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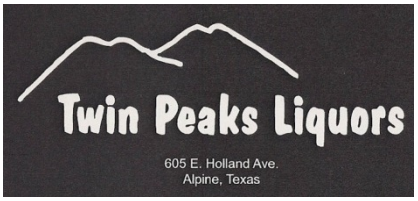
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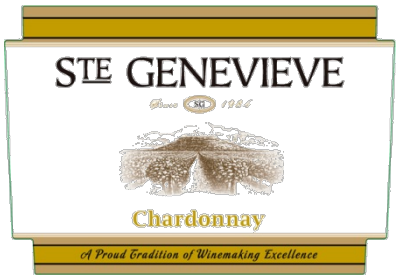
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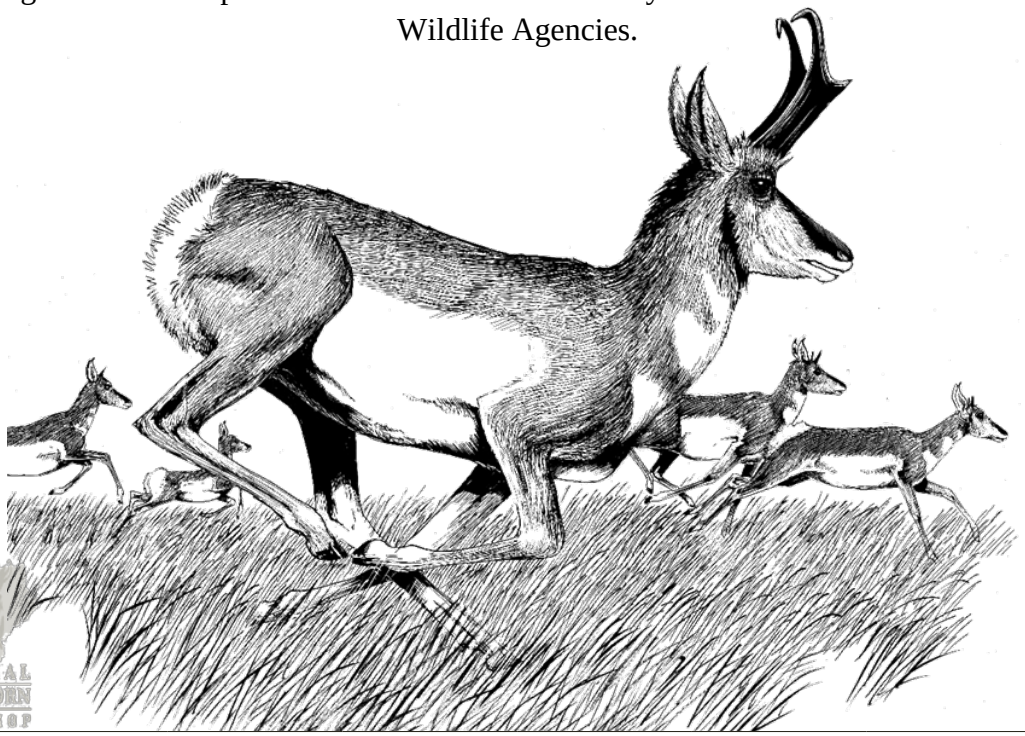

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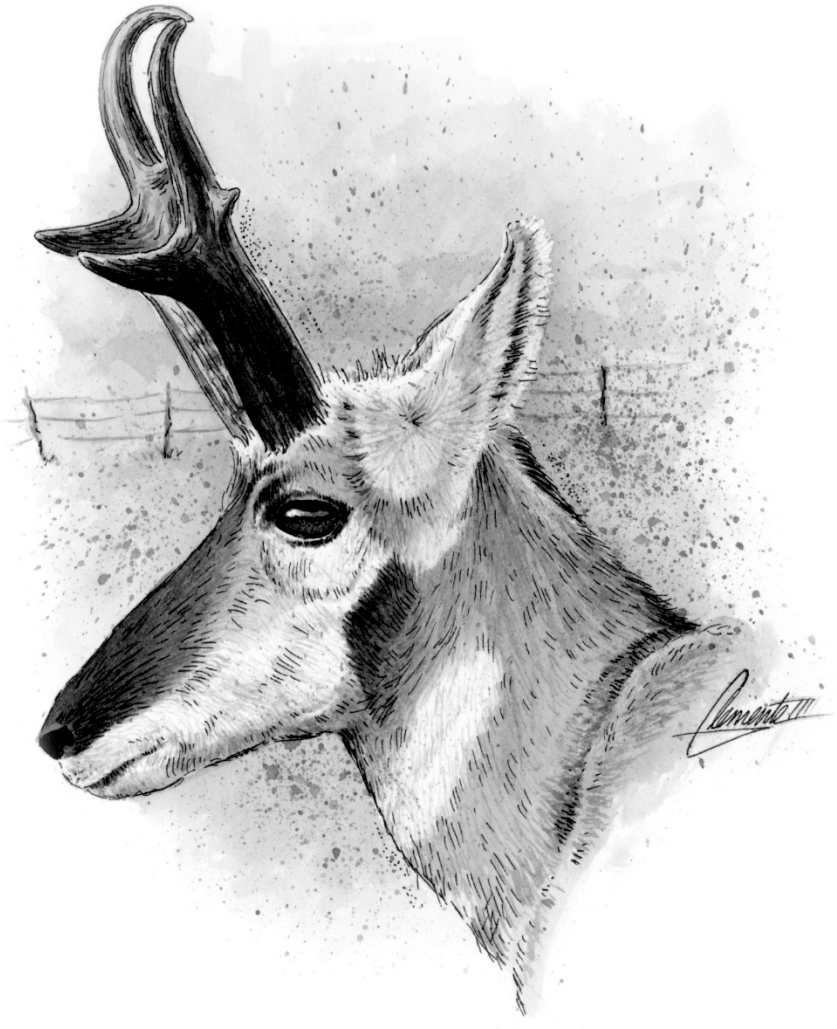


Benefits and Challenges of Managing the Public's Resource on Private Land: State Agency Perspective

By Carter Smith – Executive Director of the Texas Parks and Wildlife Department

Carter Smith serves as the executive director of the Texas Parks and Wildlife Department (TPWD), a position he has held since January 2008.

A native of central Texas, Smith developed his passion for wildlife and the out of doors at a young age while roaming his family's farm and ranch land interests in Gonzales, Williamson, and Edwards Counties. He has a wildlife management degree from Texas Tech and a master's degree in conservation biology from Yale University. He began his professional career in 1992 as a management intern at TPWD, assisting in the Private Lands and Public Hunting programs. As a biologist, he has worked on a variety of research projects ranging from studying moose in the boreal forests of Saskatchewan to mule deer and pronghorn antelope in far west Texas to waterfowl in the Laguna Madre of Texas and Tamaulipas, Mexico.

He serves on a number of conservation-related boards of directors and advisory councils and was recently named an outstanding alumnus by Yale University and Texas Tech and the College of Agriculture and Natural Resources. He currently serves as Chair of the Western Association of Fish and Wildlife Agencies, Chair of the Association of Fish and Wildlife Agencies, and as immediate past-Chair of the South-eastern Association of Fish and Wildlife Agencies. He is also a Professional member of the Boone & Crockett Club and an Honorary Lifetime Member of the Dallas Safari Club and the Texas Bighorn Society.

Prior to his selection as TPWD executive director, Smith was with The Nature Conservancy of Texas, serving as state director.

At Texas Parks and Wildlife Department, he is responsible for overseeing an agency of 3,100 professionals in 11 different divisions, including Wildlife, Law Enforcement, State Parks, Coastal Fisheries, and Inland Fisheries. Smith has been particularly active in the realms of private lands stewardship, coastal issues relating to the state's involvement with the Deepwater Horizon incident, children in nature initiatives, invasive species issues, and expanded outreach to the state's urban populace.

Carter and his wife, Stacy, and their son, Ryland, reside in Austin.

Benefits and Challenges of Managing the Public's Resource on Private Land: Landowner Perspective

By Greg Simons – President of the Texas Wildlife Association

Greg Simons of San Angelo serves as President of the Texas Wildlife Association and was first elected President of the organization on July 12, 2013. As President, Greg is the Principal Executive Officer of the Association and, in general, supervises and controls all of the business and affairs of the Association.

He has a Wildlife & Fisheries Sciences degree graduate from Texas A&M University. While in college, he served on the university wildlife conclave team (quiz bowl) for three years, was a captain two of those years, including one year when A&M won the South-eastern Wildlife Conclave Championship. He also served as president of the student chapter of The Wildlife Society.

After graduation, Greg immediately formed Wildlife Systems, Inc., which is a company he still owns and operates today. This company currently operates hunting and wildlife programs on over 800,000 acres of private land in Texas, scattered over many different properties across the state. WSI has been featured in many magazine periodicals and on numerous television shows. This company was named Dodge Outfitter of the Year in 2003 from a cast of over 450 hunting operations in North America. He has also worked with various hunting programs in several other states including Colorado, New Mexico, Oklahoma, and Utah, and various foreign countries, including South Africa, Zimbabwe, Zambia, New Zealand, Canada, and Mexico. Greg is also a partner in Wildlife Consultants, LLC, a company specializing in providing technical assistance for wildlife and land-related needs to landowners, bank trust groups, and others. He is former co-owner of the Texas Hunting Directory.

Greg has given presentations around the country, on topics ranging from entrepreneurial areas within the hunting business, hunt marketing, customer service strategies, harvest photography, wildlife management topics, roles that NGOs play in conservation, hunters' role in conservation, civic engagement, youth leadership development, and various other topics.

Greg is a past President of Student Chapter of The Wildlife Society (TAMU), past officer in the Texas Chapter TWS, current President of Texas Wildlife Association, serves on the White-tailed Deer Advisory Committee for the State of Texas, is currently on the Board of Directors for the San Angelo Chamber of Commerce, is the past San Angelo CVB Board Chairman, serves on the Legacy Advisory Committee for Wildlife and Fisheries Sciences Department at Texas A&M University, and has served on many other appointed committees. Greg is also one of the Co-

Founders of the West Texas Deer Study Group, which is now known as Texas Deer Study Group.

Greg, along with his wife and daughter reside in San Angelo, while their son is attending college at Texas A&M University.

Past, Present, and Future of Pronghorn Hunting in Texas: A Hunter and Pronghorn Enthusiast's Perspective

By Dr Dan McBride – Doctor of Veterinarian Medicine

Dr Dan E McBride was raised in Llano, Texas on the Granite Hills Hereford Ranch. He graduated from Texas A&M University, College of Veterinary Medicine in 1973. He is owner of Burnet Veterinary Clinic, Inc. and has been in practice for 40 years.

