tick populations posing increased risks of tick infestations of livestock and humans with



Figure 9. Shared habitat and direct interactions are ways in which wild pigs can introduce ticks to livestock. (Photo courtesy of Dawn Tschirhart)

complimentary risks for tick transmitted pathogens. The 7 ticks found on wild pigs in Texas are associated with pathogens causing such illnesses as Rocky Mountain spotted fever, Tularemia, Lyme disease, Ehrlichiosis, and Southern tick-associated rash illness (STARI) in humans, and Anaplasmosis in cattle, among others. Sanders (2011) estimated the exposure of 888 wild pigs collected across Texas by seroprevalence to genus-specific tick associated *Rickettsia*, *Ehrlichia*, and *Borrelia* to be 28%, 13%, and 2%, respectively. Among the *Borrelia* positive samples, two were identified as *Borrelia turicatae*, the causal agent of human relapsing fever. This pathogen is transmitted by the soft tick (Family Argasidae) *Ornithodoros turicata*, also known as the Human Relapsing Fever tick. This tick is found in various animal burrows, as well as other cavities and caves in Texas. This tick obtains a blood-meal quickly (20-30 minutes versus days for ixodid ticks) and would thus rarely be found on host animals. This discovery further illustrates the potential for broad habitat-use and omnivory to connect wild pigs to a diversity of tick species. Further research is needed to determine whether wild pigs become infected with any tick-borne pathogens and thus serve as a reservoir for tick-borne pathogens.

Lice and fleas were also found to be common blood-feeding ectoparasites of wild pigs surveyed in the Edwards plateau, Post-oak Savannah, and South Texas Plains (Schuster 2011). The Hog Louse, *Haematopinus suis*, was common to all age and gender classes of wild pigs in all 3 areas and were present on wild pigs year round. The Javelina or Peccary flea, *Pulex porcinus*, was found on 30% of wild pigs, both adults and juveniles, but only in the South Texas Plains area during this study.

Wild pig and livestock interactions

Protecting livestock from tick infestations and tick-borne pathogens can be challenging, particularly in areas that also have wild pigs. Overlapping habitat use by livestock and wild pigs increased pasture infestations, and the potential for tick introduction from Mexico (Pérez de León et al. 2012). Wild pigs are capable of transmitting diseases to livestock through direct and indirect contact; however the threat is compounded when wild pigs serve as the transport system giving ticks the opportunity to infest new areas used by livestock. Excluding wild pigs is difficult on the landscape. Research showed that wild pigs readily breach and cause damage to most types of



Figure 10. Infestation of the Gulf Coast tick. Prolonged tick infestations on livestock can lead to reduced feed intake, weight loss, slower growth in young animals, loss in overall body condition and well-being. (Photo courtesy of Dr. Pete Teel)

fencing (Hone and Atkinson 1983), and this tendency coupled with the relatively large home range of wild pigs could aide transmission of tick-borne illnesses. Wild pig home ranges in Texas can vary by sex and habitat type. For instance, in eastern Texas boar home ranges averaged 3,904 acres, while home ranges of sows averaged 1,606 acres (Mersinger and Silvy 2007). According to the Texas Ag Census the average ranch supporting livestock was 507 acres. The overlap of wild pig home ranges and livestock operations is high, potentially bringing these animals into contact with each other. The potential for wild pigs to introduce ticks to livestock points to the importance of abatement efforts to reduce economic loss within the agricultural industry and ultimately the consumer.

Economic impacts associated with tick-borne diseases and livestock

The irritation and blood-loss associated with tick feeding may result in reduced feed intake, weight loss, slower growth in young animals, loss in overall body condition, and reduced well-being. From 26-38 blood-feeding Lone Star ticks have been shown to be the economic threshold on pastured beef cattle (Barnard et al. 1986). As few as 40 blood-feeding

female Lone Star ticks have been observed to reduce weight gains in bovine (*Bos taurus*) stocker cattle by 26 kg (57 lbs) over a 100 day period tick season (Ervin et al. 1987). Drummond (1987) estimated a 32% decrease in average daily gain for *Bos taurus* stocker cattle infested with an average of 45 Gulf Coast ticks (Figure 6). It should be noted that cattle of *Bos indicus* breeding, or of crosses with *Bos taurus*, are comparatively resistant to tick infestations and therefore less susceptible to the impacts of tick feeding. Research showed that calves 9 months old and younger commonly exhibit age related immunity to tick-borne illnesses, but their susceptibility then increases with age among a variety of cattle species (Zintl et al. 2005). In livestock such as sheep and goats, tick-borne illness transmission occurred more in juveniles than in adults (Bai et al. 2002).

