

BIG GAME, BIG DECISIONS, AND BIG GOVERNMENT:

DEER AND FERAL HOG HUNTING IN TEXAS

Zachary Tabor

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APPROVED:

Mathew Fry, Committee Chair

Jamie Johnson, Committee Member

Steve Wolverton Committee Member and
Chair of the Department of Geography
and the Environment

James Meernik, Interim Executive Dean of the
College of Liberal Arts and Social
Sciences

Victor Prybutok, Dean of the Toulouse
Graduate School

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My research examines how primary stakeholders interact with Texas' most harvested big game animals: white-tailed deer, which are increasingly impacted by chronic wasting disease (CWD), and feral hogs, which impact the landscape but effectively have no management strategy. Drawing on literature on wildlife governance in Texas, managing property and the commons, and disease landscapes, and broadly framed by themes of political and historical ecology, my research asks: (1) how do management goals for deer and feral hogs compare to hunting practices and hunting culture in Texas? (2) How are deer commodified by the Texas deer breeding industry? (3) How does the commodification of deer by breeders impact deer hunting practices in Texas? To examine how local stakeholders manage CWD and feral hogs, I conducted interviews among 21 stakeholders, including hunters, game wardens, game ranch managers, and deer breeders in Texas, as well as conducting participant observation at three deer conferences. Analysis shows that contrary to my expectations, not all participants viewed feral hogs negatively, with some viewing them as profit-making ventures. Inversely, how stakeholders contend with and understand CWD varies by a stakeholder's ability to generate profit from deer breeding. Furthermore, the majority of participants identified deer breeding operations as the greatest risk for spreading CWD; deer-breeders themselves, not surprisingly, perceived CWD as either low risk or a big government conspiracy. This research demonstrates a need for further regulation or outlawing deer breeding altogether.

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CHAPTER 1

INTRODUCTION

Both my grandfathers were hunters, my father is a hunter, and I've been hunting in Texas all my life. My father was a Texas game warden for nine years before becoming a Federal Fish and Wildlife Service agent for the last 21 years of his career. As the son of a person who dedicated his life to protecting wildlife, I learned very early that hunters have a responsibility to follow wildlife regulations but, more importantly, to have strong personal hunting ethics e.g., always respect the animals you kill) and to always be aware that mistakes and misjudgments come with heavy consequences. My father instilled in me an ethic to do the right thing even when no one was watching. My mother taught me to love and respect wildlife and that a hunter's actions come with consequences that cannot be taken back. These principles guided me through experiences of elation and remorse when I wish I would have done things differently. However, the culmination of all my hunting experiences is an intense love for wildlife and wild places, and the recognition that both need protection from overexploitation. My passion for the outdoors, hunting, and wildlife conservation led me to pursue thesis research that would enable me to better contribute to wildlife conservation and to give back to a system that has given me so much. I chose to focus on deer and feral hogs because they were the animals I was most interested in hunting, and both are important components of hunting culture in Texas. I also wanted to learn more about Chronic Wasting Disease (CWD) and how it is impacting Texas deer.

The Texas white-tailed deer population is estimated at 5.5 million, with 1.1 million harvested every year (TPWD 2021). Annually, the deer harvest equates to 37 million pounds of

food. Recently, preventing the spread of CWD has become a primary goal of state wildlife managers. Similar to mad cow disease in its effects on the brain though more infectious, CWD is a fatal neurodegenerative spongiform encephalopathy (Escobar et al., 2020). While CWD is not currently transmissible to humans, there is concern that through increased exposure, CWD could breach the species barrier and become a major human health problem (Belay et al., 2004; Kong et al., 2005). High rates of CWD could lead to deer population declines and lower hunter participation (Vaske and Lyon 2011; Opsahl 2003). Ironically, lower hunter participation would contribute to the spread of CWD *and* decrease wildlife management funds generated by license sales and excise taxes. Outside of the detection of CWD in a population of mule deer in the Hueco Mountains in West Texas, every case of CWD detected in Texas has been found in deer breeding facilities (TPWD 2022). This is due to the close quarter conditions at these operations, which enhance the spread of CWD among deer herds through bodily fluids and fecal matter (Mathiason et al., 2006). The subsequent sale and transportation of deer from an infected deer breeding facility to another deer breeding facility or game ranch is one mechanism that spreads CWD across long distances and results in isolated cases across the United States (Mathiason et al., 2006; Adams et al., 2016). By examining hunters, game wardens, game ranchers, and deer breeders' perspectives and perceptions of CWD, my research contributes new insights into understanding how deer breeders' commodification of deer may contribute to the spread of CWD, which could improve CWD management and containment.

In contrast to deer, for many Texas landowners, feral hogs are an unpredictable scourge with detrimental effects on agriculture (Adams et al., 2004). The feral hog population in Texas is estimated at over 1.5 million, causing approximately \$52 million/year in property damage,

primarily through the destruction of agricultural land (Seward et al., 2004). As well as ecological damage to the habitat of native flora and fauna, and direct competition for food resources with some species (Taylor and Hellgren 1997). Texas' current feral hog management policy permits unregulated harvest by any method (including helicopter hunting), essentially allowing landowners to manage feral hogs however they see fit (TPWD 2020). However, even with the lack of regulations (means of take, no harvest limits, and no closed season), Texas continues to see growth in feral hog populations and an increasing geographic range (Massei et al., 2011). Currently, two markets exist for the species: the sale of hunts on private land and commercial trapping for sale to specialized processing facilities and eventual sale into the meat market. While Harper et al. (2016), indicate that most landowners have a negative perception of feral hogs, McLean et al., (2021) demonstrate that though this is true, there are landowners who like having feral hogs on their property. My work examines how local stakeholders engage with feral hogs and how hog hunting practices compare to peoples' engagement with and management of deer.

While this thesis focuses on property owners' perspectives, they are couched within a system of governmental regulation. Wildlife management in Texas, as elsewhere in the United States, is a complex system that involves state agencies, private landowners, hunters, and many other diverse actors. The Texas Parks and Wildlife Department (TPWD) provides stakeholders with regulations and recommendations for wildlife interaction to meet management goals. However, because Texas' land holdings are 97% privately owned, TPWD's formal management recommendations and goals are limited by private landowners' willingness to follow them.

Adding to this property mismatch, white-tailed deer are public property even when they are on privately owned land.

For my thesis research, I originally set out to understand how primary stakeholders (hunters, game wardens, game ranchers, and deer breeders) interact with Texas' most hunted big game animals, white-tailed deer, and feral hogs, and how this worked within a wildlife-food-agriculture nexus. These species are interesting because they differ in their degree of management and property designation. Feral hogs severely impact agriculture, are considered invasive, are the property of the particular landowner where they happen to be, and have few if any hunting regulations. I focused interview questions on hunters' perceptions of deer and feral hogs, how hunting has changed through time, and what people understood about CWD. However, during my interviews, I learned about the deer breeding industry, breeders' divergent opinions about CWD, and that many breeders see CWD regulations as a government conspiracy to drive them out of business. As a result, I began looking more into the deer breeding industry and how their management strategies commodify deer. This led me to change my research objectives.

My thesis research aims to understand how private and state management strategies for wildlife become entangled, get coproduced, and work within a wildlife commons for the benefit and exploitation of large game animals. I frame my research around three bodies of literature: wildlife governance in Texas, managing property and the commons, and pathogenic landscapes. I tie these three different bodies of literature together with an overarching political ecology framework links research on diseases on the landscape, power relationships around property, wildlife management, and human-environmental interactions. Three questions guide

this research: (1) how do management goals for deer and feral hogs compare to hunting practices and hunting culture in Texas? (2) How are deer commodified by the Texas deer breeding industry? (3) How does the commodification of deer by breeders impact deer hunting practices in Texas?

CHAPTER 2

LITERATURE REVIEW

This research is informed by and integrates three fields of literature: wildlife governance in Texas, managing property and the commons, and pathogenic landscapes. I unite these bodies of literature with a political ecology framework focused on the inextricable nature of humans, wildlife, and the environment. ‘Wildlife governance in Texas’ brings together literatures that discuss wildlife and livestock management in the state, biological governance, how landowners and government regulators contend with large mammals. ‘Managing property and the commons’ highlights the linkages among notions of the commons, property rights, and wildlife. Lastly, the ‘pathogenic landscapes’ literature examines the human-environment dynamics of disease with a specific focus on the concept of ‘situated knowledge’.

The framework that binds these bodies of literature together is the political ecology of human-environmental interactions. Political ecology is a broad, eclectic, and highly interdisciplinary fields that primarily examine relationships and dynamics at the intersection of humans and the environment (Crumley 1987; Robbins 2011). An extensive body of work incorporates multidisciplinary perspectives, allowing political ecologists to use various lenses to examine a variety of complex human-environmental relationships (Svarstad and Benjaminsen 2020; Agyeman and McEntee 2014; Beymer-Farris et al., 2012). Gottdenker et al., (2014) demonstrate that increased disease is strongly related to human land-use change, which reduces proximity between humans and disease vectors. As habitat loss increases, there remains an urgent need to better understand how wildlife conservation and habitat loss relate to increased disease transmission (Brearily et al., 2013). I draw on these fields to bind my bodies

of literature together, interrogating human-large game interactions to better understand behavior, management, and impacts.

Wildlife Governance in Texas

To Decker et al., (2016), wildlife governance comprises two things: 1) the complex, entangled system of decision-making processes used by governing bodies to manage wildlife populations; and 2) the ways that wildlife benefits are allocated to stakeholders. Both perspectives inform an understanding of wildlife governance in Texas. To date, much wildlife governance scholarship focuses on broader management issues, like how the system can be improved, rather than identifying differences among management practices in various places (Jacobson and Decker 2008; Armitage and Plummer 2012; Manfredo et al., 2019; Dressel et al., 2020). For this reason, this review of wildlife governance in Texas focuses on current regulations of the United States Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD).

In Texas, wildlife governance occurs among nested scales, with each scale subject to the regulations of the governing bodies above it (USFWS 2022; TPWD 2022). Hierarchically, these scales descend from federal, to state, to wildlife district, to county, to municipality, and to landowner (See Figure 2.1).

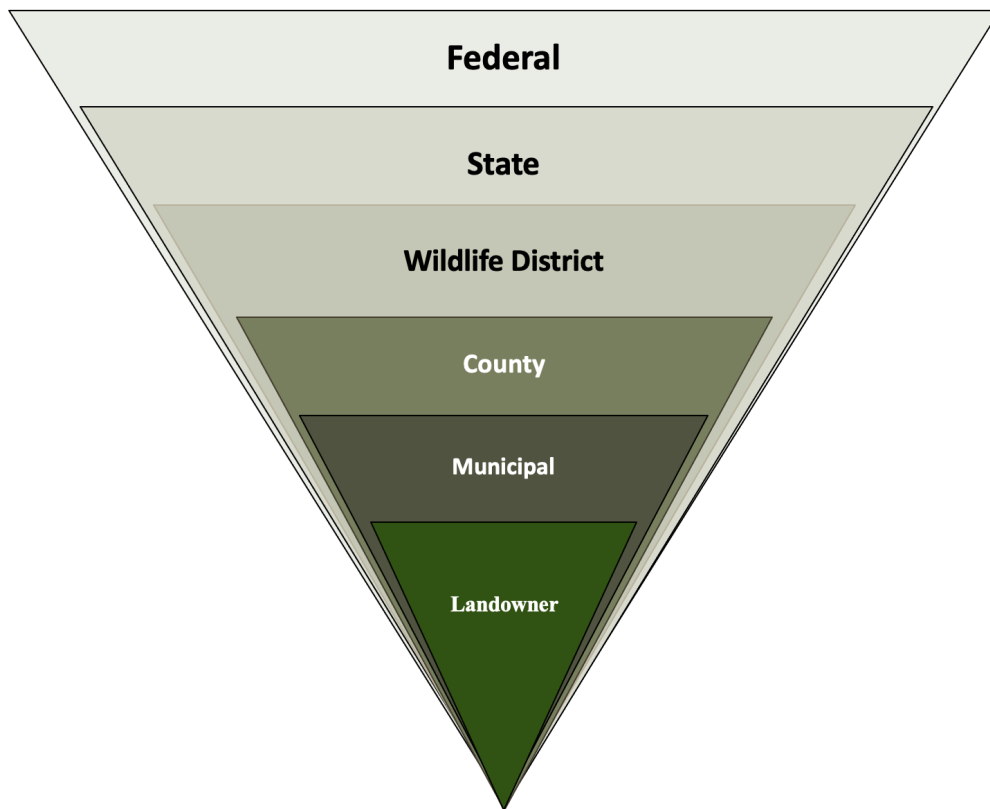


Figure 2.1: The Nested Scales of Wildlife Governance in Texas

Formal regulations are enacted at each scale, with the exception of landowners who may enact informal management strategies. Federal scale regulations can be specific to single species by targeting protections on animals listed as endangered, or broad, such as migratory bird protections (USFWS 2022). Otherwise, individual states have expansive regulatory powers to manage wildlife within their borders. State regulations dictate hunting practices, including where, when, and how people can hunt (TPWD 2022). States employ wildlife biologists who conduct research that informs regulations and game wardens who enforce those regulations. Game wardens operate at the wildlife district scale. In Texas, the eight wildlife districts are loosely based on Texas ecoregions (Figure 2.2; TPWD 2022).

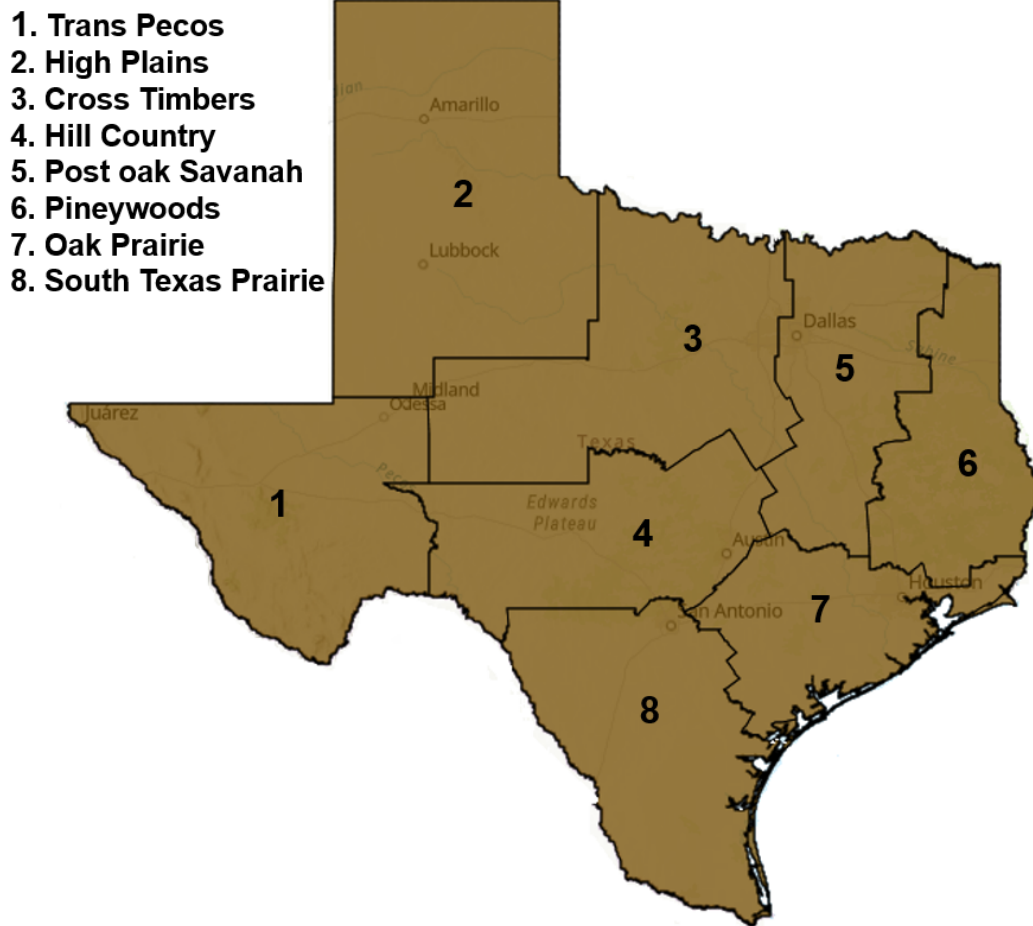


Figure 2.2: Map of Texas Wildlife Districts Based on Ecoregions

It is at the county scale that state wildlife regulations are enforced, with each county in Texas applying state wildlife regulations within the county so that wildlife management regulations are not overarching and blunt (TPWD 2022). These regulations are highly specific e.g., how many animals can be harvested, which sex can be legally harvested, how large antlers must be for a buck to be harvested, and what caliber weapon is permissible (TPWD 2022). Municipalities can enact regulations to deal with nuisances like overpopulated urban deer that may exhaust their wild food sources and turn to home gardens and landscaping (Honda et al.,

2018). All scales of wildlife governance presuppose the landowner scale. Landowners can enact their own informal wildlife governance strategies if these abide by federal, state, wildlife district, county, and municipal regulations. Since 97% of Texas is privately owned, it is at the micro scale where the majority of wildlife management occurs; this gives landowners considerable influence over wildlife management in the state.