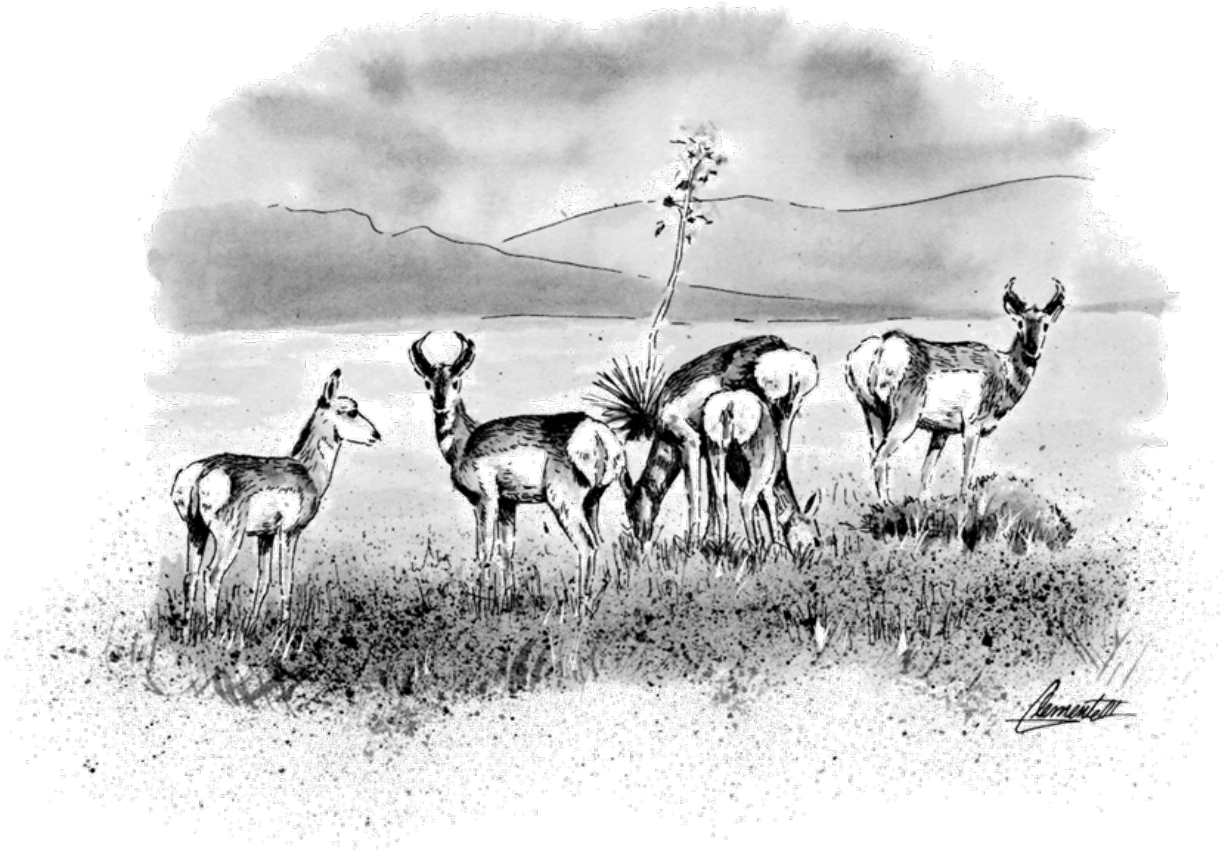
In addition to his practice, he assists Texas Parks and Wildlife Department with numerous conservation and restoration projects for many wildlife species including pronghorn, mule deer, and white-tailed deer. Dan also sits on several Texas Parks and Wildlife Department sanctioned advisory committees, task forces, and working groups that involve the management of wildlife diseases and big game. He is also a member of the Trans-Pecos Pronghorn Working Group. Dan is an active member of the Texas Wildlife Association and is the chair of the TWA Desert Big Game Committee. He is a regular member of the Boone and Crockett Club and is involved with other conservation groups. Dr. McBride is also an avid taxidermist and president of the Texas Taxidermy Association, Inc.

In 2012, he was awarded the Texas Wildlife Association's Ray A. Murski Friend of Wildlife Award and was Man of the Year in Texas Agriculture for 2013.

As a pronghorn enthusiast and hunter, Dan has hunted pronghorn for 30+ years. He has pursued pronghorn in Texas, New Mexico, Colorado, Wyoming, and Nevada. Dr. McBride leases the hunting rights on some of the best areas for trophy heads in Texas.

He is married to Linda McBride and has two adult children.

Contributed Papers



The Evolution of the Pronghorn Private Land Use System in New Mexico

RYAN N. WALKER, *New Mexico Department of Game and Fish, 215 York Canyon Rd., Raton, NM 87740, USA, ryan.walker@state.nm.us*

Abstract

Each state or provincial agency has developed their own means of hunting pronghorn (*Antilocapra americana*) that takes into account local attributes, pressures, and politics. The evolution of hunting pronghorn in New Mexico has largely been driven by limited access to public lands in pronghorn-dense areas, the political clout of landowners, the desire for additional public opportunity, and sometimes legislative intervention. During the past 50 years, New Mexico Department of Game and Fish policy has varied from a relatively strict management direction to virtually no management direction, with current management falling somewhere in the middle. Each iteration has helped mold the current Pronghorn Antelope Private Land Use System (A-PLUS) that incorporates regional harvest levels, ranch-centric hunting, and improved hunter distribution and access. New Mexico Department of Game and Fish continues to incorporate new information and new ideas to improve pronghorn management while striving to provide a balanced hunting program and maintain sustainable pronghorn populations.

Key Words: *Antilocapra americana*, New Mexico, private lands, pronghorn

Introduction

Wildlife in North America has been recognized as a resource to be held in public trust by governments since the 1840's (Batcheller et al. 2010, Brown 2010, Organ et al. 2010). Although contentious at times, this recognition has survived multiple challenges and remains a cornerstone of the North American Model of Wildlife Conservation (Batcheller et al. 2010). Despite protections as a public resource many species live, at least in part, on private lands. This presents the unique challenge of managing a public resource on private property while maintaining private property rights to the fullest extent possible.

Pronghorn (*Antilocapra americana*) are a prime example of the dilemma surrounding the public trust doctrine, especially in western North America. Across the core portion of their range pronghorn thrive in areas that are predominantly private land (Jensen et al. 2004, Walker 2012). As each state or provincial agency has a different suite of attributes, pressures, and politics dictating the formation of hunting rules and regulations over time, each pronghorn management program has evolved to manage the public resource on private property differently (Huey 1965, Autenrieth 1976). While all western agencies allocate licenses through a public draw, those

states or provinces that are predominantly private land have some sort of landowner program in place that provides a direct distribution of licenses for landowners, a specific percentage or preference through the public draw, or reduced license fees (Walker 2012).

Pronghorn distribution in New Mexico provides for a unique set of challenges as there is a stark dichotomy across the state between pronghorn density and accessible land status. Overall, pronghorn habitat is approximately 60% private land across the state (Fig. 1), but the higher densities of pronghorn live in areas that are closer to 80% private land. The majority of the hunting opportunity is available in the area with the least accessible public land. This unequal distribution of pronghorn across the state leads to the question "What is the best way to deal with access?". As such, early managers developed a hunting strategy that opened landlocked public lands and private lands to hunters through a reciprocal hunting agreement, in which all hunters hunted on the private and public land associated with a specific ranch. A license was validated for a specific ranch rather than a Game Management Unit (GMU). This ranch-centric hunting strategy has been central to the evolving Pronghorn Antelope Private Land Use System (A-PLUS) since at least the 1960's, and provides for improved hunter distribution throughout pronghorn range.

While ranch-centric hunting has provided a consistent means of hunting pronghorn, the distribution of private land authorizations and public licenses has not always been as consistent. During the 1960's, 70% of the hunting opportunity afforded to a given property went through the public draw and the remaining 30% went directly to the landowners as transferrable authorizations (Snyder 1965). The total opportunity was determined prior to the hunting season and landowners signed an agreement opening their properties to pronghorn hunting. Under this scheme, large tracts of private land were unhunted as there was little incentive to open large blocks of private land to large numbers of public hunters. This limited the ability to manage pronghorn populations and provide hunter opportunity in that part of the state that held the majority of the total population.

The 70%-to-draw rule worked for a time, but in 1972 the New Mexico State Legislature became involved in the situation and overturned this rule (Herring 1974). Private-land authorizations were then issued in accordance with the approximate private/public acreage split for a given property. This improved pronghorn management via hunting, as previously unhunted tracts of private land enrolled in the new program and the total number of licenses increased 33% in a single year even with a reported 29% decrease in public licenses.

While this rule change may have improved landowner relations and the ability to manage pronghorn with hunting, the decrease in public opportunity became a point of contention with the new allocation program. By 1976, the department was considering alternatives to the 1972 allocation method (Autenrieth 1976). The apparent solution in 1980 was to provide all private land authorizations on a first-come-first-served basis out of the main office in Santa Fe, NM rather than providing them directly to landowners (Morrison 1980). Hunters subsequently

negotiated trespass fees with landowners at a rate of USD$50–1,000 (Morrison 1980). By 1984, this practice stopped and authorizations were distributed directly to landowners once again (Morrison 1984).

Regardless of the aforementioned specifics of distributing licenses there were a few shortcomings. First, the number of pronghorn to be harvested from a given property was determined by negotiations between the New Mexico Department of Game and Fish and the landowner. Aerial surveys were conducted to determine a sustainable harvest within a given area for that year, but there was little structure provided for the total allowable harvest on a specific piece of property. While this practice worked during the early days of A-PLUS, it also resulted in concerns about overharvesting of pronghorn as more and more properties were enrolled over the years. A more biologically-driven and justifiable process was needed. Second, the negotiations also left room for inconsistencies in the public/private split of license distribution as there was no definitive rule that outlined license distribution during the 1980's, 1990's, and early 2000's. Third, while the ranch-centric hunt strategy opened a vast amount of property to hunters, it was problematic for the public hunter as he/she had little or no control over where he/she hunted outside of selecting a broad area that often encompassed several GMUs. Finally, public-land lessees controlled the pronghorn hunting on their leased land. If they chose not to return their annual agreement the property would not be hunted, whether the public land was accessible or not.

Beginning in 2008, the Department was tasked by the New Mexico State Game Commission to update A-PLUS. Specifically the Department was to create a biologically-driven program that would provide an equitable system for private landowners and public hunters. The 2008 attempt was designed to eliminate the ranch-centric hunting strategy by allowing public hunters the ability to hunt any legally accessible public land within a GMU. A sustainable harvest would be determined for a GMU, the public and private portions of that harvest would be split based on the land status within the GMU, the public licenses would go to the public draw, and the private authorizations would be distributed based on an acreage-driven formula with the option of being ranch-only or unit-wide (R. Walker, unpublished data). With such a drastic change from the past system, this proposal did not have the support of the landowner community and failed to pass.

The Department made another attempt in 2010. Many stakeholder groups were involved from the beginning and the Department made the process as transparent as possible. Through input from these stakeholders the ranch-centric hunting strategy remained part of the equation, but there were some key differences to the allocation process. First, a sustainable harvest would be determined for a GMU and that number would be distributed to participating properties via formula rather than through negotiations with the Department. The sustainable harvest would be based on current population and trend information, input from landowners (as far as overall goals for a GMU), and other pertinent available biological data. Second, the total allocation would be split based on the public and private acreage of that property. The formula to determine the hunting opportunity afforded to a given property is as follows:

$$TA = H_{GMU}\left(\frac{A_{Ranch}}{A_{GMU}}\right)$$

Where *TA* is the total allocation for a given property, H_{GMU} is the sustainable harvest for a given GMU, A_{Ranch} is the total qualifying pronghorn acreage for a given property, and A_{GMU} is the total qualifying pronghorn acreage enrolled within the entire GMU. The total allocation is then split by the percentage of public and private property to determine the number of public licenses and private authorizations, respectively. Landowners then sign an agreement confirming the number of public and private hunters they are to receive, the public licenses are issued through the draw, and the private authorizations are issued directly to the landowners as transferable authorizations.

The current model is certainly an improvement over previous versions, and provides more checks and balances throughout the allocation process to eliminate as many improprieties as possible. The formula-driven nature of the system helps to limit the impact that any single landowner may have on the system and allows a majority of landowners to know what their allocation should be from year to year. This also limits issues concerning the public/private split for any given piece of property. Maintaining the ranch-centric hunt strategy improves hunter distribution, prevents trespassing issues where fences often do not exist between private and public land, and, overall, simplifies the hunt for public and private hunters. The current system also allows the Department to create public land ranches. These public land ranches consist of contiguous tracts of public land that are legally accessible via county roads or state highways in which the lessee does not wish to open the entire property to hunters.