Seasonal and nutritional interactions can also affect the impact of ticks on cattle. The Winter tick attacks cattle from October to March when rangeland forage conditions are typically low in quality and quantity. Acaricide treatments in mid-December and mid-February to mature Black-Angus cows infested with Winter ticks and subsequently Lone



Figure 11. Prescribed burning can be used as a tool for controlling tick abundance and the action is beneficial to wildlife habitat. (Photo courtesy of Mark Tyson)

Star ticks in spring, lessened weight loss and permitted treated cattle to enter the spring breeding season with higher average body weight than untreated cattle. A companion experiment also found that Winter tick-infested lactating Brangus and Brangus cross cows on supplements high in crude protein and digestible energy experienced the least deterioration in body condition score (Teel et al. 1990). Thus the nutritional needs of cattle at different stages of growth and physiological demands, including lactation and return to estrus, can interact with tick stress to effect both the well-being of the animals and enterprise economics. Ultimately the level of tick stress on cattle is driven by the species and populations of ticks present on the landscape and this system is dependent on the diversity and density of wildlife, including wild pigs, and livestock hosts available to host-seeking ticks.

Integrated Tick Management

Opportunities for suppression of tick populations are linked to the components of tick life cycle patterns (Figures 7 and 8, above). The most common tactic for tick control is treatment of livestock with acaricides,

defined as pesticides labeled for tick control, and are directed at killing ticks that feed on the animal. A list of currently approved products (Swiger 2012) is available at:

<http://livestockvetento.tamu.edu/files/2010/10/Managing-External-Parasites-of-Texas-Cattle.pdf>

Timing the use of acaricides to coincide with seasonal activity of the tick species found on your property can maximize effect and minimize cost. Acaricides vary in their modes of action, formulation, and method of delivery, so product choices vary. For example, selection of acaricide-impregnated ear tags can be a product of choice when dealing with the Gulf Coast tick because of its habit of attaching in the ears of cattle (Figure 10), but sprays, dusts, pour-ons, or injectables may be more appropriate for other species of ticks that attach to numerous body areas.

Exposure of cattle to ticks can be reduced through grazing management, modifying wildlife host diversity or abundance and integrated brush