Much of the landowner-scale wildlife governance in Texas occurs on cattle ranches and focuses on deer and feral hogs. Therefore, there is often overlap among the three large mammal management strategies. For example, most cattle ranchers try to maintain profitable cattle operations while also promoting healthy populations of large antlered deer for personal hunting or for game ranching, striving to balance both management strategies successfully (Hines et al., 2021). Feral hogs present a constant nuisance to the successful management of both cattle and deer by destroying ranch infrastructures like roads and pasture, and competing for food (Taylor 1997; Mapston 2007; Campbell and Long 2010). Because of the entangled nature of cattle, deer, and feral hog management, as well as the historic legacy of cattle ranching in the state, the resources provided to landowners by Texas Parks and Wildlife Department and the Texas A&M AgriLife Extension inform landowners' cattle and wildlife management decisions.

Open range cattle ranching arrived in Texas from coastal northern Mexico around 1721 (Doolittle 1987). In this livestock management system, cattle are moved to unfenced areas to open graze for part of the year and then rounded up and delivered to markets. Open range ranching effectively ended in Texas with the production of cheap barbed wire, the introduction of intensive agriculture, and consumer expectations for higher-quality beef that open range

cattle could not provide (Jordan 1972). The transition to confining cattle in pens is central to the industrialized cattle ranching model we see today. Modern cattle ranching in Texas generally follows the cow-calf operation timeline, whereby the rancher manages when a bull inseminates cows in order to schedule when new calves are born (Texas AgriLife Extension 2022). Calves stay with their mothers until they are weaned and then separated. Some are kept on the ranch to increase the size of the rancher's herd and the rest are sold. Cattle grass graze until they hit the desired weight and then are moved to feedlots, where they are fattened and later processed.

Throughout the cow-calf operation system, many landowners try to balance raising cattle with managing deer. For these ranchers, both TPWD (2022) and Texas AgriLife Extension (2022) recommend prioritizing the protection of deer habitat and not overgrazing property with too many cattle. To successfully manage both cattle and deer, landowners must preserve woody habitats for deer to have sufficient browse food and cover, as well as maintain enough grazing land to fatten cattle (TPWD 2022).

Until the sale of deer hunts and renting deer leases became profitable, Texas landowners rarely concerned themselves with managing deer. But as deer hunts grew in popularity, some landowners saw that they could make more money selling deer hunts than they could raising cattle. This occurred in much of the Texas Hill Country, where the steep, rocky terrain and woody vegetation provides better habitat for deer than cattle (TPWD 2022). TPWD wildlife biologist Ramsey (1965) dates this shift to the mid 20th century, though it likely occurred later in other parts of the state.

Deer management strategies in Texas vary depending on landowners' time and the amount of work required. It is noteworthy that both TPWD (2022) and Texas AgriLife Extension (2022) focus their research and landowner recommendations on improving deer hunting through habitat improvement in order to foster larger deer populations and hasten antler growth. While TPWD (2022) and Texas AgriLife Extension (2022) recommendations depend on district and ecoregion, habitat recommendations generally revolve around improving cover to make deer feel safer and less likely to leave a property. Most natural nutritional improvement recommendations for landowners are to plant food plots including clover and oats; these plots provide food sources throughout the year, especially when other sources become exhausted (Fulbright, 1999, p. 165). Supplemental feeds like protein pellets and calcium diets are recommended for landowners who want large antlered deer (Bartoskewitz, 2003, p. 1224). However, TPWD (2022) notes that individual landowner harvest strategies are the most important factor in the promotion of large antlered deer. This requires landowners to understand 1) deer antler growth characteristics, 2) when to harvest low-potential bucks to remove them from the gene pool, and 3) when to leave high-potential bucks to spread their genes within the herd. Although neither TPWD (2022) nor Texas AgriLife Extension (2022) recommend intensive, livestock-like management strategies, deer breeders in the state legally use these practices to manage deer herds and maximize their profits (Brooks and Jayarao 2008).

Managing feral hogs is not like managing deer, and Texas AgriLife Extension (2022) refers to it as "coping with" feral hogs rather than managing them. To stabilize the feral hog population, at least 66% of the state's population – or some 1.7 million hogs – should be

harvested annually (Texas AgriLife Extension 2022). There is no current data on the number of feral hogs harvested each year. In Texas, any method of control is allowable for landowners to manage feral hogs on their property, with trapping and aerial gunning the two most effective at removing many animals quickly (TPWD 2022). In fact, standard hunting is a poor method for population control because it may disperse feral hogs into new habitats (TPWD 2022). Although some groups are looking into pesticide baits for hogs (Lapidge et al., 2012), there is currently no approved product on the market. As well, many landowners want stable feral hog populations on their property for perpetual extraction for either personal food procurement or profit through the sale of hunts (Weeks and Packard 2009; Jaekbar 2020).

Wildlife governance in Texas operates on the public trust doctrine designation, whereby wildlife is public property (Wyatt 2020; Wilkinson 1988). However, the state's judicial precedence for this designation does not fix problems associated with how peoples' interpretations of property rights could inform their interactions with public wildlife on private land (see e.g., Blomley 2005). Similar to the concerns that Acheson (2003) raises about informal management strategies giving stakeholders too much power in the direction of resource management. Texas' large percentage of private landholdings affords local stakeholders the ability to manage white-tailed deer and feral hogs according to their own goals, including as privatized commodities (Ramsey 1965; Crow 2013).

Although white-tailed deer and feral hogs are both managed as public resources in Texas, deer are highly valued while hogs are not. White-tailed deer, even with regulations, are experiencing the effects of overexploitation from increased risk of disease distribution from game ranching (Adams et al., 2016). Feral hogs are experiencing a growth in population and

distribution despite the state's best efforts to control their population by minimizing regulations. The exploitation of common resources like deer and feral hogs is often limited by access to the resource, with private property rights the primary limitation to access (Bromely 1992). In the case of white-tailed deer, it seems that privatization and notions of ownership over public wildlife on private land could be contributing to overexploitation. In a classic example of how private property is created from publicly-owned goods, Locke (1980) describes a deer as only becoming one's property when a person exerts their labor to kill it. This rigid interpretation is still an accurate way to define ownership and is used in wildlife regulations today. However, it does not account for the ambiguity, porosity, and place-dependent nature of the boundary or barrier between private and public property. Blomley (2004) describes this public-private property boundary in his investigation of residents' interpretations of private gardens and public spaces in Vancouver. While public and private property are assumed to be mutually exclusive, people often overestimate the influence of legal definitions of public and private property on everyday life (Blomely 2005). Instead, the public and private domain in people's daily life is often overlapping, complicated, and fluid. I draw on this literature to help inform my overall perspective on wildlife management in Texas. In the next section, I explore interactions among publicly-owned wildlife on private property, and property rights at the landowner scale.

Managing Property and The Commons

Garret Hardin's (1968) seminal article on the tragedy of the commons dilemma has long served as the foil in debates about managing common properties. To Hardin (1968), the

overexploitation of unregulated common resources is due to the inability to stop people from acting in their own self-interest rather than for commonly shared values. That is, the perceived threat of competition from other individuals for a shared resource causes people to take as much of the resource for themselves before others can take it from them (Hardin 1968). Common resources range from marine fisheries to the atmosphere, which can degrade overtime if overexploited. To stop the degradation of resources and halt self-interested overexploitation, one solution is to introduce regulations, and another is to privatize the resource (Ostrom 1990). Berkes et al. (1989) describe the "Tragedy of the Commons" model as oversimplifying natural resource governance and note that any property regime that governs natural resources can fail due to overexploitation. For this reason, it is important to understand how peoples' shared norms and values affect resources held in the commons (Berkes et al., 1989). Ostrom (1990) identifies how informal management systems can work to prevent common resource over-exploitation. One example of informal commons management systems can be observed in Maine lobster fisheries (Acheson and Gardner 2010).

Work by Acheson (1977; 1988) demonstrates that lobster fisheries operated successfully through informal strategies until the 1980s when federal regulations replaced informal communal management. Feeney et al., (1990) describe these informal management strategies as contrary to the scenario outlined by Hardin (1968), up until the transition to federal market-focused resource management. Before this transition, fishermen avoided overexploiting lobster by instituting informal property rights over shared lobster fishing territories. For example, harbor gangs controlled territories by either destroying interloping lobsterman's pots or through physical violence (Acheson 1988). Local communities also controlled access by forcing

new fishermen to join harbor gangs as quasi-apprentices before they could access lobster fishing grounds. Although fisheries still operated under federal regulations like season openings, method of harvest, and size regulations (Acheson 1988), lobster fishing communities wholly managed interactions with the resource through the community's traditional socio-ecological practices and structures and thereby provided broad distribution of benefits (Brewer 2012).

The shift to greater federal regulation of the lobster fisheries functionally ended the community's informal management of the resource. Harbor gangs' informal notions of private property were replaced by codified fishing grounds with strict enforcement of regulations and harsher punishment for fishing infractions (Acheson 2003). While Brewer (2012) characterizes the shift from informal to formal management as motivated by a public display of resource conservation, in practice, it led to resource consolidation through the implementation of federal market-focused resource management strategies. Hence, regulation completely changed the dynamic of the fishery (Brewer 2013).

A surface-level comparison of the Maine lobster fishery and Texas white-tailed deer and feral hog management might appear like two entirely different operations. However, key actors' notions of property rights are quite similar. For example, both are judicially managed for the commons, controlled by environmental governance, and often entangled by informal and formal market-focused management strategies. The latter operate on spatial territories based on notions of property, which have the potential to degrade the resource (Ostrom 1990). Before the shift to market-focused federal regulation, the Maine lobster fishery operated on informal management strategies that used informally instituted notions of private property to

control access to the resource and prevent overexploitation (Acheson 2004). Similarly, much of the white-tailed deer and feral hog management in Texas operates on informal management strategies that are informed by formal state strategies. Private property rights give landowners the ability to manage this public resource towards their own goals. Managing in one's own self-interest could lead to degradation of resources, including the distribution of Chronic Wasting Disease (CWD) among deer and the territorial expansion of feral hog populations. While the white-tailed deer are highly regulated and provide a useful commons comparison, feral hogs have effectively no regulation or formal management strategy.

In addition to misinterpretations of public wildlife ownership on private ranches (Butler et al., 2005), other work demonstrates connections between the game ranch and white-tailed deer breeding industry management practices and increased risk for CWD distribution among wild deer populations (Adams et al., 2016; Gerhold and Hickling 2016; Argue et al., 2007). Frosch et al., (2008) found that the Texas white-tailed deer breeding industry generates \$652 million in economic activity annually through intensive management strategies, including deer supplied to game ranches. However, state wildlife managers oppose intensive management strategies because of the increased risk of disease transmission (Chitwood et al., 2015). This indicates that stakeholder management goals for publicly-owned white-tailed deer on private land can differ from those of state management strategies. Similar to CWD management, Adams et al., (2005) demonstrates that local stakeholder management goals also affect feral hog distribution and population management in Texas. I use this body of literature to inform the entanglement of public and private property rights due to the movement of wildlife across

most property boundaries. In the next section, I discuss how disrupting this movement can magnify CWD transmission.

Pathogenic Landscapes

The pathogenic landscape concept is used to understand infectious disease dynamics within human-modified environments at the landscape scale. It links the spatial and temporal relationships between human activity, landscape change, land use, and disease transmission (Lambin et al., 2010). In a nutshell, a pathogen is a bacterium, virus, or any other disease-causing agent. In the case of this research, CWD is the pathogen. The pathogenic landscape approach is especially useful for understanding zoonotic disease risks since it juxtaposes wildlife roles in disease transmission and distribution against humanity's heterogeneous and locality-dependent relationships with wildlife. Furthermore, the concept incorporates the relationship between formal disease policy and local knowledge about the disease, which are entangled but often do not align in people's everyday lives (Tschakert et al., 2016). To understand local knowledge, I draw on Haraway's (1988) idea of 'situated knowledge,' i.e., community knowledge comes from people's positional perception of where and who they are in a society.

CWD was first found in a population of mule deer in a government livestock facility in Fort Collins Colorado in 1967 (Bastian et al., 2004). It is in the same family of transmissible spongiform encephalopathies as Mad Cow disease (Miller and Williams 2004). However, it is much more transmissible than Mad Cow because CWD prions are shed into the environment through the bodily fluids of an infected deer (Haley et al., 2011). Schramm et al., (2006) shows that because these prions are misfolded proteins and not a bacterium or virus, they can stay

infectious in the soil for up to 10 years. This means that environments with infected deer will be potential vectors for CWD for up to a decade.

CWD has spread throughout the Rocky Mountain states via natural transmission; isolated cases have appeared throughout the U.S., likely due to the unknowing transportation of CWD-positive deer through the deer breeding industry (Adams et al., 2016). As my research demonstrates, there are divergent perspectives on the origins and proper management of CWD in Texas. I contend that the pathogenic landscape can be applied to understand the complex relationship of local knowledge and actions regarding CWD transmission among deer in Texas and informal and formal management strategies for wild game on private property.

I use these three bodies of literature: wildlife governance in Texas, managing property and the commons, and pathogenic landscapes to inform my perspective. From Wildlife Governance in Texas, I draw primarily on descriptive work to understand how wildlife is managed in Texas. From Managing Property and The Commons, I draw on the theme of a wildlife commons and apply this idea to deer and feral hogs in Texas. From Pathogenic Landscapes I use situated knowledge to understand how community-level disease management as compared to formal disease policy. I tie these three different bodies of literature together with an overarching political ecology framework that focuses on how themes of diseases on the landscape, power relationships around property, and wildlife management.

CHAPTER 3

METHODOLOGY

This research asks: how do private, local-scale, and state management strategies for wildlife become entangled, get coproduced, and work within a wildlife commons for the benefit and exploitation of large game animals. To study local scale management strategies, I selected three wildlife districts to conduct interviews: Districts 3, 4, and 8. In general, wildlife district areas closely mirror Texas' eight ecosystem types (see Figure 2.2). TPWD uses these designations to implement specific management strategies, regulations, and personnel assignments (Figure 3.1; TPWD 2022).

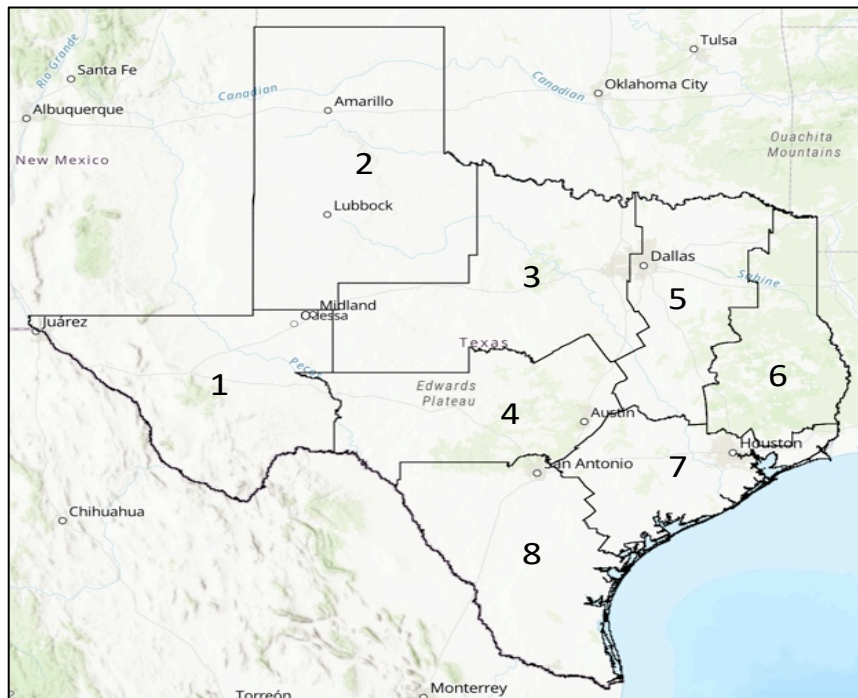


Figure 3.1: Map of Texas Wildlife Districts

TPWD Wildlife Districts 3, 4, and 8 vary in white-tailed deer and feral hog populations, number of CWD cases, and number of game ranches and deer breeding facilities (Mapston

2007; TPWD 2022; Texas Agrilife Extension 2022). A high proportion of deer and hog hunting also occurs in this central part of the state because of optimum habitat for both deer and feral hogs and this is where ranches and farms still occupy large areas outside of the major population centers of DFW, Austin, and San Antonio (Texas Agrilife Extension 2022).

To identify stakeholders to interview in each wildlife district, I used TPWD's listing of game wardens by county to identify potential game wardens. I contacted game wardens via text message using their public contact information and asked if they would be willing to participate in the study. Other stakeholders, such as game ranch managers and deer breeders, were found through online listings for their businesses. I selected and prioritized individuals based on the ease of accessing their contact information. I contacted these individuals via email or phone and asked if they were willing to participate in the study. I also used snowball sampling during interviews to identify other game ranchers in the three districts. Because there is no public information available for hunters, I used convenience sampling to contact potential participants. In total, I reached out to 10 wardens, 32 game ranchers, and 11 hunters. From May 28th to August 25th, 2021, I interviewed eight stakeholders in District 3, seven in District 4, and six stakeholders in District 8. The 21 interview participants included seven hunters, six game wardens, and nine game ranchers, of whom four were also deer breeders (Table 3.1; Table 3.2). I chose these stakeholders because they interact with white-tailed deer and feral hogs. Their relationships to each species vary from hunting for food, to regulating, to selling hunts for profit, and to raising as livestock.