The current derivation of A-PLUS may not be ideal for some, but the history behind the system helps to explain its evolution. While this type of hunt strategy may not work for other agencies that have different pressures, overall A-PLUS has worked well as a relatively equitable system to distribute pronghorn hunting opportunity across New Mexico, especially in those areas that contain the most pronghorn and the least public land.

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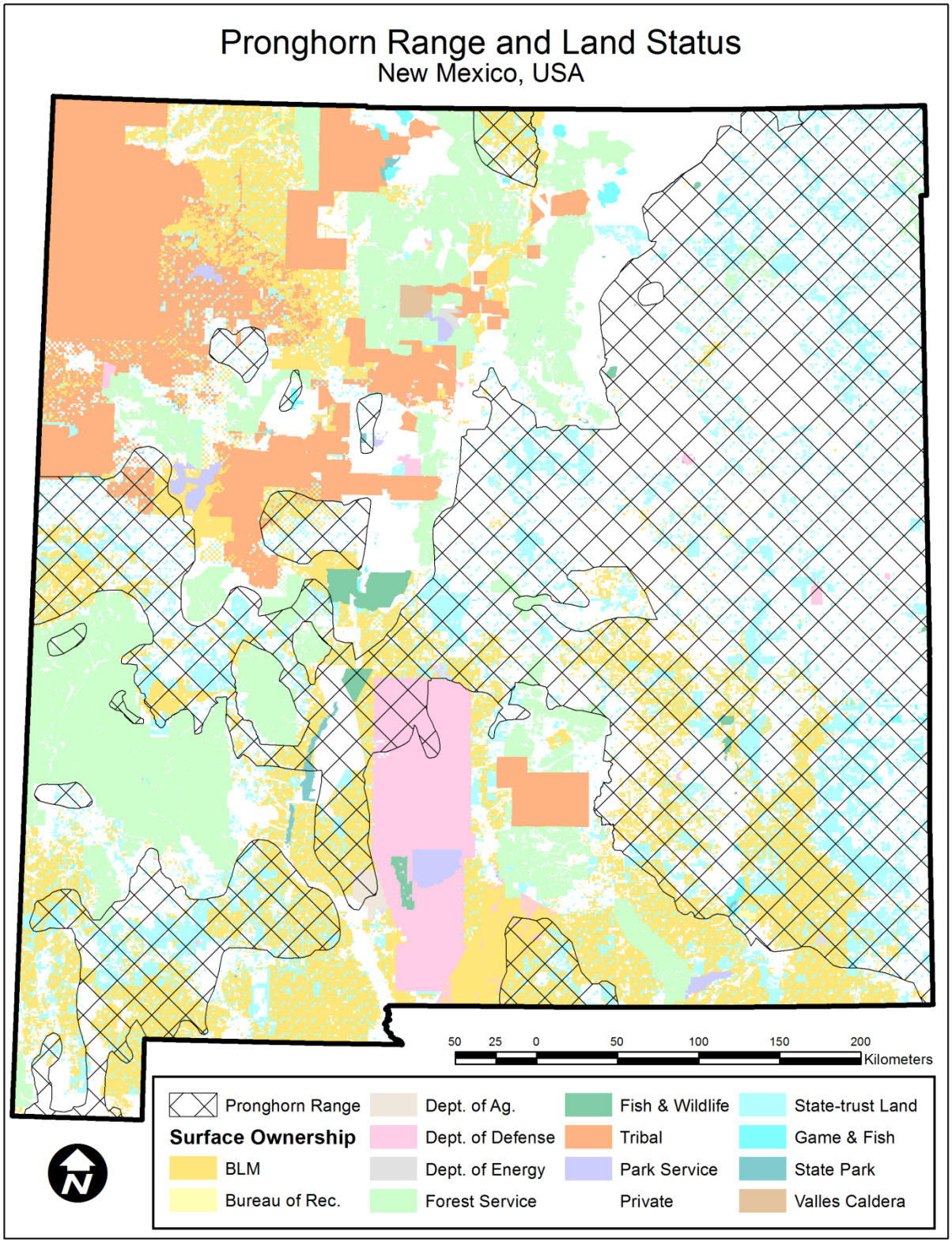

Figure 1. Pronghorn range and land status in New Mexico, USA.

Resilience of a Small Population of Translocated Pronghorn (Antilocapra americana)

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Abstract

Small populations of <50 pronghorn can be expected to disappear within a few years. To test this hypothesis we monitored a remnant population of introduced pronghorn near Hillside, Arizona, from December 1998 through November 2014. Observations were facilitated by a radio-collared buck and doe locating the animals' home ranges. Population size during this time was estimated to range from 4 to 9 animals in an area of <57.5 km². Although the possibility exists of animals immigrating or emigrating from the Hillside area, we did not document such behavior during our study. With no overt management actions this population not only persisted for 8 years, it grew to twice the number as originally observed despite this period being a time of drought and a mean adult female recruitment rate of only 11:100. This persistence is attributed to a limited home range in relatively good range condition, the pronghorn population being below carrying capacity, low adult mortality, and a greater recruitment of female than male fawns.

Key Words: Pronghorn, translocation, survival, habitat, Arizona

Introduction

In December 1984, 51 pronghorn (23 males and 28 females) from near Douglas, Wyoming, were released near Hillside in Yavapai County, Arizona. Although these animals failed to increase, some survived, prompting a second release of 54 pronghorn (5 males, 27 females and 22 fawns) from near Sheridan, Wyoming, on February 8, 1993. These animals scattered widely, and after a supplemental release of 5 male animals from Parker Mountain, Utah in December 1998, observations ceased. By 2006 it was thought that the Hillside pronghorn had disappeared (Brown and Ockenfels 2007). It was therefore a surprise when Wildlife Manager Matt Peirce saw 4 pronghorn east of Hillside near Grandview on May 6, 2008.

A subsequent observation of the same animals by MP on 11/15/2008 showed the population to consist of one adult male and 3 adult female pronghorn (Table 1). Conventional wisdom dictates that small pronghorn populations are susceptible to extirpation from effects of weather, habitat loss, poaching, and negative changes in gene frequency (Ockenfels 1994). Extirpation was also predicted by Berger (2014) to occur with populations of < 50 desert bighorn sheep (*Ovis canadensis mexicana*)—a situation refuted by Krausman et al. 1993, 1996). Miller (2014) calculated that a population of <50 individual pronghorn would face a 10% chance of extinction within 50 years even if annual adult female mortality was <15%. To test a minimum population hypothesis we decided to monitor this remnant population over several years to document its demise or survival.

Study Area

Potential pronghorn habitat east of Hillside is limited to *ca*. 78 km² of *malpai* mesas of volcanic origin ranging in elevation from 1175 m to 1370 m. Habitat quality varies with 49.21 km² described as low value and 5.2 km² described as moderate value to pronghorn (Ockenfels et al. 1996). The vegetation is almost entirely semidesert grassland leased for cattle grazing by the Arizona State Land Department (Brown 1994, Figure.1). The area is bisected by the BNSF railroad and isolated by rugged terrain and dense chaparral or other unsuitable vegetation from pronghorn populations to the north. Permanent water is lacking and the pronghorn depend on 6 to 8 windmills and stock tanks located in 7 fenced pastures on 2 ranches.

The primary grass cover is tobosa (*Hilaria mutica*) supplemented by such semidesert grassland species as side-oats grama (*Bouteloua curtpendula*), curly-mesquite grass (*Hilaria belangeri*), three-awns (*Aristida* spp.) and cottontop (*Digitaria arizonica*) among others. Important pronghorn forage plants include both perennials and annuals with the staples being Wright's buckwheat (*Eriogonum wrightii*), globe mallow (*Sphaeralcea* spp.) and filaree (*Erodium circutarium*). The most common cacti are the prickly-pears, *Opuntia phaeacantha* and *O. chlorotica* followed in descending order by *Cylindropuntia acanthaocarpa*, C. *spinosior*, and *Coryphantha* species. Leaf succulents other than *Yucca baccata* are unusual and grassland

invading plants are represented by snakeweed (*Gutierrezia* spp.), burroweed (*Isocoma tenuisecta*), catclaw acacia (*Acacia greggii*), mesquite (*Prosopis velutina*) and crucifixion thorn (*Canotia holacantha*).

Other ungulates present are mule deer (*Odocoileus hemionus*), javelina (*Pecari tjactu*) and cattle. Sign of such pronghorn predators as coyotes (*Canis latrans)* and mountain lions (*Puma concolor*) is commonly encountered.

Methods

Beginning in May 2008 we attempted to locate pronghorn at least once each season and as opportunity permitted. Seasons involved the spring fawning season of April through June, the summer breeding season from July through September, the fall herding season from October through December, and the winter months of January through March (Table 1).

Surveys were conducted by visiting waters and other known use sites and searching for pronghorn with binoculars from a four-wheel drive vehicle and on foot. These searches were greatly facilitated from 11/21/2008 through 3/29/2010 when an adult buck (9.840) and a doe (8.551) were net-gunned and equipped with "Five Spread Spectrum" GPS collars that transmitted locations twice a day at 1500 and 2300 hours. In addition to helping locate animals in the field, these collars provided location coordinates for 455 and 494 days respectively, thus providing home range and frequency use data.

Home ranges were calculated in ArcGIS 10.2.2 using the Minimum Bounding Geometry tool, convex hull. Locating animals after the collars dropped off and getting an accurate classification was sometimes difficult. The pronghorn were often wary and could rarely be approached closer than 400 m. Because pronghorn could not always be located from the ground, aerial flights with a fixed wing aircraft supplemented ground observations, and on two occasions motion sensitive cameras were set at waters to document individual animals (Table 1).

Survey results were compared with the May Palmer Drought Severity Index for Arizona's Region 3. Monthly PDSIs are NOAA generated values that take into account precipitation, evaporation, and other weather variables to measure the degree of drought. Minus values indicate drought conditions with values greater than a -4 indicative of severe drought. May was chosen as the month to sample as it reflects spring conditions and approximates the time of pronghorn natality in the Hillside area.

Results

A summary of the maximum number of pronghorn observed each year from 2008-09 through 2014-15 is shown by age class in Table 2. The total number of animals ranged from 6 to 8 during the 7 year survey period and the population remained essentially stable despite this being a time of drought (Table 2). Although the mean of 3.9 does seen per year had a potential recruitment rate of 6 fawns/year (3.9 x1.5), the actual mean annual recruitment rate observed was 23

fawns/100 females (7 fawns per 27 adult and 3 yearling females). This low recruitment rate was somewhat compensated by a recruitment rate of 20 female fawns/100 does vs 3 male fawns/100 does. This recruitment rate allowed for a mean annual herd recruitment of 0.43 yearling females.

Only 5 yearlings were observed over 7 years, 2 males and 3 females. Mean number of yearlings/ year = 0.71. Assuming that the male yearling not seen as a fawn did not come from outside the study area, 70% of the fawns survived to become yearlings—a recruitment rate of 18.5 yearlings/100 adult does. But since only half of the female fawns observed survived to be yearlings, the 0.43 mean annual female recruitment rate meant that it took 2 1/3 years for an adult female to replace herself.

Locations of the radio-collared animals are shown in Figure 2. Neither the male or female animal left the study area and had home ranges of 40.9 km² (15.8 mi²) and 57.5 km² (22.2 mi²), respectively. A high percentage of these locations appeared tied to water sources, particularly East Well (34.404° N, 112.865°W,1255 m) and Grandview Tank (34.432°N, 112.805°W, 1228 m). Although these water sources may not always have been available, other sources were, and the 866 ha "Horn Sheath" pasture containing East Well was the area where pronghorn were most frequently seen. Both Horn Sheath pasture and the pasture containing Grandview Tank were not heavily grazed and in good range condition. The large area flooded by Grandview Tank also provided excellent forage when the water receded and was much used by pronghorn. Neither the fences nor the fenced railroad right-of-way appeared to restrict movement. No collared animals were known to leave or enter the study area. The May PDSI was a minus value for every May during the survey period indicating that the area was in a drought during the entire observation period.