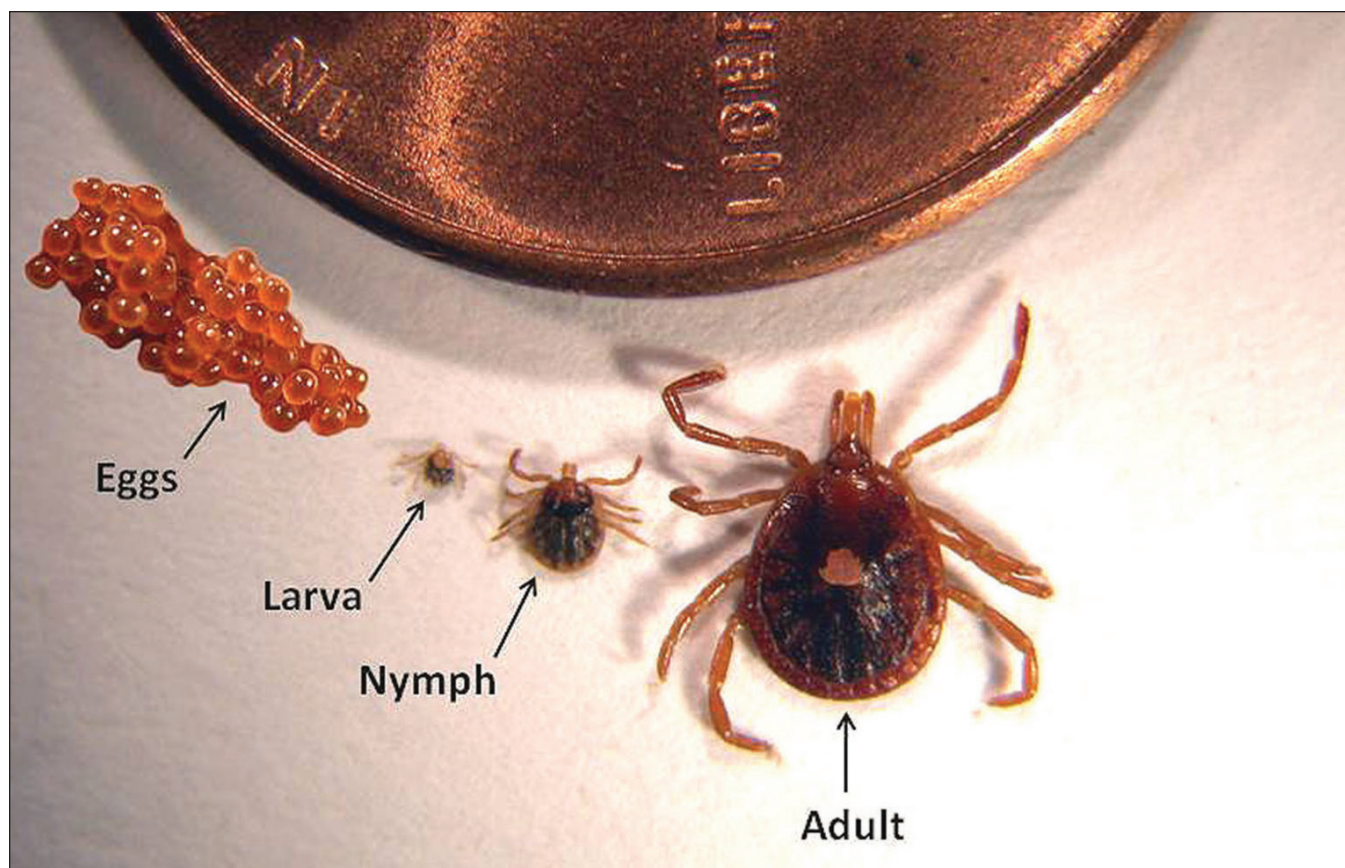


Figure 12. Life stages of the Lone Star tick from left to right: eggs, unfed larva, unfed nymph, and unfed adult female sizes relative to a penny (male not shown). (Photo courtesy of Dr. Pete Teel; <http://tickapp.tamu.edu>)

management practices including prescribed fire (Figure 11) and/or herbicide treatments (Hanselka et al. 1999). An integrated strategy can also include improved cattle handling facilities for ease of acaricide application and other practices that target either the host or off-host vegetation habitat. Tactics selected for integrated tick management will depend upon the production, management, and/or conservation goals of the producer/landowner. Since wild pigs have been shown to be a good wildlife host for ticks, wild pig abatement or control should be considered in a comprehensive management plan.

Prevention of tick-bite and tick-borne pathogen transmission to humans and companion animals

Tick-borne pathogens are transmitted through the “bite” during attachment and blood-feeding of an infected tick to an animal host. Outdoor activities related to human occupations or recreational activities that link people with tick habitats provide exposure-risk. Prevention methods to reduce tick bites include wearing light colored clothing so that ticks are easily seen, tucking pant-legs into boot tops and encircling

the boot-top with a folded band of 2-inch masking tape to act as a physical barrier, proper application of tick repellents (such as products containing DEET), and conducting inspections for attached ticks on oneself, children and pets or companion animals (dogs and horses for example). It is important to examine the hairline at the base of the human head, as tick attachment at this location can be missed and pose risk of a reversible paralytic condition caused by the saliva of the feeding tick. Early tick removal is important to reduce the risk of pathogen transmission as some tick-borne illnesses require prolonged tick attachment for transmission.

In the case of illnesses such as Lyme disease, the amount of time that an infected tick is attached to its host is an important factor in whether or not disease transmission occurs. According to the CDC, an infected tick must remain attached between 36-48 hours for Lyme bacterium to be transmitted, and ticks removed prior to that time frame will most likely not have transmitted the illness or related co-infections. Even when recommended precautions

Before Going Outdoors	When Handling Wild Pigs	After Going Outdoors or Handling Wild Pigs
Treat clothing, boots, and gear with products containing Permethrin	Wear rubber/latex gloves and protective eyewear	Conduct self-inspection of both clothes and body
Use repellents containing N,N-Diethyl-meta-Toluamide (DEET)	Thoroughly wash hands and disinfect equipment and surfaces used in processing	Shower soon after being outdoors or handling wild pigs

Table 1. Recommended practices for handling wild pigs and/or using outdoor areas where ticks are present.

Initial Population of Feral Hogs	Annual Population Growth Rate	Annual Population Harvest Rate	Five Year Population Increase	Five Year Outcome
2,600,000	28%	0%	8,658,000	Population increases 3.33 X
2,600,000	22%	15%	6,526,000	Population increases 2.51 X
2,600,000	16%	28%	5,252,000	Population increases 2.02 X
2,600,000	12%	41%	4,238,000	Population increases 1.63 X
2,600,000	0%	66%	0	No population growth

Table 2. Results of modeling indicated growth or no growth over 5 years given an estimated population of 2.6 million wild pigs (Timmons et al. 2012).

such as conducting self-inspections are taken, many people never know that a tick has attached. According to the CDC, most people are infected with tick-borne illnesses by sub-adult ticks still in the nymph stage. This is because adult ticks are much larger and more likely to be detected and removed. Nymph-stage ticks are less than 2 mm in size, and can be very difficult to detect relative to adults (Figure 12).