Table 3.1: *Respondents by District*

Wildlife District	Number of Interviews
3	8
4	7
8	6

Table 3.2: *Respondents by Stakeholder Type*

Stakeholder Type	Number of Stakeholders
Hunters	7
Game wardens	5
Game ranchers	5
Game ranchers and deer breeders	4

This study received IRB approval on April 23, 2021 (See Appendix). To minimize the risks of COVID-19 transmission and for the convenience of participants, I conducted the majority of interviews via cellphone. Two participants were unwilling to participate remotely, so I conducted face-to-face interviews following the CDC’s COVID-19 guidelines (e.g., outside, six foot spacing, and wearing masks). Prior to conducting interviews, I asked all participants for consent to audio record. I hand-annotated two interviews because participants declined to be audio recorded. All interviews were semi-structured and included questions about CWD, feral hogs, local impacts, engagement with experts, local land uses, personal ethics, and the ways that deer and hog management policies affect human interactions with these animals (See Appendix). Interviews lasted approximately one hour. Participants were not compensated and received no benefits from participating.

For the two in-person interviews, I was invited to stay as a guest at game ranches, which allowed me to conduct participant observations. At both ranches, I spent one night and two

days. During that time, I took tours of the facilities and property. One of the game ranches also was a deer breeding operation that I toured and subsequently learned about the ranch’s breeding program. During my time at both ranches, I took numerous photographs. Although it was off-season for hunting, visiting these operations provided me a better understanding of how game ranches and deer breeding operations are run and helped me to understand what a guest might experience.

Data Analysis

I used MAXQDA to transcribe all interviews. MAXQDA is a transcription and qualitative data analysis software (MAXQDA 2021). During the transcription process, I conducted a preliminary coding process to identify overarching themes in participant responses. I then extensively coded the data by themes like deer, hogs, and CWD, by sub-themes like why hunt, where hunt, and knowledge, and by participants’ individual responses, for further analysis (Table 3.3)

Table 3.3: *List of Codes*

Feral hogs	
Hog word association	What words participants associated with feral hogs?
Why hunt hogs?	What is the participants reason for hunting hogs?
Where hunt hogs?	Where does the participant hunt hogs?
Challenges	What challenges do participants face when hunting hogs?
Knowledge	Where did and where do participants get their knowledge on hog hunting?
Root of knowledge	How participants learned to hunt
Source of new knowledge	Where participants get their new knowledge about hunting
Management improvements	How do participants think feral hog management could be improved?
State management	Management improvements at the state level

Local management	Management improvements at the local level
Deer	
Deer word association	What words participants associated with deer?
Why hunt deer?	What is the participants reason for hunting deer?
Where hunt deer?	Where does the participant hunt deer?
Challenges	What challenges do participants face when hunting deer?
Knowledge	Where did and where do participants get their knowledge on deer hunting?
Root of knowledge	How participants learned to hunt
Source of new knowledge	Where participants get their new knowledge about hunting
Management improvements	How do participants think deer management could be improved?
State management	Management improvements at the state level
Local management	Management improvements at the local level
CWD	
Effects on hunting	How CWD had affected participants hunting?
Management improvement	How participants thought CWD management could be improved?
Knowledge	Where participants learned about CWD?
Eat?	Would participants eat a CWD positive deer?
Risk locations	Where participants thought CWD posed the greatest risk
Deer breeders	Participants statements about deer breeding
Politics/conspiracy	Participants statements about CWD related to politics and conspiracy

I used MAXQDA's data visualization tools to organize and evaluate the coded interview data. I also used PowerPoint to produce word clouds based on participants' responses to the questions: "What words come to mind when they think about deer?" and "What words come to mind when they think about hog?" In word clouds, repeated words hold higher significance. I also organized word clouds by wildlife district and by stakeholder type to examine variations in responses. I used MAXQDA's subcode statistic function to examine the count of different responses to different questions and I used the variable feature to determine how these responses differed by wildlife district and stakeholder type.

Conference Participant Observation

After completing the interviews, I conducted participant observation at three conferences: the Texas Deer Association Antler Extravaganza, Austin, Texas; the Cesar Kleberg Wildlife Research Institute Annual Research Meeting, San Antonio, Texas; and the National Deer Farmers of America Foundation Annual Conference, French Lick, Indiana. At each conference, I attended presentation sessions and took detailed notes on presentations, audience reactions, questions, and comments. I also attended banquets and auctions at each conference, and talked informally with organizers, speakers, and attendees. I also took photos of vendors' booths and layouts. During breaks and at the end of the day, I wrote down my impressions and observations. In addition, throughout this study, I draw on my 20+ years of experience as a hunter in Texas.

CHAPTER 4

RESULTS

I organize the results into five sections: 1) Hog and Deer Word Associations, 2) Hunting Knowledge Sources, 3) Hunting and Commodification, 4) Chronic Wasting Disease, and 5) Conference Participant Observation. Sections 1 through 4 present results from semi-structured interviews that examine deer and feral hog hunting practices and hunting culture in Texas. Section 5 presents results from participant observations at Deer Association conferences, with a specific focus on the deer breeding industry.

Word Associations

I asked interview respondents, "What words come to mind when you think about deer?" and "What words come to mind when you think about feral hogs?" (See Appendix). Organizing the responses according to font sizes based on their frequency, and color according to the categories Positive, Negative, Experience, Use, and Descriptor, word clouds provide a means to visualize how multiple respondents think about deer and hogs (Heimerl et al., 2014). For deer, although responses varied, "hunting" and "beautiful" were the words most used (Figure 4.1). In addition, many responses were positive, e.g., beautiful, tough, really pretty, and smart (displayed in green in Figure 4.1). Some of the word associations describe the physical characteristics of deer (tan words in Figure 4.1). There are also a few negative word associations like "frustrating" and "stupid" (displayed in red in Figure 4.1).

food, antlers as trophies, and outdoor experiences. For game wardens, this is the same as hunters because all but one game warden was a deer hunter, with the added perspective of enforcing deer hunting regulations as a part of their occupation.

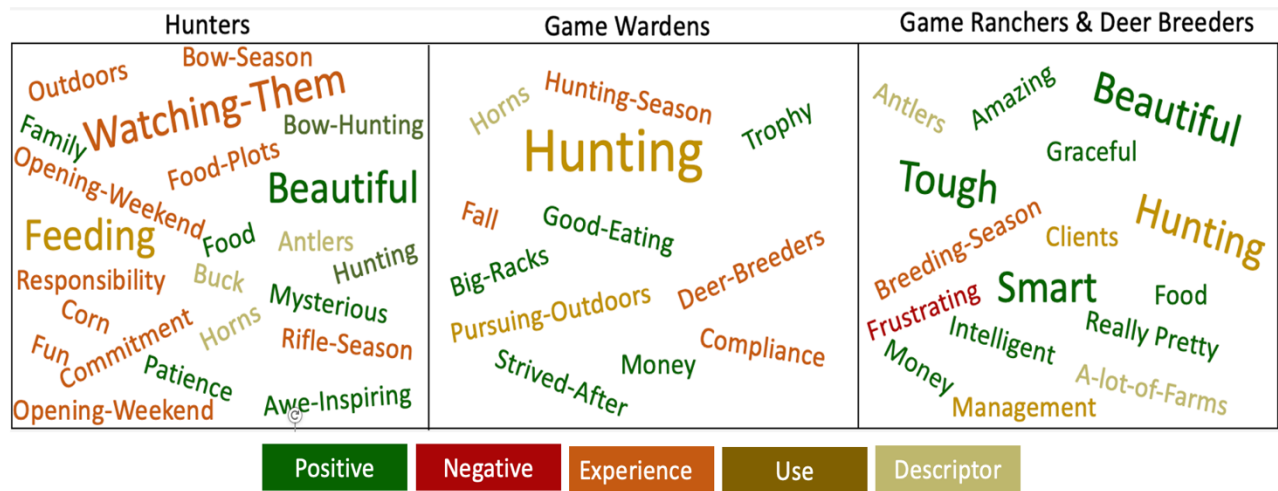


Figure 4.2: Word Clouds Created from the Interview Question: "What words come to mind when you think about deer?" Then Organized by Stake Holder Type.

When I asked, "What words come to mind when you think about hogs?" respondents used the words "destructive" and "nuisance" most frequently (Figure 4.3). It is important to note that non-negative words like "not a problem" are classified as positive associations. Unlike deer, the majority of hog word associations are negative, e.g., destructive and nuisance, though with a few exceptions. For example, one respondent (GR4) chose the term "love-hate" and another (GW3) said "fun". The negative associations may be due to the significant property damage caused by feral hogs and general negative perceptions about feral hogs among rural Texans (Connally et al., 2021). For respondents GR4 and GW3, the ability to hunt feral hogs without restrictions at any time of the year appears to outweigh those negatives. As well, some

respondents who stood to profit from selling feral hog hunts on their game ranch chose positive words to describe feral hogs.



Figure 4.3: Word Cloud Created from the Interview Question: "What words come to mind when you think about hogs?"

Organizing feral hog responses by location, i.e., Wildlife District, shows distinct patterns in word frequencies (Figure 4.4). Word associations become more positive moving from the north to the south. That is, in District 3, the furthest north district, words like "nuisance" and "nasty" are most prevalent, whereas in District 8, the most southerly, "Good eating" and "love-

hate" are more prevalent. This difference may be due to larger agricultural areas in District 3, compared to Districts 4 and 8 as hogs can do significant damage to agriculture (Mapston 2007). The southerly districts also have more game ranches and a culture of hunting on game ranches. Feral hog hunts can be sold year-round with no regulations, and there are no bag limits (TPWD 2022). Moreover, feral hogs draw out-of-state hunters who do not have feral hogs where they live.

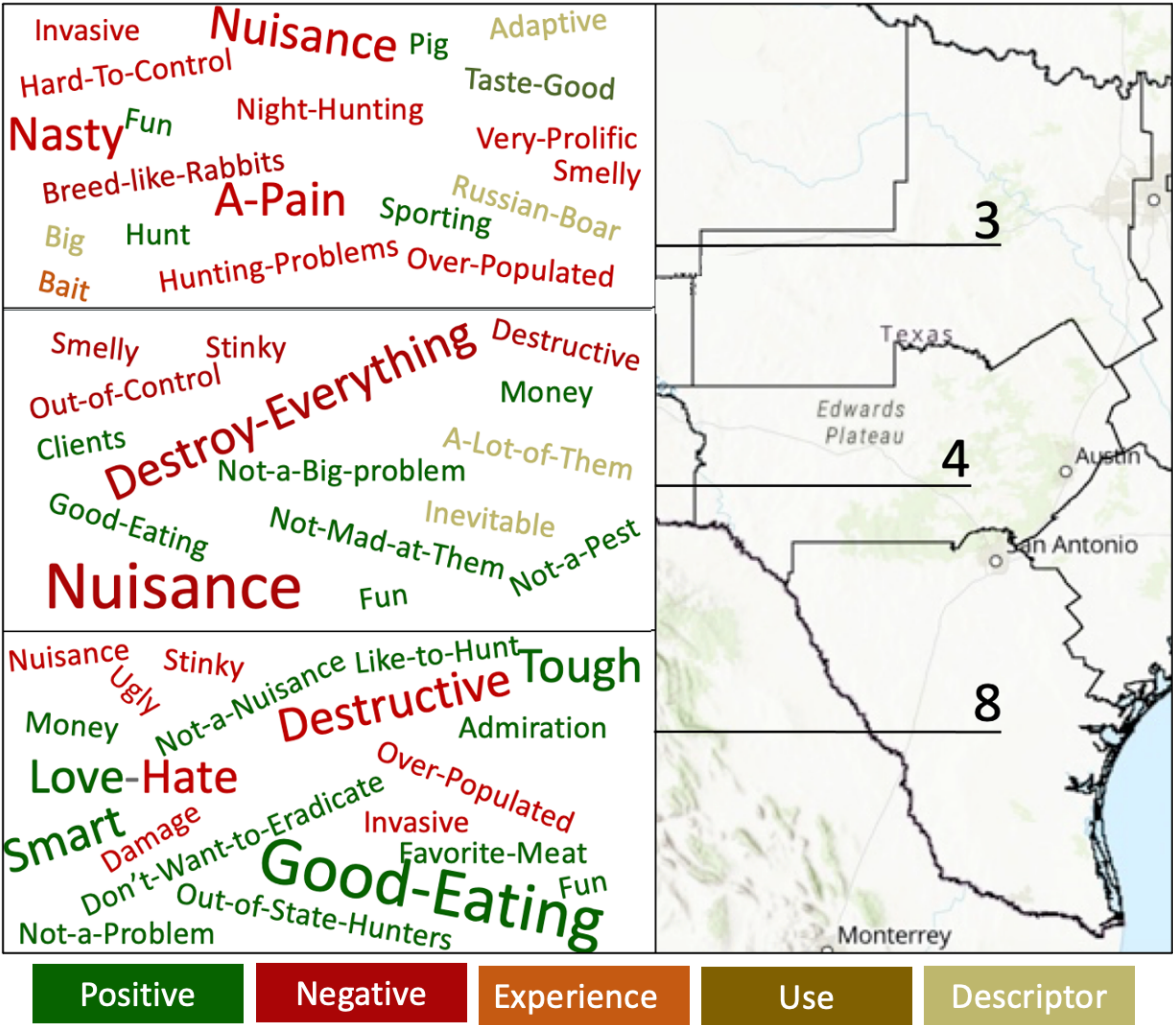


Figure 4.4: Word Clouds Created From the Interview Question: "What words come to mind when you think about hogs?" Then Organized by Respondent Wildlife District

Knowledge Sources

When I asked respondents, "How did you first learn to hunt white-tailed deer" and "How did you first learn to hunt feral hogs?" the majority of respondents replied, "from my dad" or "from my grandpa" for both species (Tables 4.1 and 4.2).

Table 4.1: *How Respondents Learned to Hunt Hogs*

Root of Knowledge	Respondents(N)	Percentage
Dad	5	55.5
Self-taught	3	33
Grandpa	1	11.5

*Note that several respondents did not respond to this question, or the question did not apply or stated, 'the same as deer'.

Table 4.2: *How Respondents Learned to Hunt Deer*

Root of Knowledge	Respondents(N)	Percentage
Dad	10	62.5
Grandpa	4	25
Self-taught	1	6.25
Both parents	1	6.25

All but one respondent was male, with the majority acquiring hunting knowledge from their father or grandfather, or through patrilineal diffusion. However, the one female respondent also learned to hunt from her father but noted that she was passing her hunting knowledge on to her son. Another respondent (GR3) specified that both parents taught him to hunt. When I asked about being taught to deer hunt by their father and self-taught to hunt hogs, respondents explained that there were no hogs around when they were young and

learning how to hunt. This group comprised older respondents who noted that feral hogs moved into their area after they had already been hunting on their own.

I also asked, "where do you get your new information about hunting white-tailed deer/feral hogs?" Respondents most frequently get new hunting information from online media sources (Tables 4.3 and 4.4). There are fewer responses for the source of information on feral hog hunting because some respondents did not look or did not feel the need to look for new information. Conversely, respondents used diverse online media and other sources for new information on deer hunting. Two game ranchers (GR2 and GR4) also noted that seminars or classes provided in-depth deer management strategies they could use on their own property. Most importantly, a comparison of Tables 4.3 and 4.4 demonstrates the shift in sources for hunting knowledge: from patrilineal diffusion to social media.

Table 4.3: *Source of Respondents' New Knowledge on Hog Hunting*

Source of New Knowledge	Respondents(N)	Percentage
Websites	3	50
Magazines	1	16.6
TV shows	1	16.6
TPWD	1	16.6

Table 4.4: *Source of Respondents' New Knowledge on Deer Hunting*

Source of New Knowledge	Respondents(N)	Percentage
Online media	6	50
Books/Magazines	3	16.6
Classes/Seminars	3	16.6
TPWD	2	11.1
Word of mouth	2	11.1
TV	2	11.1

When I asked respondents, "where do you get your information on CWD", the most frequent answer was TPWD. However, respondents also get information from a variety of other sources (Table 4.5).

Table 4.5: *Source of Respondents' New Knowledge on Chronic Wasting Disease*

Source of New Knowledge	Respondents(N)	Percentage
TPWD	9	45
Online media	4	20
Dr. Krohl	3	15
Word of mouth	2	10
Texas Deer Association	2	10

Hunting and Commodification

Although my interview questions never directly asked respondents if they profited from or participated in the commodification of white-tailed deer and feral hogs, it became clear during the interviews that these were integral aspects of Texas' current hunting culture. While there is an economy built around the commodification of white-tailed deer in Texas, participant responses also indicated that feral hog commodification is happening through the sale of hunts (see Table 4.6). Management was the most frequent response when I asked respondents, "what is your main reason for hunting hogs". However, I did not expect for-profit to be the second most frequent answer. The response "for profit" does not mean that these respondents were hunting or trapping feral hogs for the sale of meat for profit, but that the primary way these respondents interact with feral hogs is through the sale of hunts on their game ranch. Responses such as "for fun" and "for meat" also indicate that there is a group of people who

only hunts feral hogs for recreation and food, which could be representative of a more extensive client base that would pay to hunt feral hogs at a game ranch.