Discussion

Although resilient, the future of the Hillside pronghorn herd remains tenuous. A catastrophic climatic event could reduce the population below the recovery level, and unless male animals come into the population from outside the area, inbreeding depression is a threat. Adult female mortality cannot exceed 0.45 per year for the population to persist. That more female fawns were produced than males is a population dynamic that may be essential to the herd's continued existence.

If drought conditions cease, however, and range conditions continue to improve, the population may not only persist but gradually increase. In the meantime an interesting experiment is in progress.

Acknowledgements

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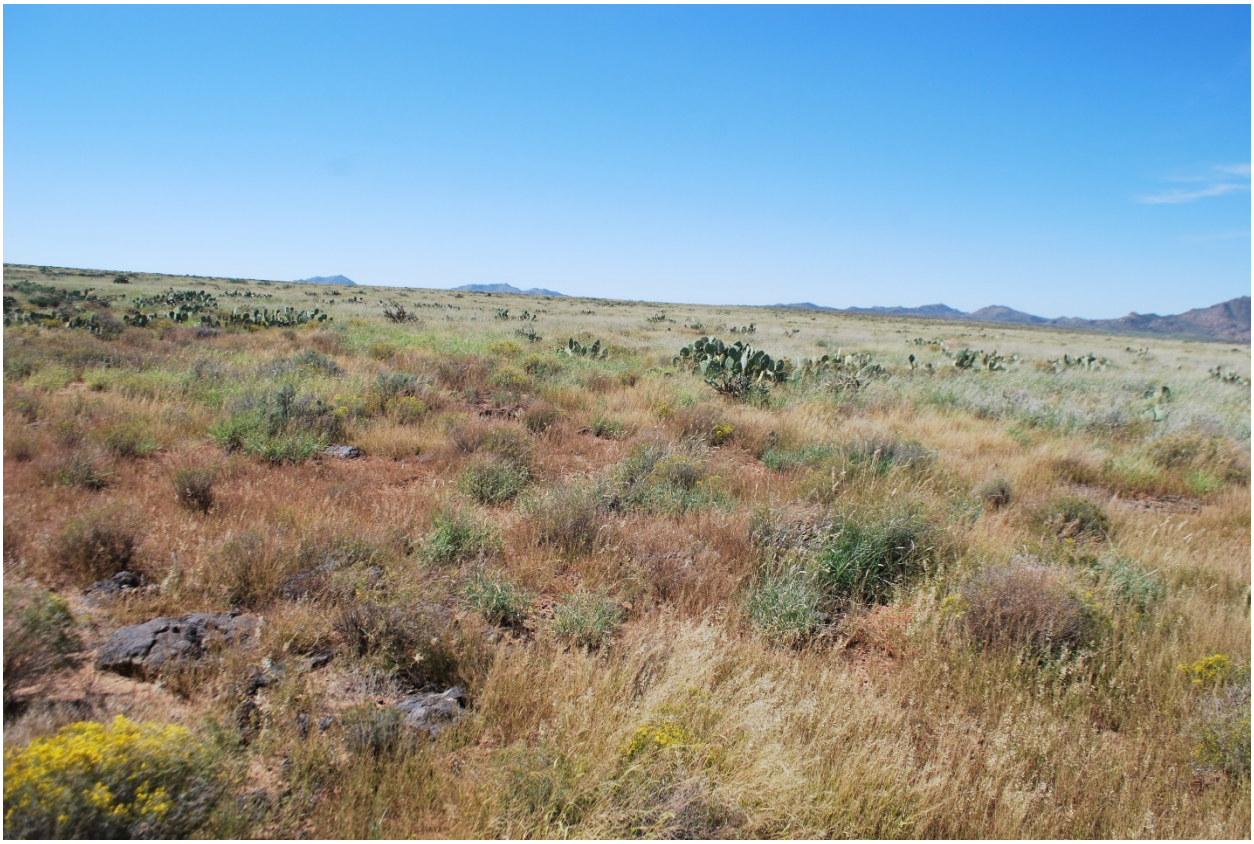

Figure 1. Spring 2014 aspect of Horn Sheath Pasture east of Hillside, Arizona.

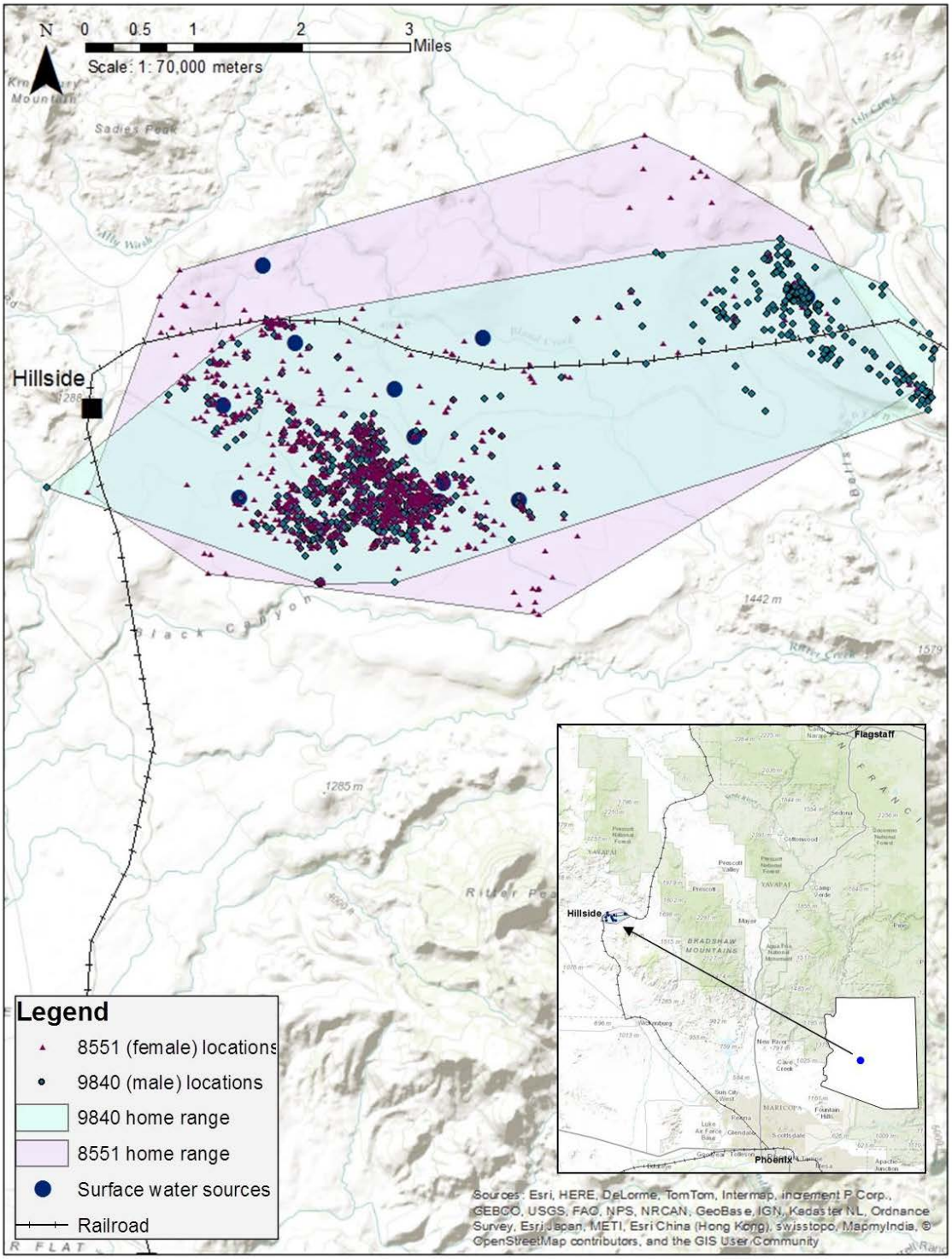

Figure 2. Home ranges of 2 radio-collared pronghorn east of Hillside, Arizona.

Table 1. Maximum numbers of pronghorn seen each year near Hillside, Arizona (2008-2015).

Year'	Seen Ad.M	Seen Ad.F	Seen Yr.m	Seen Yr.f	M.fawn	F.fawn	Max.Total	Change	MayPDSI
2008-2009	3	2	0	0	0	1	6		-2
2009-2010	2	3	0	1	0	1	7	1	-1.77
2010-2011	1	3	1	0	0	1	6	-1	1.12
2011-2012	1	6	0	0	0	1	8	2	-1.92
2012-2013	2	3	0	1	0	1	7	-1	-3.93
2013-2014	1	5	1	1	0	0	8	1	-3.34
2014-2015	2	5	0	0	1	1	9	1	-4.09
Total	12	27	2	3	1	6	51		
Mean	1.7	3.9	0.3	0.4	0.1	0.9	7.3		

'A year is from May 1 to April 30.

The Efficacy and Economics of Limited Lethal Removal of Coyotes to Benefit Pronghorn in Arizona

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Abstract

During 2008–2013, we compared the efficacy of limited lethal removal of coyotes (*Canis latrans*) designed to benefit pronghorn (*Antilocapra americana*) populations by measuring demographic parameters of pronghorn and sympatric mule deer (*Odocoileus hemionus*) populations and using a simple cost and return-on-investment approach to determine the economic cost or benefit of the removal efforts. We selected 2 management units in northern Arizona (Units 4A and 10) for treatment and compared their prey population demographic performance with adjacent, untreated units (Units 5A and 9), as well as with statewide population demographic parameters. Prey populations were monitored using standard aerial surveys. The state of Arizona spent $63,678 to remove 231 coyotes from Unit 4A during 2009–2013 and $197,071 to remove 956 coyotes from Unit 10 during 2008–2013. Coyotes were removed using foot-hold traps on private land and aerial gunning within primarily pronghorn habitat. Numerical increases were observed on surveys of pronghorn within Unit 10, although no change was observed in Unit 4A. No substantive changes were noted within Units 5A or 9, although statewide survey numbers increased over the period of study. Pronghorn fawn:doe ratios increased within all units, although by the greatest proportion in untreated Unit 9. Mule deer numbers surveyed in Units 4A, 5A, 9, and 10 exhibited some variation, but no substantive directional trend during the period of study. Statewide, mule deer numbers observed on survey increased substantively during the period of study. Permit levels for pronghorn increased in treated Units 4A and 10, whereas in untreated units they decreased in Unit 5A and increased marginally in Unit 9. Within the treated units, mule deer permits increased in Unit 4A, but decreased substantively in Unit 10. In the untreated units, mule deer permits remained relatively unchanged, with a slight upward trend. Statewide, mule deer permits did not change markedly.

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Examining return on investment strictly through returns to the state through increased permit sales (using 2008 as the baseline), Unit 4A observed an increase of $2,672.56 USD and Unit 10 observed an increase of $6,074.00 USD due to changes in pronghorn permit numbers. Based on the change in hunter days and the knowledge that a hunter-day is worth about $224.83 USD due to purchases associated with hunting (ammunition, firearms, gas, lodging, vehicles, and other related items), Unit 4A increased return to economy of $15,063.61 USD and Unit 10 increased return to economy by $97,126.56 USD due to changes in pronghorn permits numbers. During the period of study, all expenses were greater than return. If permit levels and hunter effort remained equal while all predator removal ceased, it would require another 622 hunter days (6–7 years) to reach a neutral cost for predator removal in both treated units, or 416 hunter days (4–5 years) to reach a neutral cost for predator removal in Unit 10 alone. This analysis does not take into consideration any benefit from wildlife watchers or consider the expense to restore and repatriate a population if it were allowed to become extirpated. Predation management is an important tool, but can be expensive and difficult to realize positive financial returns. Investments in habitat enhancements can be effective and longer lasting, yet these tools are also expensive and difficult to implement. Resource managers need to retain as many management tools as possible to be effective in managing wildlife populations.