Proper Tick Removal

Proper tick removal is important to minimize leaving the tick's mouthparts imbedded in skin, reduce secondary infection, and reduce the risk of tick-borne pathogen transmission. If you find a tick attached to your skin:

1. Grasp the attached tick as close to the skin surface as possible with tweezers, commercially available tick removal instruments, or with protected fingers (with use of a tissue). If you use tweezers, be careful not to use crushing pressure.
2. Slowly pull directly away from the skin surface. Do not jerk or twist.
3. To prevent secondary infection apply an antiseptic such as rubbing alcohol, iodine, or warm soapy water to the bite location.
4. The removed tick can then be:
 - a. Crushed and disposed of
 - b. Saved for identification (place the tick in a container with a small damp paper towel and keep in a cool place)

- c. Sent for pathogen testing as part of the Texas Department of State Health Services surveillance program conducted at the University of North Texas Health Science Center, Tick-Borne Disease Research Laboratory

(https://web.unthsc.edu/site/xfp/scripts/xforms_form.aspx?formID=24&language=en)

If you develop a rash, fever, or flu-like symptoms within 10-days to one-month of removing a tick, see a doctor. Inform the doctor about your recent tick bite, and the location where you encountered the tick. The identity of the tick and any associated pathogens can be beneficial to the diagnosis and treatment.

Precautions for handling wild pigs and recreating outdoors

Wild pig damage abatement activities often involve direct contact with wild pigs, and during 2010 an estimated 753,646 wild pigs were harvested in Texas. Landowners, wildlife managers, hunters, and outdoor enthusiasts should exercise caution when handling wild pigs or when recreating outdoors to avoid tick-borne illnesses (Table 1).

Controlling wild pig populations can help to mitigate the threat they pose to water quality, agricultural production, native plant communities, and livestock and human health. Abatement efforts can also potentially reduce tick abundance by limiting the number of hosts available to ticks. The current

estimated harvest rate of wild pigs in Texas is 29% of the population, annually (Timmons et al. 2012). To prevent wild pig populations from growing, research indicates that an estimated 66% of the population will need to be removed, annually for at least five years (Timmons et al. 2012). Additional harvest is needed to drive the wild pig population downward. Unless statewide wild pig harvest rates more than double, continued population growth can be expected (Table 2).

In Texas, land managers have four legal techniques available to reduce wild pig populations: trapping, shooting, snaring, and capture with trained dogs. Best management practices suggest that trapping can be highly effective; however a combination of legal control techniques generally has the largest impact on wild pig populations.

Summary

The negative impacts caused by wild pigs on water quality, wildlife habitat, livestock, and agricultural production is concerning. The prevalence of ixodid tick species associated with wild pigs can also potentially lead to an increase in tick-borne diseases in livestock. Expanding populations of wild pigs also pose a variety of public health risks. Control and prevention protocols should be enacted to reduce tick abundance on livestock and within shared habitat used by wild pigs. Efforts should also be made to reduce wild pig and livestock interactions. Safety and precaution measures are recommended when handling wild pigs or when using outdoor areas where wild pigs are known to be present. Recommendations include using appropriate repellants during outdoor activities, keeping high standards of hygiene when handling wild pigs, and conducting self-inspections after engaging in activities that could increase the risk of exposure to ticks and tick-borne pathogens.

As much as 95% of Texas is privately owned land, and successful wild pig abatement therefore relies in large part on the efforts of private landowners and wildlife managers. Texas A&M AgriLife Extension Service is dedicated to public education, outreach, and direct technical assistance to aid landowners concerning wild pig abatement. Numerous resources including publications, webinars, and videos are also available and can be found at:

<http://feralhogs.tamu.edu/files/2015/10/Texas-AM-AgriLifeExtension-Feral-Hog-Resources-8-15.pdf>

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 Hog
- 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

Acknowledgements and disclaimer

We would like to thank Dr. Pete Teel, Professor and Dr. Terry Hensley, Extension Veterinarian for their insightful review of this publication. This publication was developed in part by the Statewide Delivery for Lone Star Healthy Streams Feral Hog Component and Providing Technical Assistance on Feral Hog Management in Priority Watersheds Project, with funding support from the U.S. Environmental Protection Agency through a Clean Water Act §319(h) Nonpoint Source grant administered by the Texas State Soil and Water Conservation Board and from the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture (USDA), National Integrated Water Quality Program. Additional funding was contributed by the San Antonio River Authority. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the funding agencies.

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