Table 4.6: *Why Respondents Hunt Hogs*

Why Hunt Hogs	Respondents(N)	Percentage
Management	9	47.3
Profit	5	26.3
Fun	3	15.7
Meat	2	10.5

Respondents indicated few challenges when hunting hogs, which would facilitate the sale of hunts for the species (Table 4.7). A few respondents found night hunting to be challenging, and one respondent felt that the intelligence of hogs also made them challenging to hunt. Respondents often talked about only harvesting hogs opportunistically, for example, when they encountered one while hunting deer, which may influence respondents' lack of perceived challenges since feral hogs may not be the primary target species.

Table 4.7: *Challenges Respondents Faced when Hunting Hogs*

Hog Hunting Challenges	Respondents(N)	Percentage
Night hunting	3	75
Feral hog intelligence	1	25

Almost all respondents stated that they hunted feral hogs on private lands (Table 4.8). This indicates that, at least in my sample population, most hog hunting is happening on private land. This could be due to the hunter's preference to hunt private land over public land or

because hunting private land is more convenient than hunting public land if respondents owned land.

Table 4.8: *Where Respondents Hunted Hogs*

Where Hunt Hogs	Respondents(N)	Percentage
Private land	11	84.6
Public land	2	15.4

Only one respondent did not hunt feral hogs in the same place that they hunted deer, so the two hunters who hunted deer on public land were also hog hunting on that land (Table 4.8). This would suggest that if a hunter could not access private land to hunt feral hogs and is unable or unwilling to hunt for the species on public land, they might be inclined to pay to hunt hogs on a game ranch. While the commodification of feral hogs in and of itself may seem beneficial for hog population management, it also could incentivize game ranchers and landowners to manage feral hogs improperly because of the increased value of hogs. This could lead to the transport of feral hogs to new areas, or to a management strategy similar to deer (Connally et al., 2021).

Surprisingly, responses to "what is your main reason for hunting deer?" do not indicate that game ranchers are commodifying white-tailed deer (Table 4.9)., the way responses to the same question about feral hogs indicated (Table 4.6). Instead, participants' responses indicate that the deer meat acquired was the main reason for hunting with "trophy" and "getting outdoors" the second most frequent responses.

Table 4.9: *Why Respondents Hunted Deer*

Why Hunt Deer	Respondents(N)	Percentage
Meat	9	50.0
Trophy	4	22.2
Getting outdoors	4	22.2
Management	3	16.6
Tradition	1	5.5
Profit	1	5.5

Game rancher responses to “why do you hunt deer” reflect their participation in the white-tailed deer business or commodification process. For example, GR5 explained that:

I essentially never hunted deer. I got into this as a business opportunity. I've harvested some deer as just the necessity of cleaning out the pen at the end of the season and stuff like that. Hunting is not a personal passion. (Respondent GR5)

The response reflects a larger pattern of game ranchers divorced from traditional hunting culture and more aligned with business interests and profiteering. As another game rancher told me:

I think whitetail is one of the most interesting breeds for numerous reasons; just from an economic perspective, it's one of the most sought-after game to hunt. Yeah, the interesting thing with whitetail is that people will hunt and shoot a whitetail every year [be]cause the horns are different; you have thick ones, high ones, wide ones, really clean horns, or a lotta trash. Versus the exotics like a scimitar oryx which looks exactly like the next scimitar oryx, so whitetail create a great variety from a hunting perspective. (Respondent GR2)

On GR2’s game ranch, the focus is on white-tailed deer instead of exotic game animals because most exotic animals have identical antlers, whereas antler variation among deer entices hunters, which earns GR2 greater profits. Game rancher GR2’s ranch was so invested in white-tailed deer that his operation has a full-scale deer breeding program aimed at increasing antler size and variation. This ranch was nestled at the base of a mountain in the Texas Hill country,

most of the property is low fenced but a smaller area near the main hunting lodge contains pens for deer farming. Around this area is a larger area with high fencing where the farmed deer are released to be hunted by a client. When I asked another game rancher, GR7, how CWD regulations affect his business, he said:

There will always be a market for big bucks [large antlered male deer], and the less guys producing, the more money you're going to make, but I honestly hope that that won't be the case. I would like to see the sunshine over everybody but the guys that can hang it out and hang in there till the end they will get big money out of those bucks.
(Respondent GR7)

GR7's comments are important when it comes to CWD because there are key breeding regulations to prevent its spread. He is not against CWD regulations that restrict breeding practices, because such would ultimately make deer breeding operations more profitable. To be precise, GR7 views CWD restrictions as an obstacle that will drive competitors out of business, decrease the supply of "big bucks," and increase profits for his operation.

Interestingly, GR7 was the only game rancher interviewed that believed CWD was 'real' and not a state conspiracy aimed at driving deer breeders out of business.

Chronic Wasting Disease

Respondents were asked about their experiences with and perceptions of Chronic Wasting Disease (CWD). Questions focused on risk locations, consumption of CWD-positive deer, how CWD affects hunting, and how CWD management could be improved. Most respondents identified deer breeding facilities as the highest risk areas for CWD (Table 4.10). This is unsurprising, given that all new CWD cases in Texas have been at these facilities (TPWD,

2022). The three participants who responded that they were unsure prefaced their answers by stating that they did not know enough about CWD to provide a location.

Table 4.10: *Locations Respondents Identified as Having the Greatest Risk For CWD*

Risk Locations	Respondents(N)	Percentage
Deer breeding facilities	7	53.8
Not sure	3	23.0
Private land	2	15.3
Anywhere	1	7.6

I also wanted to understand how respondents would handle a situation where a hunted deer tested positive for CWD and whether or not to eat it. Although CWD is not currently transmissible to humans, researchers are concerned that exposure to humans via consumption of infected meat, could create a human health concern (Saunders et al., 2012). If confronted with this possibility most respondents would not eat contaminated meat (see Table 4.11). For two respondents who “did not know,” more research was needed to identify possible adverse health effects before they could give a definitive answer. Only GR5 did not believe that CWD is a genuine concern, explaining that "It is my opinion that it is a political disease, not a genuine one or it's a political problem, it's not a problem or not a genuine wildlife problem." (Respondent GR5, 7/19/2021).

Table 4.11: *If Respondents Would Eat a CWD Positive Deer*

Eat?	Respondents(N)	Percentage
No	8	72.7
Don't know	2	18.2
Yes	1	9.1

I asked respondents, "how do you think CWD management could be improved in Texas?" The most frequent answer from respondents was that they were satisfied with the current management and containment regulations (Table 4.12). However, the variation in responses likely is due to the open-ended nature of my question. The second most frequent response was for TPWD to conduct more research on CWD. Interestingly, two game wardens, GW3 and GW5, from in the same county, had very different responses. GW3 recommended that TPWD outlaw all deer breeding immediately, whereas GW5 was satisfied with the current CWD management program. The different responses may reflect different understandings of CWD.

Table 4.12: *How Respondents Thought CWD Management Could be Improved*

Management Improvements	Respondents(N)	Percentage
No improvement needed	4	28.5
More research	3	21.4
Not sure	3	21.4
Awareness	1	7.1
Ban deer breeding	1	7.1
More testing	1	7.1
More data transparency	1	7.1

I asked respondents how CWD affected hunting in Texas (see Table 4.13). The majority responded that it did not affect how they hunt. Respondents GR2, GR5, and GR7 interpreted the question to be how CWD affected their deer breeding business. Two said CWD's containment regulations hurt their business by increasing costs and possibly scaring hunters

away. The other (GR7) predicted that an effect of CWD regulations would be to drive deer breeders out of business, making deer more valuable.

Table 4.13: *How CWD has affected Respondents' Hunting*

Effect on hunting	Respondents(N)	Percentage
No effect	11	78.5
Regulations bad for business	2	14.3
Regulations good for business	1	7.2

Respondents' dialogue about CWD also reveals deeper sentiments among some game ranchers and deer breeders about CWD. Among the four deer breeders, three believe that CWD is not a serious concern, but a state conspiracy meant to drive them out of business. GR6 explained that CWD was actually:

Some way to control them [deer breeders], I don't know what their agenda is by doing that yet, but it will be revealed I'm sure, and the people I talk to are not sure why they're doing it yet, but somebody is padding the pockets by pushing control.
(Respondent GR6)

During another interview, GR5 indicated "untrustworthy publications" about CWD. When asked to explain who wrote the "untrustworthy publications," GR5 said:

It's groups that are anti-hunting and maybe anti-animal cruelty and anti-meat consumption, and maybe that's unfair to group all of those sets of concerns into the same thing, but I think that's what's driving it [be]cause there's people who don't like the idea of hunting and the idea of killing animals ... CWD for them is just convenient, it's something they can use. (Respondent GR5)

Another game rancher, GR8, said that "It just makes me wonder if this is real, are the tests real is the analysis real, are the studies like yours real?" (July 21, 2021) This high level of distrust in the information produced about CWD, even though it may be coming from reputable sources,

and the overall CWD conspiracy suspicion among the game ranching and deer breeding industry reflects a larger pattern of state distrust (Madisson and Ventsel 2020) and may also be part of a business strategy to minimize regulatory oversight (Šrol et al., 2021), which I discuss in the next section.

Conference Participant Observation

To further investigate the possible sources of CWD conspiracy narratives and to learn more about the deer breeding industry, I attended three deer management conferences: the 2022 Texas Deer Association Antler Extravaganza, the 2022 North American Deer Farmers Association Conference, and the annual meeting of the Caesar Kleberg Wildlife Research Institute. Private organizations ran the first two and the third is an academic/research conference.

Texas Deer Association: Antler Extravaganza

The Texas Deer Association (TDA) is a private organization primarily made up of deer breeders, game ranchers, and hunters. The organization serves as an information resource for deer breeders on new CWD containment regulations and TPWD general regulations. It produces videos and print material on deer breeding. The annual “Antler Extravaganza” provides deer breeders opportunities to network, conduct business, and to advertise deer breeding operations (TDA 2022).

The 2022 Antler Extravaganza conference was in a large conference room at the Kalahari Resort in Round Rock, Texas. Kalahari Resort is an African wildlife-themed large hotel

that boasts waterparks, a variety of restaurants, and caters primarily to families. Attendance was between 100-200 people given that only about half of the 24 tables with ten chairs per table (for 240 people) were occupied. There were 30 vendors, including 23 deer breeding operations, two nutrition/feed vendors, one gun vendor, two vitamin IV vendors, one construction vendor, one photography vendor, and one veterinary services vendor (Personal Observation, February 4, 2022). The typical deer breeder vendor included a large, backlight, 15x10 foot ranch logo silhouetting multiple mounted deer that showcase the ranch's genetic stock (Figure 4.5). Also included were western- or rugged-style wood furniture for attendees to make deals and network (Figure 4.6)



Figure 4.6: The Gist Kinsman Ranch Conference Booth



Figure 4.7: Blackjack Whitetails Taxidermy Deer

When I arrived at the conference, I met with the marketing director of the Texas Deer Association who briefly walked me around the conference area. In our short conversation, he told me about the conference set up and, while explaining the deer industry, he noted, "well you know how people farm cattle, these people farm deer." This suggests similarities among the deer breeding and cattle industries. As discussed below, the overlap mostly occurs in the auctioning of pedigree semen and stock.

Purina, the pet food conglomerate, is a large sponsor of the conference. The Purina representative told me that their company supplies approximately 60% of the food to the Texas deer breeding industry. He also explained that Purina uses their patented food additive 'Climate Guard' in their feed. Climate Guard inhibits the animals' aversion to eating during the hot part

of the day. This allows breeders to get more food and protein into deer bodies, causing antlers to grow larger and more rapidly, according to the Purina rep.

The Antler Extravaganza auction involved about 30 items; these were primarily female deer with high genetic potential that had been artificially inseminated with high genetic potential semen. Sale prices for the artificially inseminated does ranged from \$5,500-\$28,000. Sale prices varied based on the deer's pedigree. The more well-known the pedigree, the higher the auction sale price. The auction also included donated items such as semen straws from various game ranch bucks that had high genetic potential and that could be used to artificially inseminate female deer; as well as 3 tons of deer feed from Purina, various advertisement spots for Antler Extravaganza 2023, and four-wheeler. All donated-item proceeds went to the TDA for operating expenses.

For their keynote speaker, TDA invited Chris Seabury, professor of animal genetics at Texas A&M University. Seabury's early work focused on genetic improvement in livestock then shifted to white-tailed deer and CWD resistance (e.g., Kerley et al., 2012; Seabury et al., 2020). Seabury spoke for 2 hours, partly to educate deer breeders on his patented genetic array and partly to make a sales pitch for his genetic services, which identify genetic markers for CWD resistance. Seabury developed the genetic array while at the USDA studying deer breeding facilities with CWD outbreaks. After explaining how the array works, he noted that certain genetic markers are linked to increased resistance to CWD while other genetic markers are linked to increased susceptibility to CWD. By using his services, breeders could increase CWD resistance among their deer herds. Despite general support for his genetic work, some audience members raised concerns about potential regulatory oversight. For example, one

audience member suggested that TPWD might require *all* deer facilities in Texas to purchase genetic resistors. However, Seabury assured the audience that neither TPWD or USDA would get access to his data or the genetic array information (Observation, February 5, 2022).

In his talk, Seabury also proposed two possible origins for CWD. First, he suggested that it may have come through transmission from sheep through the prion disease Scrapie; or second, that CWD in deer is spontaneous and occurs randomly in populations. During the question-and-answer portion of the presentation, another audience member became visibly agitated and began arguing with Seabury about the CWD-from-Scrapie theory. To the audience member, if Seabury could prove that Scrapie was the origin of CWD, deer breeders would stop being the "bad guys," because this would transfer the blame for CWD to the sheep industry (Personal Observation, February 5, 2022).

Caesar Kleberg Wildlife Research Institute: Annual Research Meeting

Caesar Kleberg Wildlife Research Institute (CKWRI) is a nonprofit research group affiliated with Texas A&M University-Kingsville which focuses on wildlife research in Texas. CKWRI's research is primarily centered on south Texas wildlife like white-tailed deer and quail, and on rangeland ecology for cattle ranching. The research conference allows donors and landowners to learn about CKWRI research (CKWRI 2022).

I arrived at the Witte Museum in San Antonio, site of the research meeting, on the morning of March 4, 2022. In a small conference room at the back of the museum, there were approximately 150 people in attendance, primarily TPWD employees and south Texas landowners there to learn about new deer management research. Six researchers presented on

rangeland ecology and deer management topics. With the exception of Peter Larsen's talk on the Minnesota Center for Prion Research and Outreach's (MNPRO) work, few of the other talks were useful for my thesis research. Larsen discussed his work as a "war against CWD". Although his talk focused on prions and their functions, Larsen acknowledged that "CWD politics are a bloodbath" (P. Larsen, Presentation, March 4, 2022). He also explained that his lab was improving its facilities to conduct more RT-QuilC prion tests to reduce CWD test wait times, which is one of the greatest challenges for deer breeders and state agencies. RT-QuilC (real-time quaking-induced conversion) can detect CWD in a sample. Larsen explained that, in order to reduce the cost of the tests, MNPRO was developing their own version of the RT-QuilC test called MN-QuilC. The MN-QuilC tests are already patented. MNPRO also is developing a metal test plate that could be placed in the bottom of a deer feeding trough, which could be swabbed and tested for CWD prions using the MN-QuilC test, allowing for more frequent, less expensive, and more effective herd surveillance for CWD. Larsen also discussed preliminary work on copper dietary supplements that could reduce CWD transmission rates. Although preliminary results show promise, there have been no tests on animals.

North American Deer Farmers Association Conference

The primary goals of the North American Deer Farmers Association (NADeFA) are to organize and unit people who raise deer for commercial purposes. NADeFA also organizes events to promote the education of deer breeding practices and foster business relationships between deer breeders. It also lobbies at the federal level for CWD research since the disease is the largest, current threat to their industry (NADeFA 2022).

The NADeFA conference was held at the French Lick Resort convention center in French Lick, Indiana. The French Lick Resort is a historic hotel that has multiple locations throughout the town, its amenities primarily cater to families, but it also has a large casino. NADeFA staff estimates that 500 people attended the four-day conference. There were also 60 vendors (Figure 4.7). Deer breeders from the Midwest, there to market their ranches' genetics to other deer breeders (Figure 4.8), comprised the majority of vendors, which also included veterinarians and companies who specialize in pharmaceutical drugs, dart guns, deer feed, rustic furniture, and outdoor media (Personal Observation, March 23, 2022).