Key Words: Arizona, coyote, economics, mule deer, predator control, pronghorn

Introduction

The relationship between limited lethal removal of coyotes and biological benefits to declining pronghorn populations has been studied for decades (e.g., Neff and Woolsey 1979, Smith et al. 1986, Phillips and White 2003). In general, and for most prey species, predator removal can be effective at increasing prey recruitment if that removal is focused, intensive, substantive, and timed to provide advantage to prey (e.g., near parturition) if predators are limiting or regulating the prey population when it is below carrying capacity (e.g., Ballard et al. 2001).

Limited lethal removal of predators can be a volatile and contentious topic (Andelt et al. 1999). While prey species numbers may increase with fewer predators, human social perspectives may be intolerant of the use of lethal measures on predators. Additionally, economics may be an important factor when communicating with the public and in decisions regarding the use of management actions. When limited lethal removal is employed to benefit livestock producers, cost-benefit analyses become very important because private individuals or corporations bear the bulk of expenses. Livestock producers must consider and evaluate several animal husbandry techniques at their disposal, including livestock containment, predator disturbance, repellants, and lethal removal (Knowlton et al. 1999). If a livestock producer cannot afford associated expenses, then the business may no longer operate.

Wildlife management is often viewed as operating in a business sense. Most state wildlife agencies do not receive much, if any, general tax revenues and must operate according to public trust doctrine under the North American Model of Wildlife Conservation. This paradigm requires that wildlife is managed in trust for all citizens (e.g., Smith 2011), yet it is funded

primarily by hunters, anglers, and recreational shooters. This paradigm places responsibility for state wildlife agencies to manage wildlife, but the revenue yield must be substantial enough to support all legitimate uses of wildlife.

Value can be difficult to ascribe to wildlife in a strict business sense. Periodically, hunters and anglers are surveyed to determine not only what they pay for permits and licenses, but also what they expend in local economies to conduct their recreational activities (see Southwick Associates 2012). Based on data collected on all hunters in Arizona, hunters expend about $224.83 USD for each day they spend hunting big game (Southwick Associates 2012). Part of the equation for hunting is the benefit that the economy receives from these acquisitions, such as the purchase of food, fuel, ammunition, and other related items. While a similar value may be placed on the value of wildlife watching days, there is less of a linear relationship between the abundance of wildlife and amount of time spent watching that wildlife. It can also be difficult to determine the absolute cost to reestablish a prey population if it should be extirpated, which may plausibly occur if predation is not mitigated in some instances.

Our objective was to implement limited lethal removal of coyotes to benefit pronghorn populations in 2 locations in Arizona. To evaluate the cost-benefits in a strict business sense, we wanted to specifically look at the costs and determine the simple return on investment through permit fees and hunter expenditures per day. We also wanted to compare pronghorn population performance in adjacent, untreated units and simultaneously evaluate demographic performance of mule deer in the same management units.

Study Areas

We selected 4 management units that supported hunted populations of pronghorn for study. Units 4A and 5A are located in northcentral Arizona south of Winslow and Flagstaff. Each unit is about 2,500 km^2 with elevations ranging from about 1,650–2,650 m. Although the vegetation ranges from mixed-conifer forests at the higher elevations to ponderosa pine (*Pinus ponderosa*) in the mid-elevations, pronghorn primarily occupy the grassland habitats at the lower elevations. Both units have a primarily north-facing orientation, with grassland habitats in the northernmost portions.

Units 9 and 10 are northwest of Flagstaff. Unit 9 is located south of the Grand Canyon, and ranges from about 2,650 m in the north to about 1,650 m in the south. Unit 9 encompasses about 3,000 km^2 and has similar vegetative communities as Units 4A and 5A, although the pronghorn habitat is located primarily in the southern portion. Unit 10 is about 4,000 km^2 and is located north of Kingman, adjacent to Unit 9. Vegetative communities are similar, although there is less mixed conifer in this unit. Grasslands are located throughout the unit, and elevations are predominately in the 1,800–2,000 m range.

Methods

Limited lethal removal of coyotes.—We used fixed-wing aircraft and foot-hold traps (on private land) to conduct limited lethal removal of coyotes within Units 4A and 10. Coyotes were removed from Unit 4A during 2009–2013, whereas removal occurred during 2008–2013 in Unit 10. Trapping was conducted during the months of March–May and aerial gunning occurred during April and May annually. We monitored actual expenditures for the contracted activities to lethally remove predators.

Survey of pronghorn and mule deer.—Pronghorn and mule deer were surveyed annually using aerial survey techniques. Surveys were conducted for both species using protocols developed to conduct simultaneous double count surveys (Potvin et al. 2004, Potvin and Breton 2005). Survey hours were adjusted to achieve confidence intervals of ±5% for fawn:doe ratios, but did not result in substantive changes during the period of study within a specific unit. Pronghorn were surveyed using fixed-wing aircraft during August or early September, whereas mule deer were surveyed from a helicopter during January.

Permit regulation.—Permit numbers for hunting pronghorn and mule deer are adjusted annually based on biological recommendations from biologists that include considerations of recruitment (fawn:doe ratios), buck:doe ratios, past season hunter success, and estimated population trend. Permit recommendations were based on the preponderance of evidence of these 4 parameters, and the Arizona Game and Fish Commission (Commission) had final authority on approving or adjusting permit levels. Although the Commission has at times adjusted permit levels based on social considerations, no adjustments to final recommendations were made in these units for these species during the period of study.

Hunter days.—Hunter days were measured using a post-hunt, voluntary questionnaire mailed to all permit holders by the Arizona Game and Fish Department. Generally about 65% of pronghorn hunters return their questionnaires, whereas only about 43% of mule deer hunters would generally return theirs (Arizona Game and Fish Department, unpublished data). These return rates are sufficient to yield statistically reliable estimates (Munig and Wakeling 2005)

Economic value.—We calculated the economic value of a permit to the state as a proportional value based on the weighted mean purchase of pronghorn and mule deer tags by resident and nonresident hunters. Typically, 96% of all permits are issued to residents and about 4% are issued to nonresidents. A resident pronghorn permit costs $103.00 USD, a nonresident pronghorn permit costs $565.00 USD, a resident mule deer permit costs $58.00 USD, and a nonresident mule deer permit costs $315.00 USD. For this evaluation, we assumed the weighted mean cost of a pronghorn permit would be $121.48 USD and the weighted mean cost of a mule deer permit was $68.28 USD. Based on the data presented by Southwick Associates (2012), we assumed a hunter day was worth $224.83 USD.

Results

During 2008–2013, 231 coyotes were removed from Unit 4A (no removal effort in 2008), whereas 956 coyotes were removed from Unit 10 (Table 1). The cost of the removal effort was $63,678 USD in Unit 4A and $197,071 USD in Unit 10 (Table 2). This yields a cost of $275.66 USD/coyote in Unit 4A and $206.14 USD/coyote in Unit 10. Removal expenditures (and effort) generally increased each year, with the exception of 2012 in Unit 10. We did not attempt to remove coyotes in Units 5A or 9 during 2008–2013.

During 2008 and 2009, fawn:doe ratios within the treated units remained below 30 fawns:100 does, but these ratios increased substantially in both Units 4A and 10 during 2010–2013 (excepting Unit 4A in 2011, which was estimated at 29:100; Table 3). There were commensurate, notable increases in the adjacent untreated units at the same time (Table 3). However, only Unit 10 saw a substantive increase in the number of pronghorn observed over time during surveys, indicating that the population within that unit increased substantially as well (Table 4). The number of pronghorn observed on survey within Unit 10 increased by more than 300% during the period of study.

Although there was variation in observed fawn:doe ratios for mule deer populations among treated and untreated units, no substantive increase was noted among units (Table 5). In contrast, we observed a substantial decrease in measured fawn:doe ratios in Unit 10 during the period of study within Unit 10. We did not note any substantive difference in the number of mule deer observed on survey within any of the treated or untreated units, however we did detect a 44% increase in the total number of deer observed on survey statewide (Table 6).

Using 2008 permit levels as the baseline, there were 22 cumulative additional permits authorized for pronghorn in Unit 4A and 50 cumulative additional pronghorn permits for pronghorn authorized in Unit 10 after limited lethal removal of coyotes was initiated (treated units; Table 7). In Unit 5A, permits were reduced by 32 cumulative permits, whereas Unit 9 had 7 cumulative additional permits during the same time period. Statewide, the cumulative reduction in permits was 200 (Table 7).

Mule deer permits were increased by 255 cumulative additional permits in Unit 4A after limited lethal removal of coyotes was initiated, yet mule deer permits were reduced by a cumulative 475 permits in Unit 10 (treated units; Table 8). The untreated units all experienced a cumulative decrease in mule deer permits during this time period, including 50 permits in Unit 5A, 25 permits in Unit 9, and 2,903 permits statewide (Table 8).

Pronghorn hunters spent an additional cumulative 67 hunter days within Unit 4A and 432 hunter days within Unit 10, using 2008 hunter days as a baseline (treated units; Table 9). During that same time period, hunters expended a cumulative 33 fewer days in Unit 5A, whereas they spent 1 additional day in Unit 9 (untreated units). Statewide, hunters expended a cumulative 611 more days hunting pronghorn after 2008 (Table 9).

Mule deer hunters spent an additional cumulative 690 days hunting in Unit 4A, although they spent 2,651 days fewer in Unit 10 (treated units; Table 10). In untreated units, hunters spent 625

cumulative fewer days pursuing mule deer in Unit 5A, 663 cumulative days more in Unit 9, and 6,512 fewer days pursuing mule deer statewide (Table 10).

In Unit 4A, pronghorn hunters spent $2,672.56 USD on permits since 2008 (mean pronghorn permit value = $121.48 USD). In Unit 10, that amount was $6,074.00 USD. Return to the state of Arizona for pronghorn hunting in the treated units was $8,746.56, although total expenditures for limited lethal removal of coyotes was $260,749 USD.

Pronghorn hunters spent an additional 67 hunter days in Unit 4A and 432 in Unit 10 (a hunter day = $224.83 USD). The value of pronghorn hunter days to the economy was equivalent to $112,191.03 USD. In combination, the state and economy received $120,937.59 USD, $139,811.41 USD less than the state spent on the limited lethal removal of coyotes. An equivalent of another 622 additional hunter days would be needed to break even financially.

Untreated units (excluding statewide comparison) were reduced by 25 total permits, which amounted to the loss of $3,037 USD. These same units were reduced in hunter days by 32 hunter days, or the equivalent of $7,725.30 USD. Although pronghorn did not increase and revenue was lost in the untreated units, the net financial loss in those units was less during the period of study than in the units where treatment occurred.

Mule deer permits were reduced in the treated units by 220 in Units 4A and 10, or a net revenue loss of $15,021.60 USD (mean mule deer permit value = $68.28 USD). Mule deer permits decreased by 75 in the untreated units, and net revenue decreased $5,121 USD as well. Hunter days decreased in the treated units by 1,961 days, resulting in an economic loss of $459,070.10 USD. Untreated units saw an increase of 38 days of mule deer hunting, or the equivalent of $8,543.54 USD in revenue to the economy.

Discussion

Limited lethal removal has been demonstrated repeatedly to be effective in benefitting pronghorn populations that are below carrying capacity of the habitat and where predation is a substantial limiting or regulating factor (Neff and Woolsey 1979, Phillips and White 2003). Ballard et al. (2001) concluded after an exhaustive review of the mule and black-tailed deer literature that limited lethal removal had to be focused, intensive, and substantive to affect deer, and likely most prey, populations. In other words, the number of predators removed is less important than the location and proportion of predator population removed and the timing of important reproductive events, such as parturition, of the prey population. In our study, removal was designed to influence pronghorn populations because they inhabit open landscapes where aerial removal efforts can be effective. Mule deer populations tend to inhabit less open landscapes and select habitats with greater cover, which makes aerial removal efforts less effective. Additionally, limited lethal removal of coyotes was timed to occur just prior to pronghorn fawn parturition, not mule deer fawn parturition. Not surprisingly, we did not detect any benefit to mule deer populations as a result of the limited lethal removal of coyotes in our study.

Similarly, surveyed pronghorn numbers responded in Unit 10, whereas increases were not detected in Unit 4A. Increases in surveyed recruitment did not result in increases in observed pronghorn. Other variables (e.g., a new district wildlife manager was in place in Unit 9 during 2011–2013, which may have influenced classification bias) may explain some survey results, or study design (e.g., treatments in Unit 10 may have influenced adjacent untreated population surveys in Unit 9) may have influenced outcomes. Yet only in Unit 10 did we observe linkages among intensive limited lethal removal, apparent responses in pronghorn recruitment, and substantive increases in population surveys. This reinforces the concept that predation management must be sustained, focused, and timely to be effective.

Our economic analyses do not indicate that limited lethal removal was financially effective for the state during the duration of our study, as we did not detect a positive return on investment. Including a broader evaluation of the affect that hunting has on the economy, due to the contributions of purchases related to food, lodging, ammunition, and assorted supporting equipment, similarly did not immediately yield a positive return on investment. Adding subsequent years to this analysis until the point at which pronghorn populations return to pretreatment levels could result in a positive return on investment. An additional 6–7 years at current permit levels would probably yield the necessary return on investment to recoup the equivalent of the expenses that the state spent on this treatment; however, the return on the investment would not be to the state, but to the overall economy. Finally, without continued predator removal, pronghorn populations may return to pretreatment levels before the additional financial recovery may be realized.

Looking simply at Unit 10, the cost of limited lethal removal of coyotes was $197,071 USD, whereas revenues through permits was $6,074.00 USD and return to the economy was $97,576.22 USD. This yields a deficit of $93,420.78, which could be recovered with an additional 416 hunter days or 4–5 years at the current permit level. This more intensive predator removal could become cost effective in less time, but pronghorn populations may decline before the cost could be recovered.

Other benefits are more difficult and less tangible to enumerate. For instance, wildlife watchers have a similar benefit on the economy as do hunters due to the purchases they make in association with their activities. There is a less linear relationship between the numbers of animals and the amount of effort they expend; sometimes wildlife watchers spend more to observe rare and endangered species, such as the whooping crane (*Grus americana*), than a relatively more common animal like a pronghorn. Also, increases in pronghorn numbers does not immediately translate into more watchers or more expenditures by those that enjoy observing pronghorn.

Investments in habitat tend to yield greater, long-term benefits. Recently, Bergman et al. (2014) determined that treatment of winter habitats of mule deer alone could yield substantial benefits to overwinter survival and recruitment without predator removal. Improving habitat is a simple concept, but often complex to implement. Habitat fragmentation with roadways and fences can

be difficult and habitat conversion sometimes impossible to mitigate. Limited lethal removal of predators rarely permanently limits predator populations when implemented correctly, and may provide immediate relief to prey populations that may be in danger of extirpation. The financial cost of replacing a population once it has been extirpated can be tremendous and far exceed the temporary cost of manipulating predator populations.

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Table 1. Number of coyotes removed by year within Units 4A and 10, Arizona during 2008–2013.

Year	Unit 4A	Unit 10
2008	--	96
2009	63	74
2010	68	300
2011	21	194
2012	31	176
2013	48	116

Table 2. Expenditures (USD) for coyote removal by year within Units 4A and 10, Arizona during 2008–2013.

Year	Unit 4A	Unit 10
2008	--	$10,000
2009	$10,000	$10,000
2010	$10,000	$36,514
2011	$10,000	$54,902
2012	$12,000	$31,178
2013	$21,678	$54,477
Total	$63,678	$197,071

Table 3. Fawn:doe ratios for pronghorn populations estimated from fixed-wing aerial surveys in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	8	21	36	27	19
2009	7	15	34	8	18
2010	42	31	42	24	27
2011	29	53	28	63	29
2012	54	35	44	64	29
2013	46	30	40	60	29

Table 4. Observed numbers of pronghorn from fixed-wing aerial surveys in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	248	177	109	138	4,380
2009	151	157	107	88	4,290
2010	251	135	133	172	4,970
2011	178	242	141	169	4,752
2012	251	624	134	153	4,972
2013	171	540	82	163	5,068

Table 5. Fawn:doe ratios for mule deer populations estimated from aerial surveys in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	55	45	34	58	47
2009	27	31	44	35	38
2010	69	46	48	30	43
2011	48	43	42	58	45
2012	55	28	44	55	46
2013	58	23	49	45	48

Table 6. Observed numbers of mule deer from fixed-wing aerial surveys in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	35	99	97	79	7,367
2009	71	136	148	113	7,095
2010	38	210	203	84	7,602
2011	89	172	130	132	9,360
2012	92	216	198	239	9,866
2013	89	112	207	159	10,614

Table 7. Pronghorn permits authorized in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	10	60	15	25	503
2009	10	60	15	25	525
2010	15	70	15	20	502
2011	15	70	10	25	436
2012	15	70	10	27	428
2013	17	80	8	30	424

Table 8. Mule deer permits authorized in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	150	725	400	400	24,900
2009	150	750	350	400	24,475
2010	180	750	350	400	24,650
2011	200	600	400	350	23,352
2012	225	550	400	400	24,995
2013	250	500	450	425	24,125

Table 9. Hunter days expended during pronghorn hunts in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	24	146	32	69	1,226
2009	33	212	15	82	1,490
2010	27	230	41	60	1,451
2011	78	236	34	71	1,491
2012	26	228	25	78	1,198
2013	23	256	12	55	1,111

Table 10. Hunter days expended during mule deer hunts in treated units (Units 4A and 10) and untreated units (Units 5A, 9, and statewide) within Arizona during 2008–2013.

	Treated		Untreated		
Year	Unit 4A	Unit 10	Unit 5A	Unit 9	Statewide
2008	823	3,472	1,912	1,669	101,221
2009	691	3,442	1,649	1,892	99,841
2010	908	3,452	1,771	1,940	103,028
2011	910	2,787	1,692	1,459	93,991
2012	948	2,642	1,775	1,734	102,720
2013	1,348	2,386	2,048	1,983	100,013

Literature Search – Does hunting pronghorn during the breeding season disturb breeding, resulting in a longer breeding season and reduced birth synchrony?

THOMAS C. MCCALL, *Arizona Game and Fish Department, 3500 S. Lake Mary Rd., Flagstaff, Arizona 86001, USA*

Abstract

For several years in Arizona there has been the question of whether hunting pronghorn during the breeding season disturbs breeding, resulting in a longer breeding season and reduced birth synchrony. A narrow birthing period in some species has been found to swamp the predators and increase survival of neonates. The following is a literature search related to this question. The literature search includes information on birth synchrony, disturbance during the breeding season, length of the gestation period, nutrients and body condition as they relate to birthing dates, and predator swamping. I also included a table of fawning dates by state. In summary, there have been no controlled studies that tested the hypothesis that hunting during the peak of the pronghorn breeding season reduced birth synchrony by lengthening the breeding period. However, a few studies demonstrated that precipitation levels and body condition influenced birth synchrony. In Oregon, birth date affected survival where neonates born during the peak period of fawning lived longer than those born during the non-peak period.

W. Hepworth personal communication:1981 cited in O'Gara. B. W., and J. D. Yoakum. 2004. Pronghorn Ecology and Management. University Press of Colorado, Boulder, Colorado, USA. 903pp.

Pronghorn in captivity in Wyoming had gestation periods of 245-255 days with an average of 250 days. These data indicate that the gestation period can vary.

Autenrieth, R. E., and E. Fichter. 1975. On the behavior and socialization of pronghorn fawns. Wildlife Monographs 42.

Throughout the majority of the pronghorn's distribution, fawns are born within a 3-week window during the early growing season, most of which are born within a 10-day period.

Dauphine, T. C., Jr., and R. L. McClure. 1974. Synchronous mating in Canadian barren-ground caribou. J. Wildl. Manage. 38:54-66.

Birth synchrony, or predator swamping, was thought to reduce predation in caribou calves.

Estes, R. D. 1976. The significance of breeding synchrony in the wildebeest. E. African Wildl. J. 14:135-152.
Birth synchrony was thought to reduce predation in the African wildebeest.

Byers, J. A. 1997. American pronghorn: Social adaptations and the ghosts of predators past. Univ. Chicago Press, Chicago, Illinois. 300 pp.
Pronghorn were found to have narrowly synchronized parturition dates on the National Bison Range in Montana. The length of the gestation period was influenced by precipitation. For example dry summers resulted in gestation lengths that were 1 day longer in young, 4 days longer in prime-aged does, and 10 days longer in older does, compared to those after wet summers. Results from arid areas, such as Arizona, are unknown.

Bronson. F. H. 1989. Mammalian reproductive biology. Univ. Chicago Press, Chicago, Illinois. 325pp.
Nutrients for lactating females and for fawn growth is probably the ultimate factor influencing seasonal breeding in long-lived animals from northern areas.

Gregg, M. A., M. Bray, K. M. Kilbride, and M. R. Dunbar. 2001. Birth synchrony and survival of pronghorn fawns. J. Wildl. Manage. 65:19-24.
Predation is commonly the primary mortality factor of pronghorn fawns. Causes of mortality and the effect of birth synchrony on survival of neonatal pronghorn (n=104) at Hart Mountain National Antelope Refuge in Oregon were investigated from mid-May to mid-July in 1996 and 1997. Most (84%) of the fawns died during the monitoring period. Mean age at death was 8.4 days and 83 (95%) of the fawns that died were <18 days old. Predation, mostly coyote, accounted for 86% (75 of 87) of the fawn deaths. Birth date affected survival where neonates born during the peak period of fawn drop lived longer than those born during the non-peak period (P - 0.002). Of 17 surviving fawns, 14 had birth dates during the peak fawning period compared to 3 born during the non-peak period (P = 0.024). Survival rates for all fawns born during the peak fawning period (S = 0.23) were greater (P < 0.001) than fawns born during the non-peak period (S = 0.07). Their results indicated that birth synchrony in pronghorn may be an important adaptation through which losses of young to predation can be reduced.

Dunbar: Unpublished data
Additional unpublished data from the Hart Mountain studies indicate that fawns were born during a very narrow period in 1999 compared to 1998. Radio-telemetry data suggest that fawns born during the peak of parturition survived longer. Hart Mountain was particularly wet in 1998, and Dunbar wondered if birth synchrony was related to body condition of does. He believed that does in good condition would breed at around the same time, thus giving birth around the same time. Alternatively, if does were in poor condition, the does would breed later and extend the parturition dates.

Copeland, G. L. 1980. Antelope buck breeding behavior, habitat selection and hunting impact. Idaho Department Fish and Game, Wildlife Bulletin 8.

Too much disturbance of pronghorn by hunters during the breeding season was thought to disrupt the social breeding structure. Gregg et al (2001) hypothesized that this could reduce birth synchrony by lengthening the breeding period.

Yoakum, J. D. 2008. Pronghorn and habitat management for fifty years on the Hart Mountain National Antelope Refuge: a review and assessment. Presentation at the 23rd Biennial Pronghorn Workshop, Canmore, Alberta.