Figure 4.7: The NADeFA Conference Vendor Room

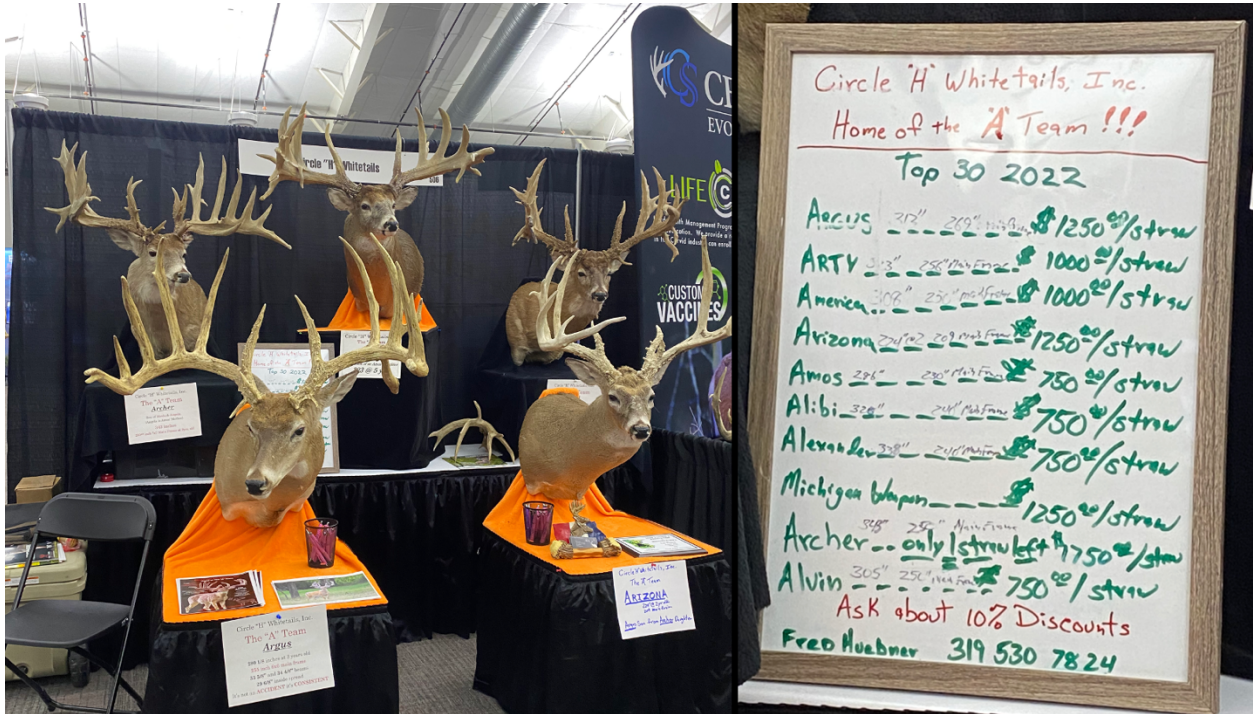


Figure 4.8: Circle “H” Whitetails Vendor Booth with Semen Price List

At the conference, I attended the “New Deer Breeder Seminar” which aimed to bring new deer breeders up to speed on how to run a profitable deer breeding business. In her presentation “Principals of Herd Held and Neonatal Management,” veterinarian and deer breeder Roxanne Knibb discussed common medical issues that new deer breeders might encounter. A few things stand out from her presentation and shine a light on deer breeder management strategies. For example, the term “Neonatal Management,” or the management of deer fawns immediately after birth, indicates an intensive, livestock-style of management that begins at birth and lasts the entire life of the deer -- if the deer remains at the same deer farm -- or until it is sold to a game ranch. Interestingly, if sold to a game ranch, the managed deer becomes a profitable hunting target and, in a sense, reverts back to a wild animal. This ‘managed deer-to-wild deer’ also became apparent when Knibb recommended using

“aluminum bandages,” which is a medial spray that is bright silver when it is applied to a deer’s wound (Personal Observation, March 23, 2022). Knibb made it clear that this silver color was highly visible and that deer breeders need to:

be respectful of the game preserve owner so they don’t have to explain to hunters why there is silver spray paint on their deer.

This indicates a clear desire for hunters to not have to confront evidence of the deer’s management origin, i.e., as livestock. It also demonstrates the ways that deer breeders commodify ‘wild animals’ for personal gain and profit.

In the “Marketing and Genetics” Q and A presentation, Oklahoma deer breeder Chris Ezell walked the room and gave advice on his marketing and genetics strategies (Personal Observation, March 23, 2022). Ezell explained that building a breeding operation has two routes: quantity or quality. For a new deer breeder, a quantity operation is cheaper to start because the cost of deer to start a herd is not too expensive. The quantity business model is to breed “stocker” bucks that reach a very large antler size like 200 inches by a certain age. Each generation of “stocker” bucks is then sold to stock game ranches for trophy hunters to pay to shoot. Conversely, a quality-focused deer breeding operation’s business model is to breed a herd of very expensive deer that have high genetic potential. These deer are not sold to game ranches to be hunted, instead profit is realized from the sale of buck semen and female deer with high genetic potential to other deer breeders who hope to improve the genetic quality of their own herd. Although the quality model is more profitable, Ezell dissuaded new deer breeders from pursuing this path because it requires more initial investment and carries higher risks, e.g., if their ‘stocker’ buck dies, those initial investments would be lost (Personal

Observation, March 23, 2022). Attendee's questions to Ezell about deer breeding marketing and genetics varied greatly, but the following two replies by Ezell are telling:

- If you can keep deer alive, you'll make money.
- It's really hard to lose money in the deer industry.

In fact, Ezell convincingly described deer breeding as a foolproof way to take any property, especially one too small to sustain other types of livestock operations, and turn it into a highly profitable business. To Ezell, properties as small as 10-15 acres could support a profitable deer herd since the "optimal" number of deer per acre is four to six, though he knows of some people who keep as many as 30 per acre!

Testament to the allure of deer breeding for rural Americans was the large number of Mennonites at the NADeFA conference. Significantly, most were not at the new deer breeder seminar, but seemed to be established players in the Midwest deer breeding industry (Personal Observation, March 23, 2022). Indeed, for Mennonites, deer breeding is more profitable than any other agriculture or livestock activities and it allows them to keep their rural lifestyle and maintain their cultural heritage (Lee and English 2011). Although deer breeding may offer promising economic opportunities for some rural Americans, it also creates potential consequences for deer, public citizens, and hunters (Geist 1985). One consequence is the degradation of deer hunting opportunities because of the spread of CWD. In addition, high-fencing confinement essentially makes deer private property, which undermines the institution of publicly-owned wildlife.

It is noteworthy that Ezell's presentation lacked any mention of exotic species, which was advertised at the Antler Extravaganza Conference in Texas (observation, March 23, 2022). It is likely that colder climates limit the number of exotics available to deer breeders in northern latitudes. Whereas Texas' warmer climate can support deer and exotic species from Asia and Africa. Nevertheless, I wondered if more Texas deer breeders would be breeding white-tailed deer if they did not have the ability to diversify their ranch's animal stocks by breeding exotic species that also earn profits.

The NADeFA new deer breeder seminar ended with a question-and-answer session with the panel of presenters. Most of the audience's questions asked about various topics related to the management of deer in a deer breeding operation or how to run a profitable breeding operation (Personal Observation, March 23, 2022). The session was helpful in gaining knowledge about the intricacies of the deer breeding industry. Two questions that elicited answers from the panel revealed the conditions of some deer breeders' herds. The first question asked if having grass in one's deer pens is important for herd success. Keith Warren, a deer breeder and content creator, exclaimed that "there is less grass in my pens than there is in [this conference hall]!" (K. Warren, presentation, March 23, 2022). While many livestock industries also raise animals on bare ground, I was surprised to hear that this is also happening with deer. The second question asked how the panelists deal with swarming flies in their deer pens (Personal Observation, March 23, 2022). Most panelists indicated that they didn't have to deal with flies due to their colder climate, but Shawn Shafer, the NADeFA executive director, and Keith Warren described just how bad flies could be on some farms:

- Graphic designers in this field spend most of their time editing out flies. (S. Shafer)

- When I'm filming my TV show, I'll tell guys to go spray your pens or I'm not filming. [There are] so many flies you just feel bad for the deer. (K. Warren)

Here again, I was surprised to learn about the poor conditions on some deer breeding facilities. Also surprising was how casually leaders in the deer breeding industry talked about those poor conditions in a public setting to a room full of aspiring deer breeders.

On day two of the conference, I attended the “Examining CWD agent transmission and shedding in rare genotypes of white-tailed deer that may have increased resistance to CWD” presentation by Justin Greenlee from the USDA Agricultural Research Services. Greenlee’s research is the beneficiary of NADeFA funding and is part of a larger, two-year lobbying effort for seven million dollars to go towards CWD research (Personal Observation, March 24, 2022). Greenlee described his research project and provided preliminary results. The research uses live deer to determine the age when CWD prion shedding begins, which can indicate the levels of transmissibility in small and controlled settings. Most audience questions asked about the study’s methods and expected date of completion. It was telling that the questions hinted at the audiences’ desire for CWD researchers to figure out how to push the start of prion shedding back to older aged deer (Personal Observation, March 24, 2022). That is, if CWD prions begin shedding later in life, deer breeders could ensure that positive deer are sold to be hunted at a younger and before prion shedding starts. Simply pushing the start time of CWD back would allow them to “still have an industry” (Personal Observation, March 24, 2022).

Many attendees at the conference appeared to be skeptical of science. For example, three attendee comments about Greenlee’s study show how some deer breeders feel about CWD research:

- It's nice to see research at a believable level!
- If you try hard enough you can get anything out of research!
- Is [Dr. Anthony] Fauci involved in any of this science whatsoever?!

The first two comments reference previous CWD research that injected CWD prions into the brains of deer to examine transmission rates, something that many deer breeders disagreed with because it was not a natural method of transmission (Personal Observation, March 24, 2022). While this research was peer-reviewed and made it clear these methods were used to create a situation with the highest efficacy of transmission, it seems to have negatively affected how some deer breeders perceive CWD research (Personal Observation, March 24, 2022). The third comment, although made in jest, draws a parallel between the deer breeding industry's perception of CWD and some groups' doubts about the validity of Covid-19 research, which Dr. Anthony Fauci seems to embody. This may be indicative of a larger trend of distrust among deer breeders for CWD research that is not funded by their organization, the NADeFA.

To summarize my results, perceptions of deer and feral hogs differ due to how people interact with deer and where people interact with hogs. Unsurprisingly, the way participants accessed new information on hunting leaned towards sources like the internet and TV. After attending multiple deer conferences, it is clear that there is a thriving deer breeding industry that is uncomfortable with CWD research that they do not fund. Some breeders frame CWD regulations as government overreach, simultaneously positioning themselves as victims, which removes them from the blame of spreading CWD.

CHAPTER 5

DISCUSSION

I organize this discussion into four sections: 1) Why Deer and Hogs? 2) Deer Hunting Ethics: Traditional, Traditional Trophy, and Nontraditional Trophy, 3) The Commodification of Deer, and 4) Chronic Wasting Disease.

Why Deer and Hogs?

Based on my interviews, peoples' perceptions of deer and hogs vary according to geography and type of stakeholder. When interview respondents think about deer and hogs different words come to mind. Hunters' perceptions of deer are more likely to be based on in-the-field experiences, e.g., "watching them" and "responsibility". This is likely due to hunters drawing on their past experiences and the positive memories of deer hunting and less so with the deer. Game wardens, the smallest stakeholder group interviewed, used words like "compliance," which reflects their professional relationship with deer as agents who enforce hunting regulations. Game wardens' use of words like "money" reflect what they see happening in the deer industry today, which is people making money from deer hunts. Game ranchers' and deer breeders, i.e., the people who make money from deer, used words like "frustrating" and "breeding season" to describe deer because they spend more time around deer than the other stakeholder groups.

With feral hogs, stakeholder perceptions are tied to geography. Stakeholder perceptions of hogs are most negative in wildlife District 3 and become more positive in the more southerly wildlife Districts 4 and 8. This is likely because District 3 has more agricultural land that can be

damaged by feral hogs (see Figure 5.1). However, stakeholders with no connection to agriculture may also think of hogs negatively because of popular narratives about feral hogs as invasive and destructive (Morthland 2011; Ferguson 2019; Laughead 2020). Positive perceptions of feral hogs in Districts 4 and 8 may be due to less agricultural land and more game ranches, which means that stakeholders might benefit from selling feral hog hunts. As well, in District 8, game rancher GR1 explained that on his ranch, hogs do not cause much damage because “the ground is just too dry”, elaborating that he would like to have more feral hogs on his ranch because out-of-state hunters come to hunt them so much. While this may be the minority of stakeholders, the sentiment aligns with the work of Adams et al., (2005) and Mclean et al., (2021) who found similar perceptions of feral hogs in Texas.

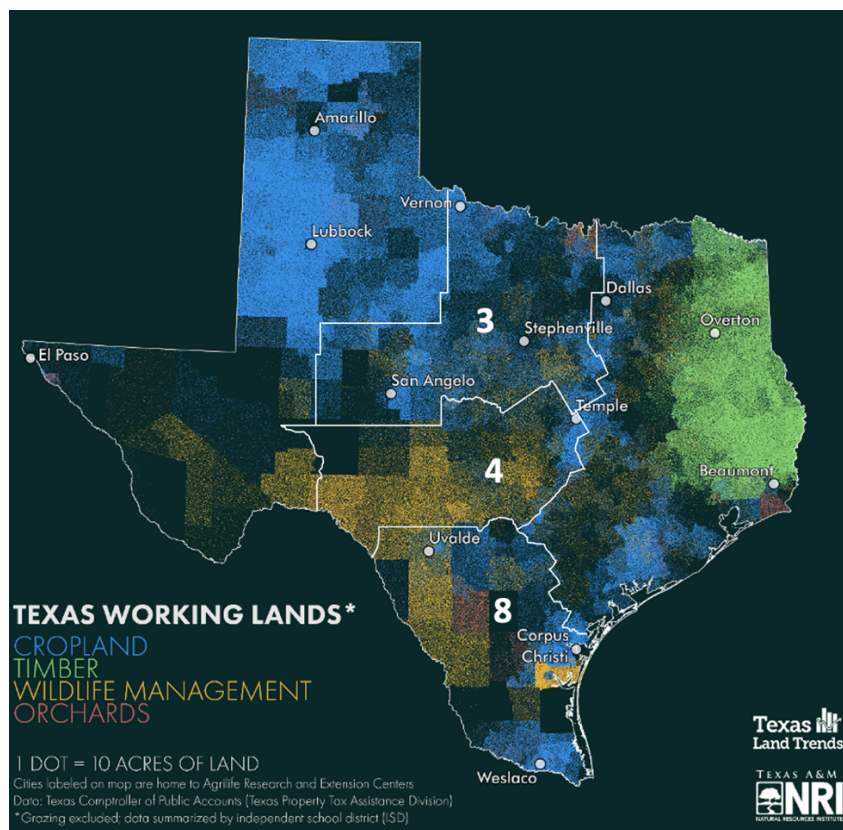


Figure 5.1: Map of primary land uses overlaid with Texas wildlife districts 3,4, and 8 (Texas A&M Natural Resources Institute 2020)

Deer Hunting Ethics: Traditional, Traditional Trophy, and Nontraditional Trophy

Before discussing the commodification of deer, I describe hunting in Texas, contrasting traditional deer hunting and trophy deer hunting. Hunting ethics play a role in hunting practices (Cohen 2014; Essen 2018), which can be categorized as traditional hunting, traditional trophy hunting, and nontraditional trophy hunting. Drawing on my interviews and participant observations, I characterize traditional hunters as primarily motivated to acquire food; traditional trophy hunters as motivated by both food and trophy (i.e., large antlers); and non-traditional trophy hunters as motivated by trophy only, which involves paying to hunt farm raised deer.

Traditional hunting is a food-rewarding, recreational activity, and wildlife management tool. *Traditional hunters* learn to hunt from their parents and grandparents. Eighty-seven percent (87%) of hunters interviewed for this study said they were taught to hunt deer by a father or grandfather. Traditional hunters may go out every deer season to harvest a deer on family land, public land, or on a hunting lease. Their primary motivation is to acquire venison, though they generally would harvest a larger antlered deer over a smaller antlered deer. In this way, every traditional hunter is in some way a trophy hunter because antler size often plays a role in their decision to shoot a deer or not. Demographically, traditional hunters are older (>30 years); conversely, many hunters under 30 are influenced by online hunting media and may learn to hunt from these sources. Indeed, traditional hunters most often learn to hunt from fathers/grandfathers, but some now get most of their hunting information from the internet, primarily hunting websites, hunting forums, and social media. This change in knowledge source

clearly affects hunting practices; it may also affect hunter ethics, although this study did not focus on hunting ethics and how these have changed.

Traditional trophy hunters are motivated to acquire food *and* to have a large set of antlers to decorate their homes. This mindset may set in as hunters get older and are no longer satisfied with harvesting the first deer they see and instead wait for a large antlered male deer. In my interviews, 19% of participants noted that their primary motivation for hunting deer was the trophy and three hunters talked about not harvesting deer for multiple years because they did not have an opportunity to harvest a trophy animal. For example, hunter H7 explained that he goes deer hunting to “just watch them” and only harvests a deer if he sees what he considers to be a really nice trophy buck.