Population size for the Hart Mountain Antelope Refuge in Oregon fluctuated from <300 in the early-1950s to >2,700 in 2006, representing a 1,300 percent increase. A number of factors were studied, including weather, diseases, accidents, predation, forage competition, vegetation alterations, harvests, and diet selection. But none of these factors were isolated as limiting the population. The 12-year study of neonate mortality showed an average predation loss of 50 percent at the same time the herd doubled in size. Vegetation quantity and quality was the one factor correlated with population increases. Fawn recruitment increased and population size improved as preferred, succulent nutritious foods increased during pronghorn pregnancy and lactation. More rapid population increases appeared to be related to suspending of domestic and feral livestock and habitat modification techniques.

Brown, D. E., and R. A. Ockenfels. Arizona's pronghorn antelope: A conservation legacy. Arizona Antelope Foundation. 190pp.

Although many pronghorn populations are hunted during the breeding season in Arizona, seldom does a doe not breed. Even if the dominant buck is killed, satellite bucks are normally able to breed all of the available does. Dominant bucks will be harvested, but the effect on the herd is minimal. Most of the breeding takes place within late-August to early-September in northern Arizona and from mid-June to August in southern Arizona. The gestation period in Arizona is from 240-250 days.

Ticer, C. L. D., R. A. Ockenfels, and J. C. deVos, Jr. 2000. Pronghorn fawning dates in Arizona. Pronghorn Antelope Workshop (1996) Proc. 17:50-55.

The fawning period in Arizona ranged from late-February to April in southwestern Arizona to May through June in the northern portion of the state. Fawning periods appeared to differ according to differences in elevation, average number of frost-free days, average minimum spring air temperatures and precipitation patterns that influenced spring green-up.

Miller, W. H., 2006. Comparison of Diet Characteristics of Two Pronghorn Herds in North Central Arizona. Presentation at the 22nd Pronghorn Antelope Workshop, Idaho Falls, Idaho.

The authors compared the diets of the Anderson Mesa and Garland Prairie pronghorn herds in north-central Arizona to determine if they might explain differences in fawn recruitment between the 2 herds. Dietary characteristics were examined from April 2002 to August 2004. The Garland

Prairie herd had significantly higher forage species diversity across all years and seasons. In 2002 and 2004, the Garland Prairie herd had higher amounts of forbs and lower amounts of shrubs than the Anderson Mesa herd. There was little difference in the diet composition in 2003. Across the 3 years, Garland Prairie pronghorn consumed an average of 8.5 % grass, 74.5 % forbs and 17 % shrubs, while Anderson Mesa pronghorn consumed 12.2 % grass, 53.4 % forbs, and 30 % shrubs. The greater species diversity and higher amounts of forb and lower amounts of grass and shrub in the Garland Prairie diets may explain the higher fawn recruitment in this herd than the Anderson Mesa herd.

Fawning dates by state.

Area	Fawning Dates	Source
Northern Distribution		
Northern states	late-May to early-June	Hepworth and Blunt 1966, Mitchell 1967, O'Gara 1968, Autenrieth and Fichter 1975
Colorado	2 fawning peaks – one mid-June, the other mid-July	Pojar and Miller 1984
Idaho	July	Fichter 1958
Montana	narrow period	Byers 1997
Southern Distribution		
Southern states	February to late-May	Buechner 1950, Larsen 1964, Ticer et al. (2000)
Arizona - Southwestern	late-February to April	Ticer et al. (2000)
Arizona - Northern	begins in May	Ticer et al. (2000)
Mexico – Baja Peninsula	earliest in February	
New Mexico - southeast	late-May	Larsen 1964
Texas – Trans-Pecos	early-April to early-June	Buechner 1950
Texas - South	as early as February 23 and commonly by March 15	O'Gara. B. W., and J. D. Yoakum. 2004

State and Province Pronghorn Status Report 2014

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SHAWN S. GRAY, *Mule Deer and Pronghorn Program Leader, Texas Parks and Wildlife Department, Alpine, TX 79830, USA*

Abstract

As the host jurisdiction of the 26th Biennial Pronghorn Workshop, it is customary to provide a pronghorn (*Antilocapra americana)* status update on populations and management throughout North America. On February 18, 2014, a standardized questionnaire was sent out electronically to every state and province in North America within current pronghorn range, which includes 26 states and provinces in the United States, Mexico, and Canada. A total of 20 questionnaires were returned from across North America. Using the data received the North American pronghorn population is estimated to be about 804,180 animals. Wyoming's population is over half of the entire North American pronghorn population at 407,600 animals. The next highest populations are in Montana and New Mexico, which have estimated populations of 110,225 and 45,000 animals, respectively, while in Washington the population estimate was 23 animals. Montana, North Dakota, and South Dakota have all seen large population decreases in recent years. Sex ratios (bucks:100 does) vary across North American pronghorn populations, ranging from 18:100 in Oklahoma to 100:100 in Baja California Sur. Fawn:doe ratios also fluctuate throughout their range with ratios as low as 16:100 in New Mexico to 61:100 in Wyoming. Harvest data was collected by several different methods across districts. About 47,600 bucks, 24,700 does, and 2,300 fawns were harvested in 2013. Arizona and California did not allow the harvest of any does or fawns, while Baja California Sur, North Dakota, Saskatchewan, and Washington did not have hunting seasons in 2013. The questionnaire results will be used for comparisons and will help encourage the transmission of knowledge and data about pronghorn management across North America.

Key Words: pronghorn, *Antilocapra americana*, status report, workshop, North America

Introduction

The Biennial Pronghorn Workshop is a Western Association of Fish and Wildlife Agencies (WAFWA) sanctioned event, which requires the hosting jurisdiction to provide a pronghorn status update for all jurisdictions within current pronghorn range. In February of 2014, Texas Parks and Wildlife Department (TPWD) sent a standardized questionnaire electronically to 26 states and provinces in the United States, Canada, and Mexico. Of those, 20 questionnaires were returned by all the states and provinces in the U.S. and Canada and also by Baja California Sur in

Mexico. The data was then compiled into a database, which was used to give an update at the 26th Biennial Pronghorn Workshop and be available for future use.

Pronghorn management and population numbers across North America vary considerably. This status update is used to give an overview of current pronghorn population size, survey methods, hunting seasons, harvest numbers, sex and age ratios, predator management, and pronghorn related research projects throughout pronghorn range.

Population Survey Methodology and Population Estimates

Survey methods used to estimate pronghorn numbers varied immensely between jurisdictions. Fixed-wing line transect method was the most common survey technique used, while several other unique techniques were used by separate jurisdictions. Surveys from a fixed-wing aircraft were used by 16 jurisdictions, helicopter surveys were used by 4 jurisdictions, and ground surveys were used by 10 jurisdictions. Many jurisdictions used more than one survey type, while 1 jurisdiction did not survey for pronghorn. For the jurisdictions that used aerial surveys, 13 used line transects, 2 used strip transects, 2 used a directed search, and 1 surveyed opportunistically. Survey timing also varied. Surveys were conducted in the summer by 13 jurisdictions, winter by 3, and spring by 6. There were 6 states and provinces that surveyed in 2 different seasons, while none surveyed during the fall. Eleven surveyed pre-hunt, while 7 jurisdictions surveyed post-hunt. There were 7 jurisdictions that reported using some sort of sightability correction during surveys, while 13 jurisdictions did not correct for sightability.

In North America, the estimated pronghorn population was approximately 804,180 animals for 2012-2013. Numbers ranged from 23 pronghorn in Washington to an estimated 407,600 animals in Wyoming (2012 estimate), which is over half of the entire North American pronghorn population. Montana, Wyoming, Colorado, and New Mexico seem to be the core for North America's pronghorn population. These 4 states together hold more than 78 percent of the continent's total pronghorn population (Figure 1). The overall trend of pronghorn populations appears to be decreasing.

Sex ratios and fawn recruitment varied significantly across North America in 2013. In Baja California Sur, Mexico the buck:doe ratio was 1:1, whereas in Oklahoma the sex ratio was 18:100 (Figure 2). Most jurisdictions were around 40 bucks for every 100 does. Fawns:doe ratios were as high as 61:100 in Wyoming, and as low as 16 fawns per 100 does in New Mexico (Figure 3).

Hunting Season Structure

Hunting season lengths and methods varied considerably across North America. Hunting is a very important part of pronghorn management and most jurisdictions do their best to provide both resident and non-resident hunters with an opportunity to hunt pronghorn. Hunting season lengths and methods are listed by jurisdiction below in Table 1. Season lengths ranged from a 3 day rifle season in New Mexico to a 133 day archery season in Nebraska. Many jurisdictions had

separate seasons for muzzleloader and archery, while others had no separation. The most common license issuing strategy was a draw system, which was used by 13 jurisdictions. Landowner tags and over-the-counter tags were the other 2 strategies used, and all but 4 jurisdictions used a combination of 2 or 3 of these systems. Multiple harvest of pronghorn was allowed by 7 jurisdictions in North America, while 3 did not have a hunting season. Fifteen jurisdictions limited the amount of non-resident hunters, while 3 jurisdictions did not put any limitations on hunters from another jurisdiction. Additionally, 7 jurisdictions offered some type of youth hunt or youth season as a way to get kids started in the sport of hunting.

Harvest Summary

Harvest and harvest trends usually follow population trends. Wyoming harvested 41,064 pronghorn in 2013, which was the highest harvest in North America. Oklahoma, Kansas, and California had lower harvest numbers than other jurisdictions that had a season. Harvest data is important for managing pronghorn and is critical to determine if harvest objectives are being met. Thirteen jurisdictions used a web based survey or report either completely or with another survey type to obtain harvest data in 2013. Mail surveys are still being used by 7 jurisdictions, phone surveys by 6 jurisdictions, and 2 jurisdictions used other means to acquire harvest information. Half of the states and provinces that replied to the questionnaire had mandatory harvest reporting with the other half having voluntary reporting. During 2013, a total of 74,761 pronghorn were harvested across North America (47,634 bucks, 24,758 does, and 2,369 fawns). Estimated harvest is summarized by jurisdiction in figure 4.

Predatory Management

Since predation accounts for most mortality on pronghorn fawns, it can be important to implement predator management when populations are critically low. Jurisdictions were asked whether they have any strategies in place to manage coyote numbers as a management tool used to benefit pronghorn. Even though 7 jurisdictions reported that they conducted predator management, some were associated with livestock losses. One jurisdiction reported a statewide bounty system, which was livestock driven, but probably benefited pronghorn. Responses from jurisdictions that have implemented a predator management program are identified in Table 2.

Habitat Enhancements

Ten jurisdictions are actively enhancing pronghorn habitat. Fence modifications/removal, prescribed fire or fire rehab, brush control, and water development are the most utilized enhancements in pronghorn habitat. Most pronghorn habitat work is being done on federal, state, or provincial lands, but several jurisdictions are working with landowners on private lands. Partnering with private landowners is essential for pronghorn management since the majority of pronghorn range is privately owned in many jurisdictions (Figure 5).

Pronghorn Research and Restocking Efforts

New challenges face pronghorn through time. It is important that pronghorn managers and researchers continue to learn more about the species so that management strategies can be improved and modified to aid in facing these new challenges. In many cases, research and restocking are necessary to maintain pronghorn populations for the continued existence of the species throughout its range. Table 3 lists current research and restocking efforts that are being conducted by many different states and provinces.

Discussion

The questionnaire used to generate this status report was very similar to questionnaires used in previous biennial pronghorn workshops. There is a lot of variation in pronghorn survey techniques and methods, hunting seasons and lengths, habitat enhancements, predator management practices, and research projects among jurisdictions within pronghorn range. Private lands and working with private landowners continue to be a very important issue in regards to pronghorn management in most states and provinces. The reason for this workshop is to facilitate the sharing of information between jurisdictions. This is crucial to the management and long term survival of pronghorn across its range.