Although Lee and Widmar (2017) argue that to the general public trophy hunting is the least acceptable form of hunting, in some way, many hunters are trophy hunters, as I note above. Perhaps "trophy hunting" has negative connotations because of the perception that the hunter will only keep the trophy and discard the meat. In Texas, hunters are legally required to keep the meat from any game they kill, so discarding meat would be breaking the law. As well, "trophy" animals often represent the oldest males of a population, are more likely to have multiple offspring, and will likely soon die, which better manages the deer herd by not harvesting young animals and removing older animals. Moreover, wildlife management regulations mirror the goals of traditional trophy hunting by enforcing minimum antler size restrictions (Wallingford et al., 2017). Finally, it is important to note that what constitutes a "trophy" deer is subjective and varies from hunter to hunter.

The third class of hunters, *nontraditional trophy hunters*, are primarily motivated by the trophy and will purchase a hunt to shoot a bred deer with unnaturally large antlers. This purchase guarantees an easy hunt and trophy deer antlers, with antler size dependent on cost. The deer breeding industry is integral to nontraditional trophy hunting. Nontraditional trophy hunters are often older since this type of hunting requires very little physical effort and it is expensive, costing upwards of \$10,000. Nontraditional trophy hunting is transactional and entails much less physical work by the hunter compared to other hunting methods. For example, nontraditional trophy hunters may be driven to a deer stand before sunrise and wait for a scheduled feeder to attract deer. The hunter then chooses a deer to shoot. If larger than the size paid for, the 'hunter' pays the difference. While nontraditional trophy hunting is especially common in Texas, few of the hunters I interviewed participated in nontraditional trophy hunting. This is likely due to expense and the types of hunters interviewed. Most are from a similar middle-class income bracket and are drawn to traditional hunting.

Where Deer Hunting Happens

Deer hunting in Texas occurs in locations that can be classified as *non-confined* and *confined*. Non-confined is any land where deer mobility is not limited and the deer freely cross property boundaries. Non-confined is what most people imagine when they think of hunting. This is where most traditional hunting and traditional trophy hunting take place (See Figure 5.2).

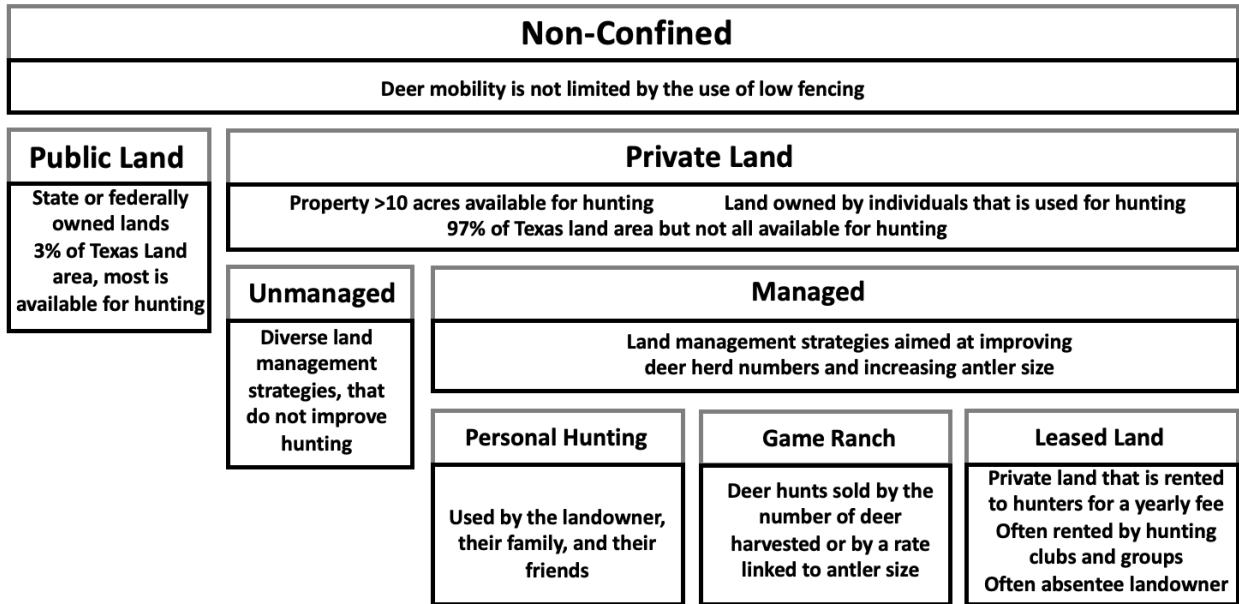


Figure 5.2: Classification of Non-confined Hunting in Texas

Non-confined land can be divided into public and private. Public land comprises 3% of the state’s land area, including state and national parks, forests, grasslands, and wildlife management areas, most of which are available for hunting (Figure 5.2). However, public land hunting may have the lowest hunter participation because hunters enter a lottery system to draw a hunting permit tag. Because of high demand, TPWD uses lotteries to conserve and manage animal numbers. Public land hunters face challenges that private land hunters do not, including competition from other hunters, which makes hunting more difficult.

A majority of hunting in Texas occurs on private land. Hunters with access to private land have a higher chance of success (Figure 5.2). They also generally encounter fewer regulations and can harvest more animals. In Figure 5.2, I categorize private land as managed or unmanaged. Managed private land is any land where land management strategies are used to

improve hunting, although hunting is not necessarily the only land use. Unmanaged private land is not managed to improve hunting, though people still use the land for hunting.

In Figure 5.2, I further divide managed private land into three categories: personal hunting, game ranching, and leased land. Personal hunting land is only used for the personal harvesting of deer by the landowner or with the landowner's consent. This is likely the most common form of hunting in Texas because it is accessible to anyone with access to property greater than ten acres, as this is the minimum amount of land to legally hunt. Game ranches often confine deer with high fences (i.e., fences that are too high for deer to jump over); though some game ranches may use non-confining low fences, these are increasingly uncommon among game ranches. Confined and non-confined game ranches operate similarly, selling deer hunts by the number of deer or by the size of the deer's antlers. Groups of hunters use leased land to set up hunting camps. These groups pay the landowner for access to the land. Generally, the leasing landowner is an absentee owner and may choose not to manage the land. Hunters who lease land usually have no other way to access huntable land other than public land.

The antithesis of non-confined land are lands where deer are confined using high fencing that keeps deer from leaving or entering the property. Some states ban high fences because the fences limit deer mobility. These states view high fencing as a violation of public property rights since deer are codified as the property of all citizens (Smith 2011). It is within the confined hunting lands of small ranches where deer commodification occurs (see red outline boxes Figure 5.3).

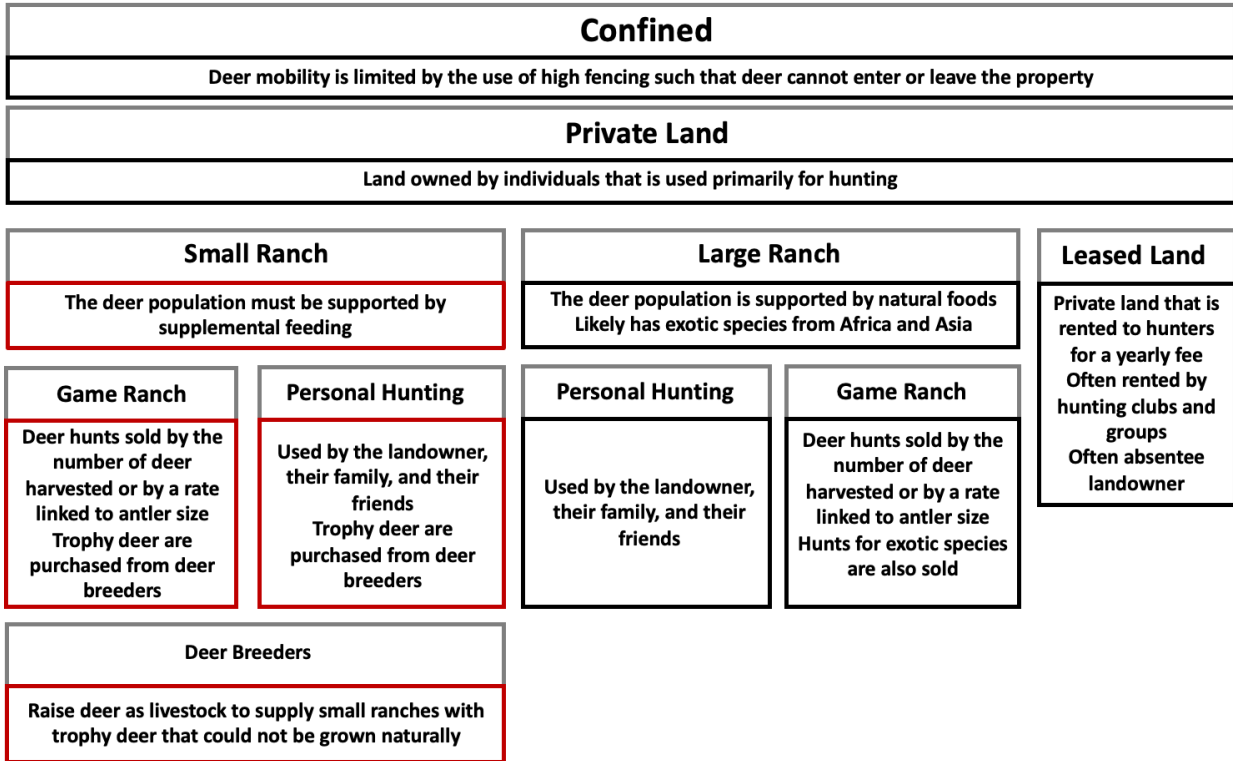


Figure 5.3: Classification of Confined Hunting in Texas

All confined hunting lands are privately owned. In Figure 5.3, I divide privately-owned, confined hunting lands into leased land, large ranches, and small ranches. Confined leased land operates the same way as unconfined leased land, although these hunting leases are more expensive due to the costs of erecting high fencing and the exclusive access to the deer on the property. Ranches are divided into small and large based on the property being large enough to contain sufficient food to support the confined deer population. Large ranches also often have exotic species from Africa and Asia. Small ranches provide supplemental feed to deer, requiring extra food to support an unnatural, over-capacity deer population that are purchased from deer breeders. Although this may be for the landowner’s personal hunting, it is often done to keep the small game ranch profitable by charging hunters a premium for trophy deer. While

large ranches are also used for game ranching, they seldom purchase deer from deer breeders because they generally target clientele seeking more traditional hunting experiences. It's within the supply and demand of small game ranches that deer breeders commodify deer.

The Commodification of Deer

The commodification of deer involves individuals profiting from deer, which creates a conundrum because deer in Texas are publicly owned, and the state is mandated to manage the public deer herd for the benefit of all citizens in perpetuity. While the element of the public property being mobile adds another layer of complexity, Blomely (2004) outlines that even with immobile goods like garden produce at the interface of public and private property, notions of property become entangled and confused. Here, I draw attention to the most extreme and detrimental form of commodification: deer breeding operations. Deer breeders raise deer as livestock, using livestock management strategies to extract the most profit from the deer. Profits come from the sale of buck semen and high genetic potential does (i.e., high likelihood of birthing bucks with fast-growing, unnaturally large antlers) to other deer breeders or to game ranches. The commodification of deer comes at a time when traditional rural land uses, like cattle ranching or agriculture, are losing profitability. And because deer breeding can be done profitably on small properties, a growing number of land owners throughout the U.S. are becoming deer breeders. This trend is similar to how Jordan (1972) describes the shift from open-range cattle ranching to the confined cattle ranching system we have today. Furthermore, Acheson (2003) indicates that the confinement of a species is a crucial step in the commodification and inevitable exploitation of a species, which, in the case of deer, will

diminish populations, and the quantity and quality of hunting opportunities, as well as degrade the notion of public ownership.

Hardin's (1968) "The Tragedy of the Commons" provides insight into the exploitation of deer as a 'commons resource.' In the case of contemporary deer overexploitation – as a result of breeders and high fence ranchers privatizing deer herds – overexploitation does not mean harvesting to the point of diminishing populations but managing in a way that increases the likelihood of diseases and excluding other owners of the commons from being able to access a common good. Indeed, the privatization of deer seems to be the anthesis of Locke's (1980) notion of deer as only becoming property after an individual's labor is used to kill it.

Although the process of how deer became increasingly commodified is complex, the rise of deer breeders primarily occurred as the profitability of cattle ranching decreased and deer populations increased (Figure 5.4). In the 1800s, deer were an unregulated resource, hunted for meat and hides. After the turn of the century and with the introduction of wildlife regulations, deer became a regulated commons resource, and populations stabilized (Hewitt 2015). Unthreatened for decades during the 20th century, efforts to privatize deer began around the turn of the 21st century.

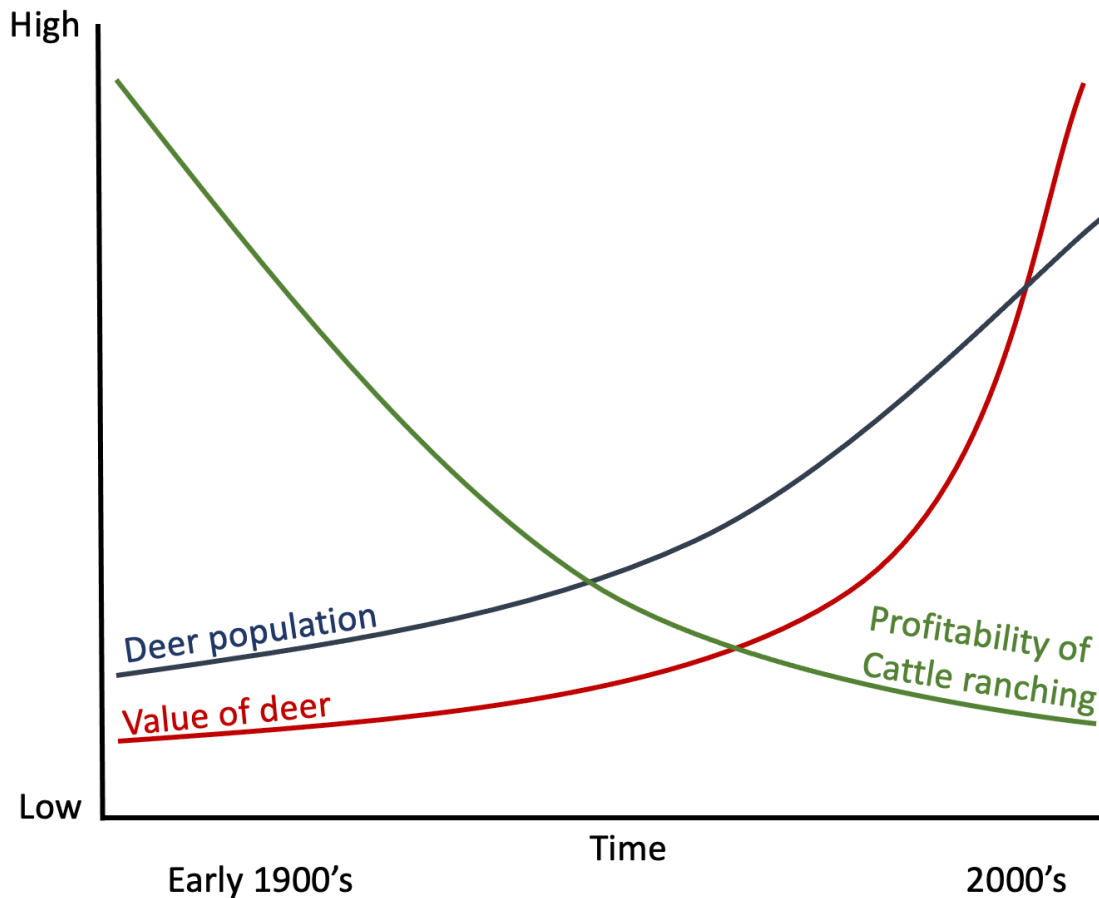


Figure 5.4: Conceptual Model of the Commodification of Deer Through Time

Figure 5.4 shows a concurrent rise in the value of deer, an increase in the deer population, and a decrease in the profitability of cattle ranching. Due to market hunting and the commercial sales of deer meat to the public, at the turn of the 19th Century, the U.S.'s deer population was estimated at ~500,000 (Hewitt 2015). Through the ban on the sale of wild-harvested meat and careful wildlife management, over the next hundred years, U.S. deer populations rebounded to ~38,000,000 (USFWS 2022). During this same period, the price of cattle steadily declined, while the costs to run a cattle ranch increased (Brooks 2015). Similar to

what Ramsey (1965) noted, I interviewed several game ranchers who stated that they became game ranchers because game ranching was more profitable than cattle ranching.

This dramatic increase in the U.S.'s deer population means that states like Texas have more deer than hunters, and the deer population continues to grow (TPWD 2022). It is within these conditions, as well as the high percentage of privately held lands, that state wildlife managers have had little power or will to stop the commodification of deer. Originally, game ranching was possibly just a way for landowners to control and benefit from the deer populations on their property. However, with the commodification of deer, breeders and high fences no longer work towards TPWD's goals and instead use annual stocking to increase herd sizes in order to maximize profit.

There has always been a demand for the opportunity to hunt deer but because deer are a resource held as a public good to be managed for the benefit of the public, wildlife regulations have ensured that deer management on private land stayed in line with this goal. With deer commodification, private property rights and what the State can and cannot tell a landowner to do with their private property have come to the forefront – but with the caveat that all deer are public property, which was reaffirmed by the Texas supreme court as recently as 2020 (Wyatt 2020). The state generally allows landowners to erect high fences, which entrap deer on the property, but the deer do not legally become the landowners' property even though they are the sole person controlling access. This aligns with how Brewer (2013) describes the notion of exclusive access to a resource being a key element in the implementation of market-focused wildlife management strategies. With exclusive access to deer, deer breeders raise deer as livestock and aim for fast-growth and large antlers, which cost

a nontraditional trophy hunter between \$10,000-\$30,000. For deer breeders, the most profitable deer have unnaturally large antlers. Unnatural trophy deer look nothing like naturally occurring trophy deer that most traditional trophy hunters look for. Extreme antlers take on unnatural shapes, include far more antler tines, and resemble nothing like the deer most people encounter (Figure 5.5). With deer breeding, all financial benefits accrue to the deer breeders, although costs, including increasing the spread and prevalence of CWD in deer populations, are borne by the public and state.



Figure 5.5: Comparison of a Traditional Trophy Deer (left) and Non-traditional Trophy Deer (right)

I qualify the deer breeding industries' deer management strategies as unethical because these management strategies mimic those of industrialized livestock (Muller 2018; Purcell 2011). Although these practices are deemed ethical for domestic cattle, managing wild species with home ranges of at least 350 acres in small pens with up to six deer per acre is highly

unethical (Webb et al., 2007; Personal Observation, March 23, 2022). Furthermore, small and cramped spaces that immobilize deer, increase deer contact, which increases the likelihood of CWD transmission, and facilitates the spread of CWD across the landscape (Adams et al., 2016).

In addition to concerns over promoting CWD transmission, the deer breeding industry and the privatization of deer are detrimental because they degrade deer herds, which are a common resource. In some ways, deer breeding represents a regression to the old British model of wildlife management, where animals were the exclusive property of landowners. This is where the term “the king’s deer” comes from, and hunting any of the king’s game was viewed as poaching, which incurred a punishment, including death (Eliason 2012). Popularized in the tale of Robin Hood, who hunts the king’s deer to get meat for the poor. Just as Geist (1985; 1988) warned in his assessments of the dangers that game ranching poses to wildlife conservation, in the U.S. today, deer breeders circumvent public ownership of deer by using private property rights narratives to commodify deer for their sole benefit. Deer breeding is an example of political disinterest in protecting the U.S. public’s codified right to deer ownership.

Chronic Wasting Disease

Outside of a small population of mule deer in the arid Hueco Mountains of West Texas, every case of CWD detected in Texas was in a deer breeding facility (TPWD 2022). This is due to the close quarter conditions that are perfect for spreading CWD through bodily fluids and fecal matter within a deer breeder’s herd (Mathiason et al., 2006). The subsequent sale and transportation of deer from an infected deer breeding facility to another deer breeding facility or game ranch is the mechanism that spreads CWD across long distances and results in isolated

cases across the United States. While deer infected with CWD inside deer breeding facilities in and of itself is an issue, the primary concern is that the fences that keep infected deer separated from wild populations are chain-link, which allows nose-to-nose contact between confined deer and wild deer, thought to be a major method of CWD transmission between confined and nonconfined populations (Vercauteren et al., 2007).

There are no recent outbreaks of CWD in wild deer populations in Texas, but there are in other states. For example, areas of Wisconsin have CWD prevalence rates of more than 75% (Jennelle et al., 2014). Researchers predict that this will lead to an irreversible population-level decrease as these areas will be permanently contaminated with infectious CWD prions (Smith 2011; Edmunds et al., 2016). For deer, this means a shortened life span while enduring the neurologically degenerative effects of CWD. For hunters, with antler size generally linked to age progression and an individual deer's overall fitness, this means the end of traditional trophy hunting. The life expectancy of a deer infected with CWD is around four years and deer enduring the advanced stages of CWD are anything but healthy. Besides the degradation of traditional trophy hunting, if a harvested deer tests positive for CWD, a hunter must decide what to do with the infected meat: eat it themselves? feed it to their family? or dispose of it? While current evidence suggests CWD is not transmissible to humans, there is concern that the increased exposure of CWD to human hosts through the consumption of tainted meat could lead to the disease becoming zoonotic (Pritzkow 2022). This would be dangerous for deer and humans, because, unlike mad cow prions, CWD prions do not have to be consumed to infect the host, and deer would no longer be seen as wildlife but as potential disease vectors for a 100% fatal disease (Saunders 2012). While CWD may never become zoonotic, Bishop (2004)

shows that as rates of CWD rise in a deer population, hunters become less interested in participating in hunting in the area. This means fewer infectious animals removed from the landscape each year and a decrease in wildlife management funds generated from excise taxes on hunting licenses and hunting-related equipment.

During my interviews with stakeholders, I was excited to hear that most hunters were not affected by CWD. Hopefully, CWD is stopped early enough to not become an issue for these hunters and the broader public. Yet, the most alarming finding from my interviews was deer breeders' perceptions of CWD and their attitudes towards their industry's responsibility for its spatial dispersion.

Although deer breeders' perceptions of CWD are divergent from those of TPWD wildlife managers, the situation of divergent informal versus formal disease perspectives aligns with work by Lambin et al. (2010) and Tshakert et al. (2016), who propose that peoples' perceptions of diseases often diverge from disease managers perceptions because of how everyday lived experiences and local culture shape landscape-level disease perceptions. Among the deer breeders I interviewed, CWD was viewed as a government conspiracy to drive them out of business. I found no further evidence of conspiracies or the use of conspiracy narratives during my participant observations at the conferences. Therefore, it is likely that some deer breeders are using false narratives to push back against state regulations. Moreover, conspiracy mongering relieves them from the blame of spreading CWD and positions them as a victim of government overreach. It is noteworthy that both interviewees and speakers at the deer conferences sowed distrust about CWD research, hoping perhaps to influence the broader hunting communities' opinions.

CHAPTER 6

CONCLUSION

In this thesis, I set out to expand the body of knowledge on hunting and wildlife management in Texas. As I became immersed in the research process and engaged with local stakeholders, it became clear that private and state management strategies for wildlife are entangled within a wildlife-commons vs. private-benefits dilemma. In this study, I conducted 21 interviews with hunters, game wardens, game ranchers, and deer breeders within three wildlife districts. I also conducted six days of participant observations at the Texas Deer Association Antler Extravaganza, Austin, Texas; the Cesar Kleberg Wildlife Research Institute Annual Research Meeting, San Antonio, Texas; and the National Deer Farmers of America Foundation Annual Conference, French Lick, Indiana.

Stakeholders' perceptions of deer and hogs depended on the way they interact with deer or on their geographic location. I also found that the Texas deer breeding industry commodifies deer by exploiting the entangled notions of public and private property. Deer breeders confine publicly-owned deer on their private property and take advantage of the State's inability to regulate on private land. The commodification of deer in Texas could lead to diminished quality and quantity of hunting opportunities in Texas if there is an increase in CWD transmission, which could decrease deer populations and lower hunter participation.

By exploring how and why local stakeholders' goals and practices diverge from the management goals of state wildlife agencies, this research contributes new knowledge to inform the decisions of state wildlife managers. Even though this study is limited by the size of the sample and study area, equipping wildlife managers with more information about what is

guiding stakeholders' management decisions could improve the success of future management strategies for deer, feral hogs, and CWD in Texas.

This research also contributes to the literature on managing property and the commons through its investigation of the roles of containment and commodification of wildlife. It shows how private property rights can be used to commodify public goods through wildlife confinement, exclusion of public access, and through sales of access rights. This study also informs scholarship on pathogenic landscapes by demonstrating how situated knowledge shapes self-interest and profit potential (Haraway 1988). It also reveals how the management and perceptions of CWD differ among stakeholders and how breeders' perceptions diverge from the formal management strategies of State disease managers. Better understanding CWD risks, which include conspiratorial ideas of people who interact with large numbers of deer, can help State regulators' public engagement activities.

To better understand the implications of these results, further research could investigate the Texas deer breeding industry's perspective on their ownership of the deer confined to their property. As well, a larger sample size and larger study area would be better able to understand the broader implications of how the deer breeding industries' practices contribute to the privatization of wildlife in the United States.

In conclusion, the Texas deer breeding industry harms deer in order to benefit themselves through maximizing profit generation. This is unethical for at least three reasons: it is cruel to deer, diminishes the quality of hunting in Texas, and is an affront to the notion of public ownership of wildlife. For these reasons, I recommend that the State of Texas follow the lead of states like Montana and ban deer breeding altogether.

APPENDIX

IRB APPROVED INTERVIEW SCRIPT

Interview Script

Participant code _____

date _____

Participant background

1. Describe your Occupation? (Company, field)
 - A. How Long? (years, months)
2. What county do you live in? (Have you lived in other parts of the state?)
 - A. How long? (years, months)

Deer

3. Could you give me a few words that come to mind when you think about deer?
4. Do you hunt deer? (If no, do you ever interact w/ deer? How?)
 - A. How long have you hunted deer? (decades, years) _____
 - B. In a typical year, how often do you hunt?
 - C. What is your main reason for hunting deer? (meat, property damage, management)
5. Where do hunt? (own land, other private land, public lands, rented lease, game ranch)
 - A. For each of these spaces/places: Why there? Or, why not there?
 - B. Similarly, could you discuss opportunities and challenges you encounter in these places? (e.g. access, other hunters, hogs, fences)
6. How did you learn about hunting deer/who taught you? (sources of knowledge; fencing)
 - A. Do you continue to rely on those sources for updated information?
 - B. Or, where do you get new or updated information on deer hunting? (TPWD, online, tv)
7. If it were up to you, how do you think deer management could be improved in the places where you hunt? (Including: own land, other private land, public lands, rented lease, game ranch)

Feral hogs – I'd like to ask you similar questions about Feral Hogs

8. Could you give me a few words that come to mind when you think about feral hogs?
9. Do you hunt feral hogs? (If no, do you ever interact w/ hogs? How?)
 - A. How long have you hunted (or dealt with) feral hogs? (decades, years) _____

- B. In a typical year, how often do you hunt (or deal with) hogs?
- C. What is your main reason for hunting hogs? (meat, property damage, management)

10. Where do you hunt (interact with)? (own land, other private land, public land, rented lease, game ranch)

- A. For each of these spaces/places: Why there? Or, why not there?
- B. Similarly, could you discuss opportunities and challenges you encounter in these places? (e.g. access, other hunters, hogs, fences)

11. How did you learn about hunting hogs/who taught you? (sources of knowledge; markets)

- A. Do you continue to rely on those sources for updated information?
- B. Or, where do you get new or updated information on deer hunting? (TPWD, online, tv)

12. If it were up to you how do you think feral hog management could be improved in the places where you hunt? (Including: own land, other private land, public lands, rented lease, game ranch)

CWD-- Now I'd like to talk about chronic wasting disease. CWD has affected deer herds throughout the US and I'd like to get your impressions of CWD?

13. Are you familiar with Chronic Wasting Disease?

- A. How did you learn about CWD?
 - a. Where do you get your information on CWD? (TPWD, online, tv)
- B. Has CWD altered your deer hunting?
- C. What would you do if you killed a CWD positive deer? (test it, eat it)
- D. Do other people you know handle or view CWD differently?
 - a. Could you give an example?

14. Where do you think CWD poses the greatest risk? (private land, public land, rented lease, game ranch)

15. If it were up to you how do you think CWD could be better managed? (By who, where, and why)

16. That's it for my questions, but I'd like to know if you have any questions for me?

17. But before I finish, do you know of anyone else who you'd recommend I talk to?

REFERENCES

- Acheson, J. M. (1975). The lobster fiefs: economic and ecological effects of territoriality in the Maine lobster industry. *Human Ecology*, 3(3), 183-207.
- Acheson, J. M. (1988). *The lobster gangs of Maine*. Upne.
- Acheson, J. M. (2003). Capturing the commons: devising institutions to manage the Maine lobster industry. Upne.
- Acheson, J. M., & Gardner, R. J. (2004). Strategies, conflict, and the emergence of territoriality: the case of the Maine lobster industry. *American Anthropologist*, 106(2), 296-307.
- Acheson, J. M., & Gardner, R. (2010). The evolution of conservation rules and norms in the Maine lobster industry. *Ocean & Coastal Management*, 53(9), 524-534.
- Adams, C. E., Higginbotham, B. J., Rollins, D., Taylor, R. B., Skiles, R., Mapston, M., & Turman, S. (2005). Regional perspectives and opportunities for feral hog management in Texas. *Wildlife Society Bulletin*, 33(4)
- Adams, K. P., Murphy, B. P., & Ross, M. D. (2016). Captive white-tailed deer industry—Current status and growing threat. *Wildlife Society Bulletin*, 40(1), 14-19.
- Agyeman, J., & McEntee, J. (2014). Moving the field of food justice forward through the lens of urban political ecology. *Geography Compass*, 8(3), 211-220.
- Argue, C. K., Ribble, C., Lees, V. W., McLane, J., & Balachandran, A. (2007). Epidemiology of an outbreak of chronic wasting disease on elk farms in Saskatchewan. *The Canadian Veterinary Journal*, 48(12), 1241.
- Armitage, D., De Loë, R., & Plummer, R. (2012). Environmental governance and its implications for conservation practice. *Conservation Letters*, 5(4), 245-255.
- Armstrong, C. G., & Veteto, J. R. (2015). Historical ecology and ethnobiology: applied research for environmental conservation and social justice. *Ethnobiology Letters*, 6(1), 5-7.
- Bartoskewitz, M. L., Hewitt, D. G., Pitts, J. S., & Bryant, F. C. (2003). Supplemental feed use by free-ranging white-tailed deer in southern Texas. *Wildlife Society Bulletin*, 1218-1228.
- Bastian, F. O., Dash, S., & Garry, R. F. (2004). Linking chronic wasting disease to scrapie by comparison of *Spiroplasma mirum* ribosomal DNA sequences. *Experimental and molecular pathology*, 77(1), 49-56.

- Belay, E. D., Maddox, R. A., Williams, E. S., Miller, M. W., Gambetti, P., & Schonberger, L. B. (2004). Chronic wasting disease and potential transmission to humans. *Emerging infectious diseases*, 10(6), 977.
- Benestad, S. L., Mitchell, G., Simmons, M., Ytrehus, B., & Vikøren, T. (2016). First case of chronic wasting disease in Europe in a Norwegian free-ranging reindeer. *Veterinary research*, 47(1), 1-7.
- Berkes, F., Feeny, D., McCay, B. J., & Acheson, J. M. (1989). The benefits of the commons. *Nature*, 340(6229), 91-93.
- Beymer-Farris, B. A., Bassett, T. J., & Bryceson, I. (2012). Promises and pitfalls of adaptive management in resilience thinking: the lens of political ecology. *Resilience and the cultural landscape: understanding and managing change in human-shaped environments*. Cambridge University Press
- Bishop, R. C. (2004). The economic impacts of chronic wasting disease (CWD) in Wisconsin. *Human Dimensions of Wildlife*, 9(3), 181-192.
- Blomley, N. (2004). The boundaries of property: lessons from Beatrix Potter. *Canadian Geographer/Le Géographe canadien*, 48(2), 91-100.
- Blomley, N. (2005). Flowers in the bathtub: boundary crossings at the public-private divide. *Geoforum*, 36(3), 281-296.
- Blomley, N. (2005). The borrowed view: Privacy, propriety, and the entanglements of property. *Law & social inquiry*, 30(4), 617-661.
- Brearley, G., Rhodes, J., Bradley, A., Baxter, G., Seabrook, L., Lunney, D., ... & McAlpine, C. (2013). Wildlife disease prevalence in human-modified landscapes. *Biological Reviews*, 88(2), 427-442.
- Brewer, J. F. (2012). Don't fence me in: boundaries, policy, and deliberation in Maine's lobster commons. *Annals of the Association of American Geographers*, 102(2), 383-402.
- Brewer, J. (2012). Revisiting Maine's lobster commons: rescaling political subjects. *International Journal of the Commons*, 6(2).
- Brewer, J. F. (2013). Making an environmental market, unmaking adaptive capacity: Species commodification in the New England ground fishery. *Geoforum*, 50, 172-181
- Bromley, D. W. (1992). The commons, common property, and environmental policy. *Environmental and resource economics*, 2(1), 1-17.
- Brooks, J. W., & Jayarao, B. M. (2008). Management practices used by white-tailed deer farms in Pennsylvania and herd health problems. *Journal of the American Veterinary Medical Association*, 232(1), 98-104.

- Brooks, K. (2015). Annual and seasonal price patterns for cattle.
- Butler, M. J., Teaschner, A. P., Ballard, W. B., & McGee, B. K. (2005). Commentary: Wildlife ranching in north America; arguments, issues, and perspectives. *Wildlife Society Bulletin*, 33(1), 381-389.
- Byrd, E., Lee, J. G., & Widmar, N. (2017). Perceptions of Hunting and Hunters by U.S. Respondents. *Animals : an open access journal from MDPI*, 7(11), 83.
- Campbell, Tyler A., and David B. Long. "Activity patterns of wild boars (*Sus scrofa*) in southern Texas." *The southwestern naturalist* 55, no. 4 (2010): 564-567.
- Taylor, R. B., & Hellgren, E. C. (1997). Diet of feral hogs in the western South Texas Plains. *The Southwestern Naturalist*, 33-39
- Chitwood, M.C., Peterson, M.N., Bondell, H.D., Lashley, M.A., Brown, R.D. and Deperno, C.S. (2015), Perspectives of wildlife conservation professionals on intensive deer management. *Wild. Soc. Bull.*, 39: 751-756
- Cohen, E. (2014). Recreational hunting: Ethics, experiences and commoditization. *Tourism Recreation Research*, 39(1), 3-17.
- Connally, R. L., Frank, M. G., Briers, G. E., Silvy, N. J., Carlisle, K. M., & Tomeček, J. M. (2021). Hunter motivations and use of wild pigs in Texas, USA. *Human–Wildlife Interactions*, 15(1), 10.
- Crow, K. L. (2013). Oh deer: The public trust doctrine and issues regarding estate planning for the cervid breeding industry. *Est.Plan.& Cmty.Prop.LJ*, 6, 375.
- Crumley, Carole L. "Historical ecology." *Regional dynamics: Burgundian landscapes in historical perspective* (1987): 237-264.
- Decker, D., Smith, C., Forstchen, A., Hare, D., Pomeranz, E., Doyle-Capitman, C., ... & Organ, J. (2016). Governance principles for wildlife conservation in the 21st century. *Conservation Letters*, 9(4), 290-295.
- Doolittle, W. E. (1987, January). Las Marismas to Pánuco to Texas: The transfer of open range cattle ranching from Iberia through northeastern Mexico. In *Yearbook, Conference of Latin Americanist Geographers* (Vol. 13, pp. 3-11).
- Dressel, S., Ericsson, G., Johansson, M., Kalén, C., Pfeffer, S. E., & Sandström, C. (2020). Evaluating the outcomes of collaborative wildlife governance: The role of social-ecological system context and collaboration dynamics. *Land Use Policy*, 99, 105028
- Edmunds, D. R., Kauffman, M. J., Schumaker, B. A., Lindzey, F. G., Cook, W. E., Kreeger, T. J., ... & Cornish, T. E. (2016). Chronic wasting disease drives population decline of white-tailed deer. *PloS one*, 11(8), e0161127.

- Eliason, S. (2012). From the King's deer to a capitalist commodity: A Social Historical Analysis of the Poaching Law. *International Journal of Comparative and Applied Criminal Justice*, 36(2), 133-148.
- Escobar, L. E., Pritzkow, S., Winter, S. N., Grear, D. A., Kirchgessner, M. S., Dominguez-Villegas, E., & Soto, C. (2020). The ecology of chronic wasting disease in wildlife. *Biological Reviews*, 95(2), 393-408.
- Feeny, D., Berkes, F., McCay, B. J., & Acheson, J. M. (1990). The tragedy of the commons: twenty-two years later. *Human ecology*, 18(1), 1-19.
- Ferguson, Wes. "Feral Hogs Are Invading Yankeeland. Northern Friends, Here's What You Need to Know." *Texas Monthly*, 30 Dec. 2019, <https://www.texasmonthly.com/travel/feral-hogs-invading-northern-states/>.
- Floyd, M. F., & Lee, I. (2002). Who buys fishing and hunting licenses in Texas? results from a statewide household survey. *Human Dimensions of Wildlife*, 7(2), 91-106.
- Frosch, B. J., Anderson, D. P., & Outlaw, J. L. (2008). Economic Impact of Deer Breeding Operations in Texas.
- Geist, V. (1985). Game ranching: threat to wildlife conservation in North America. *Wildlife Society Bulletin (1973-2006)*, 13(4), 594-598.
- Geist, V. (1988). How markets in wildlife meat and parts, and the sale of hunting privileges, jeopardize wildlife conservation. *Conservation Biology*, 2(1), 15-26.
- Gerhold, R., & Hickling, G. (2016). Diseases associated with translocation of captive cervids in North America. *Wildlife Society Bulletin*, 40(1), 25-31.
- Gottdenker, N. L., Streicker, D. G., Faust, C. L., & Carroll, C. R. (2014). Anthropogenic land use change and infectious diseases: a review of the evidence. *EcoHealth*, 11(4), 619-632.
- Gordon, H. S. (1954). The economic theory of a common-property resource: the fishery. In *Classic papers in natural resource economics* (pp. 178-203). Palgrave Macmillan, London.
- Haley, N. J., Mathiason, C. K., Carver, S., Zabel, M., Telling, G. C., & Hoover, E. A. (2011). Detection of chronic wasting disease prions in salivary, urinary, and intestinal tissues of deer: potential mechanisms of prion shedding and transmission. *Journal of virology*, 85(13), 6309-6318
- Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*, 14(3), 575-599.

- Hardin, G. (1968). The tragedy of the commons. *Journal of Natural Resources Policy Research*, 1(3), 243-253.
- Harper, E. E., Miller, C. A., Vaske, J. J., Mengak, M. T., & Bruno, S. (2016). Stakeholder attitudes and beliefs toward wild pigs in Georgia and Illinois. *Wildlife Society Bulletin*, 40(2), 269-273.
- Hewitt, D. G. (2015). Hunters and the conservation and management of white-tailed deer (*Odocoileus virginianus*). *International Journal of Environmental Studies*, 72(5), 839-849.
- Hines, S. L., Fulbright, T. E., Ortega-S, A. J., Webb, S. L., Hewitt, D. G., & Boutton, T. W. (2021). Compatibility of dual enterprises for cattle and deer in North America: a quantitative review. *Rangeland Ecology & Management*, 74, 21-31.
- Holmquist, G. R. (2001). Montana's game farm industry | An indictment for abolishment
- Jacobson, C. A., & Decker, D. J. (2008). Governance of state wildlife management: reform and revive or resist and retrench?. *Society and Natural Resources*, 21(5), 441-448.
- Jaebker, L. (2020). Exploring the Role of Social Identity and Social Media in Understanding Hunters' Perceptions of Wild Pigs and Their Management in the US (Doctoral dissertation, Colorado State University).
- Jennelle, C. S., Henaux, V., Wasserberg, G., Thiagarajan, B., Rolley, R. E., & Samuel, M. D. (2014). Transmission of chronic wasting disease in Wisconsin white-tailed deer: implications for disease spread and management. *PLoS One*, 9(3), e91043.
- Jordan, T. G. (1972). The Origin and Distribution of Open-Range Cattle Ranching. *Social Science Quarterly*, 105-121.
- Kong, Q., Huang, S., Zou, W., Vanegas, D., Wang, M., Wu, D., ... & Gambetti, P. (2005). Chronic wasting disease of elk: transmissibility to humans examined by transgenic mouse models. *Journal of Neuroscience*, 25(35), 7944-7949.
- Kurz, J. C., & Marchinton, R. L. (1972). Radiotelemetry studies of feral hogs in South Carolina. *The Journal of Wildlife Management*, 1240-1248.
- Lambin, E. F., Tran, A., Vanwambeke, S. O., Linard, C., & Soti, V. (2010). Pathogenic landscapes: interactions between land, people, disease vectors, and their animal hosts. *International journal of health geographics*, 9(1), 1-13.
- Lapidge, S., Wishart, J., Staples, L., Fagerstone, K., Campbell, T. A., & Eisemann, J. D. (2012). Development of a feral swine toxic bait (Hog-Gone®) and bait hopper (Hog-Hopper™) in Australia and the USA
- Laughead, Laura. "Texas Has a Plague of Wild Pigs, and the Pandemic Has Only Made It Worse." KLBK | KAMC | EverythingLubbock.com, KLBK | KAMC | EverythingLubbock.com, 20 Nov. 2020,

<https://www.everythinglubbock.com/news/local-news/texas-has-a-plague-of-wild-pigs-and-the-pandemic-has-only-made-it-worse/>.

Locke, J. (1980). *Second treatise of government* (C. B. Macpherson, Ed.). Hackett Publishing.

Manfredo, M. J., Salerno, J., Sullivan, L., & Berger, J. (2019). For US wildlife management, social science needed now more than ever. *BioScience*, 69(12), 960-961.

Mapston, M. (2007). *Feral hogs in Texas*. Texas FARMER Collection.

Massei, G., Roy, S., & Bunting, R. (2011). Too many hogs? A review of methods to mitigate impact by wild boar and feral hogs. *Human-Wildlife Interactions*, 5(1), 79-99.

Mathiason, C. K., Powers, J. G., Dahmes, S. J., Osborn, D. A., Miller, K. V., Warren, R. J., ... & Hoover, E. A. (2006). Infectious prions in the saliva and blood of deer with chronic wasting disease. *science*, 314(5796), 133-136.

McLean, H. E., Teel, T. L., Bright, A. D., Jaebker, L. M., Tomecek, J. M., Frank, M. G., ... & Carlisle, K. M. (2021). Understanding tolerance for an invasive species: An investigation of hunter acceptance capacity for wild pigs (*Sus scrofa*) in Texas. *Journal of Environmental Management*, 285, 112143.

Messmer, T., Dixon, C., Shields, W., Barras, S., & Schroeder, S. (1998). Cooperative Wildlife Management Units: Achieving Hunter, Landowner, and Wildlife Management Agency Objectives. *Wildlife Society Bulletin (1973-2006)*, 26(2), 325-332.

Miller, M. W., & Williams, E. S. (2004). Chronic wasting disease of cervids. *Mad cow disease and related spongiform encephalopathies*, 193-214.

Morthland, John. "A Plague of Pigs in Texas." *Smithsonian.com*, Smithsonian Institution, 1 Jan. 2011, <https://www.smithsonianmag.com/science-nature/a-plague-of-pigs-in-texas-73769069/>.

Muhly, T. B., & Musiani, M. (2009). Livestock depredation by wolves and the ranching economy in the Northwestern U.S. *Ecological Economics*, 68(8-9), 2439-2450.

Muller, S. M. (2018). Zombification, social death, and the slaughterhouse: US industrial practices of livestock slaughter. *American Studies*, 57(3), 81-101.

Nie, M. (2004). State wildlife governance and carnivore conservation. *People and predators: From conflict to coexistence*, 197-218.

Nugent, G., & Fraser, K. W. (1993). Pests or valued resources? conflicts in management of deer. *New Zealand Journal of Zoology*, 20(4), 361-366.

Opsahl, R. W. (2003). Chronic wasting disease of deer and elk: a call for national management. *Environmental Law*, 1059-1092.

- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.
- Prevatt, J. W., & VanSickle, J. J. (2000). *United States Cattle Cycles: Perspectives on US Cattle and Calves Inventories and Prices*. Food and Resource Economics Department, Institute of Food and Agricultural Sciences, University of Florida.
- Pritzkow, S. (2022). Transmission, Strain Diversity, and Zoonotic Potential of Chronic Wasting Disease. *Viruses*, 14(7), 1390.
- Purcell, N. (2011). Cruel intimacies and risky relationships: Accounting for suffering in industrial livestock production. *Society & animals*, 19(1), 59-81.
- Ramsey, C. W. (1965). Potential economic returns from deer as compared with livestock in the edwards plateau region of texas. *Rangeland Ecology & Management/Journal of Range Management Archives*, 18(5), 247-250.
- Robbins, P. (2011). *Political ecology: A critical introduction*(Vol. 16). John Wiley & Sons.
- Rodriguez, S. L., & Sampson, C. (2019). Expanding beyond carnivores to improve livestock protection and conservation. *PLoS Biology*, 17(8), e3000386.
- Rollins, D., Higginbotham, B. J., Cearley, K. A., & Wilkins, R. N. (2007). Appreciating feral hogs: extension education for diverse stakeholders in Texas. *Human-Wildlife Conflicts*, 1(2), 192-198.
- Saunders, S. E., Bartelt-Hunt, S. L., & Bartz, J. C. (2012). Occurrence, transmission, and zoonotic potential of chronic wasting disease. *Emerging infectious diseases*, 18(3), 369.
- Schneider, R. (1990). Concerns about game ranching. *The Canadian Veterinary Journal*, 31(7), 479
- Schramm, P. T., Johnson, C. J., Mathews, N. E., McKenzie, D., Aiken, J. M., & Pedersen, J. A. (2006). Potential role of soil in the transmission of prion disease. *Reviews in mineralogy and geochemistry*, 64(1), 135-152.
- Seward, N. W., VerCauteren, K. C., Witmer, G. W., & Engeman, R. M. (2004). Feral swine impacts on agriculture and the environment. *Sheep & Goat Research Journal*, 12.
- Siemann, E., Carrillo, J. A., Gabler, C. A., Zipp, R., & Rogers, W. E. (2009). Experimental test of the impacts of feral hogs on forest dynamics and processes in the southeastern US. *Forest ecology and management*, 258(5), 546-553.
- Smith, C. B., Booth, C. J., & Pedersen, J. A. (2011). Fate of prions in soil: a review. *Journal of environmental quality*, 40(2), 449.
- Smith, C. A. (2011). The role of state wildlife professionals under the public trust doctrine. *The Journal of Wildlife Management*, 75(7), 1539-1543.

- Svarstad, H., & Benjaminsen, T. A. (2020). Reading radical environmental justice through a political ecology lens. *Geoforum*, 108, 1-11.
- Taylor, R. B., & Hellgren, E. C. (1997). Diet of feral hogs in the western South Texas Plains. *The Southwestern Naturalist*, 33-39.
- Texas A&M Agrilife Extension. (2022). Retrieved June 12, 2022, from <https://agriflifeextension.tamu.edu>
- Texas A&M Natural Resources Institute. (2020). Retrieved June 12, 2022, from <https://nri.tamu.edu/blog/tag/map>
- Texas Deer Association. (n.d.). Texas Deer Association. Retrieved March 15, 2022, from <https://texasdeerassociation.com>
- Texas Parks and Wildlife Department. (n.d.). Retrieved June 14, 2022, from <https://tpwd.texas.gov>
- Treves, A., Chapron, G., López-Bao, J. V., Shoemaker, C., Goeckner, A. R., & Bruskotter, J. T. (2017). Predators and the public trust. *Biological Reviews*, 92(1), 248-270.
- Tschakert, P., Ricciardi, V., Smithwick, E., Machado, M., Ferring, D., Hausermann, H., & Bug, L. (2016). Situated knowledge of pathogenic landscapes in Ghana: Understanding the emergence of Buruli ulcer through qualitative analysis. *Social Science & Medicine*, 150, 160-171.
- USFWS. (n.d.). USFWS, Retrieved May 10, 2022, from <https://www.fs.fed.us/database/feis/animals/mammal/odvi/all.html>
- Vaske, J. J., & Lyon, K. M. (2011). CWD prevalence, perceived human health risks, and state influences on deer hunting participation. *Risk Analysis*, 31(3), 488-496.
- Vercauteren, K. C., Lavelle, M. J., Seward, N. W., Fischer, J. W., & Phillips, G. E. (2007). Fence-line contact between wild and farmed cervids in Colorado: potential for disease transmission. *The Journal of wildlife management*, 71(5), 1594-1602.
- Vercauteren, K. C., Anderson, C. W., Van Deelen, T. R., Drake, D., Walter, W. D., Vantassel, S. M., & Hygnstrom, S. E. (2011). Regulated commercial harvest to manage overabundant white-tailed deer: An idea to consider?. *Wildlife Society Bulletin*, 35(3), 185-194
- Von Essen, E. (2018). The impact of modernization on hunting ethics: Emerging taboos among contemporary Swedish hunters. *Human dimensions of wildlife*, 23(1), 21-38.
- Wallingford, B. D., Diefenbach, D. R., Long, E. S., Rosenberry, C. S., & Alt, G. L. (2017). Biological and social outcomes of antler point restriction harvest regulations for white-tailed deer. *Wildlife Monographs*, 196(1), 1-26.

- Watson, R. (2013). Public wildlife on private land: Unifying the split estate to enhance trust resources. *Duke Environmental Law & Policy Forum*, 23(2), 291-321.
- Webb, S. L., Hewitt, D. G., & Hellickson, M. W. (2007). Scale of management for mature male white-tailed deer as influenced by home range and movements. *The Journal of wildlife management*, 71(5), 1507-1512.
- Weeks, P., & Packard, J. (2009). Feral hogs: Invasive species or nature's bounty?. *Human Organization*, 68(3), 280-292.
- Wilkinson, C. F. (1988). The headwaters of the Public Trust: some thoughts on the source and scope of the traditional doctrine. *Envtl. L.*, 19, 425.
- Williams, E. S. (2005). Chronic wasting disease. *Veterinary pathology*, 42(5), 530-549.
- Wyatt, M; Correspondent. (2020, Oct 22,). Outdoors; ruling goes against breeders; texas supreme court stance reaffirms white-tailed deer herd belongs to public. *Houston Chronicle* Retrieved from <https://global.factiva.com/en/du/article.asp?accessionno=HOU0000020201023egam0001d>