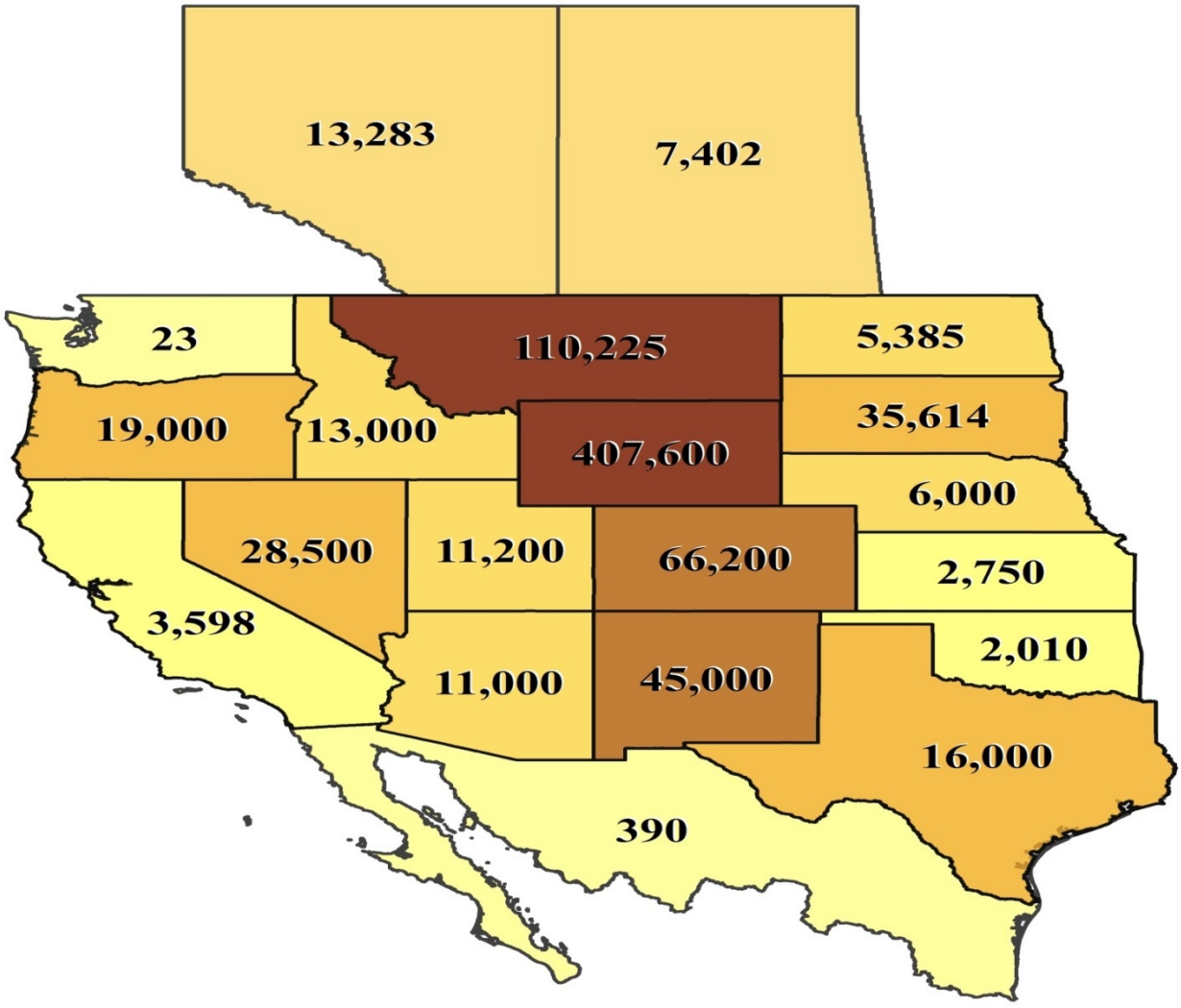

Figure 1. North American pronghorn population estimates by jurisdiction in 2013. Mexico represents only Baja California Sur's population estimate.

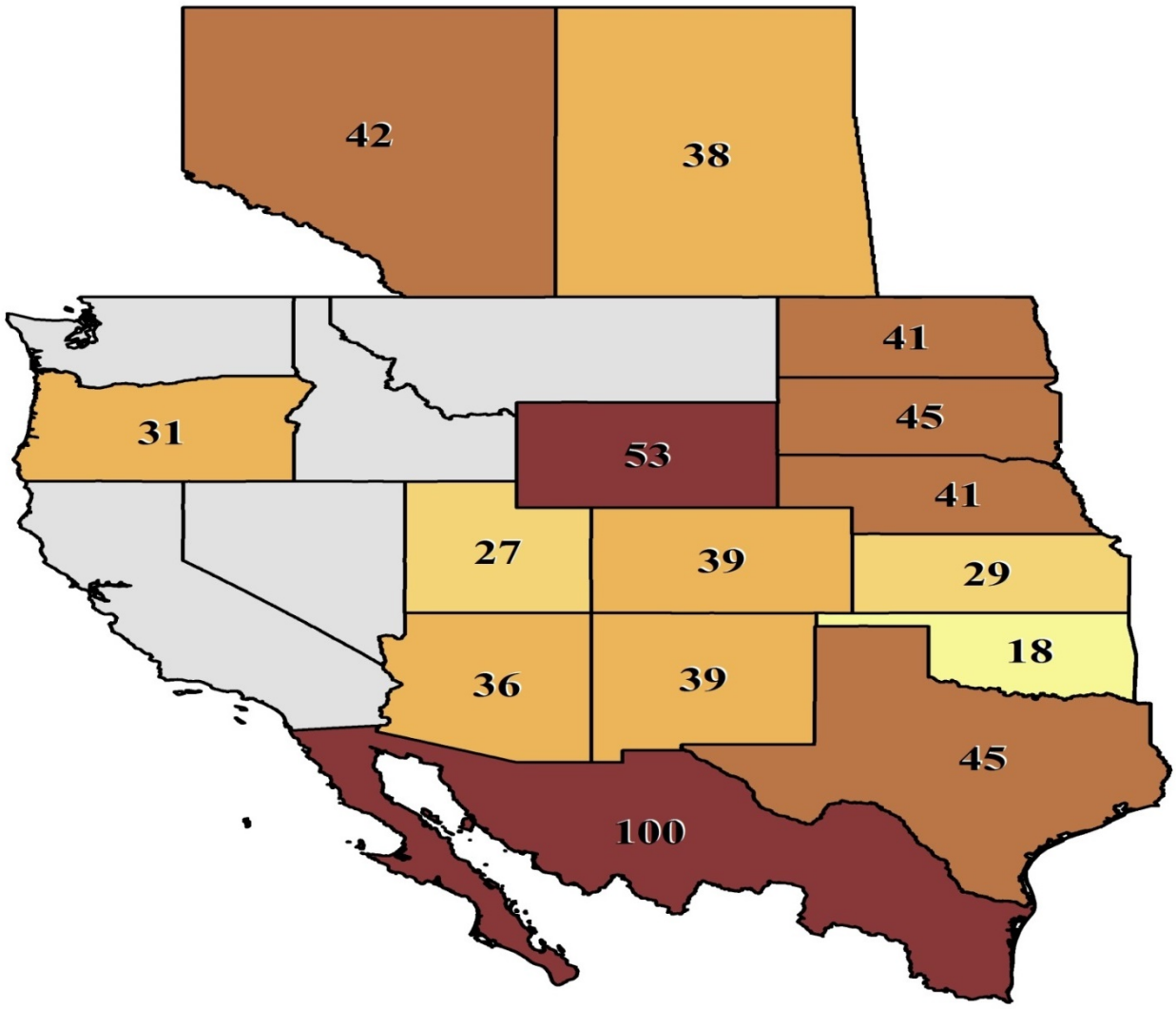

Figure 2. North American pronghorn sex ratios by jurisdiction in 2013. Each number represents the number of bucks for every 100 does. States illustrated in gray did not collect or report this information.

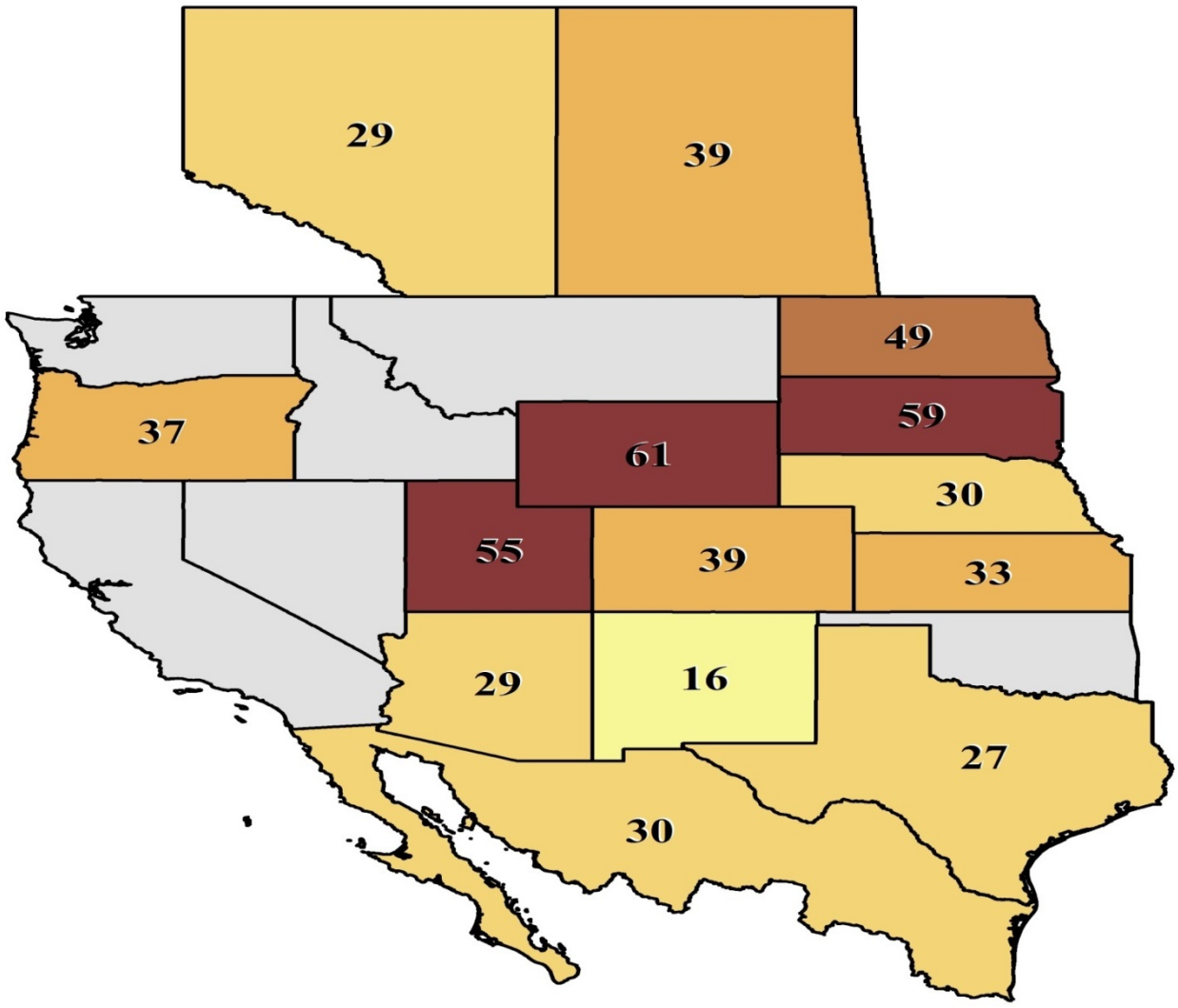

Figure 3. North American pronghorn fawn:doe ratios by jurisdiction in 2013. Each number represents the number of fawns for every 100 does. States illustrated in gray did not collect or report this information.

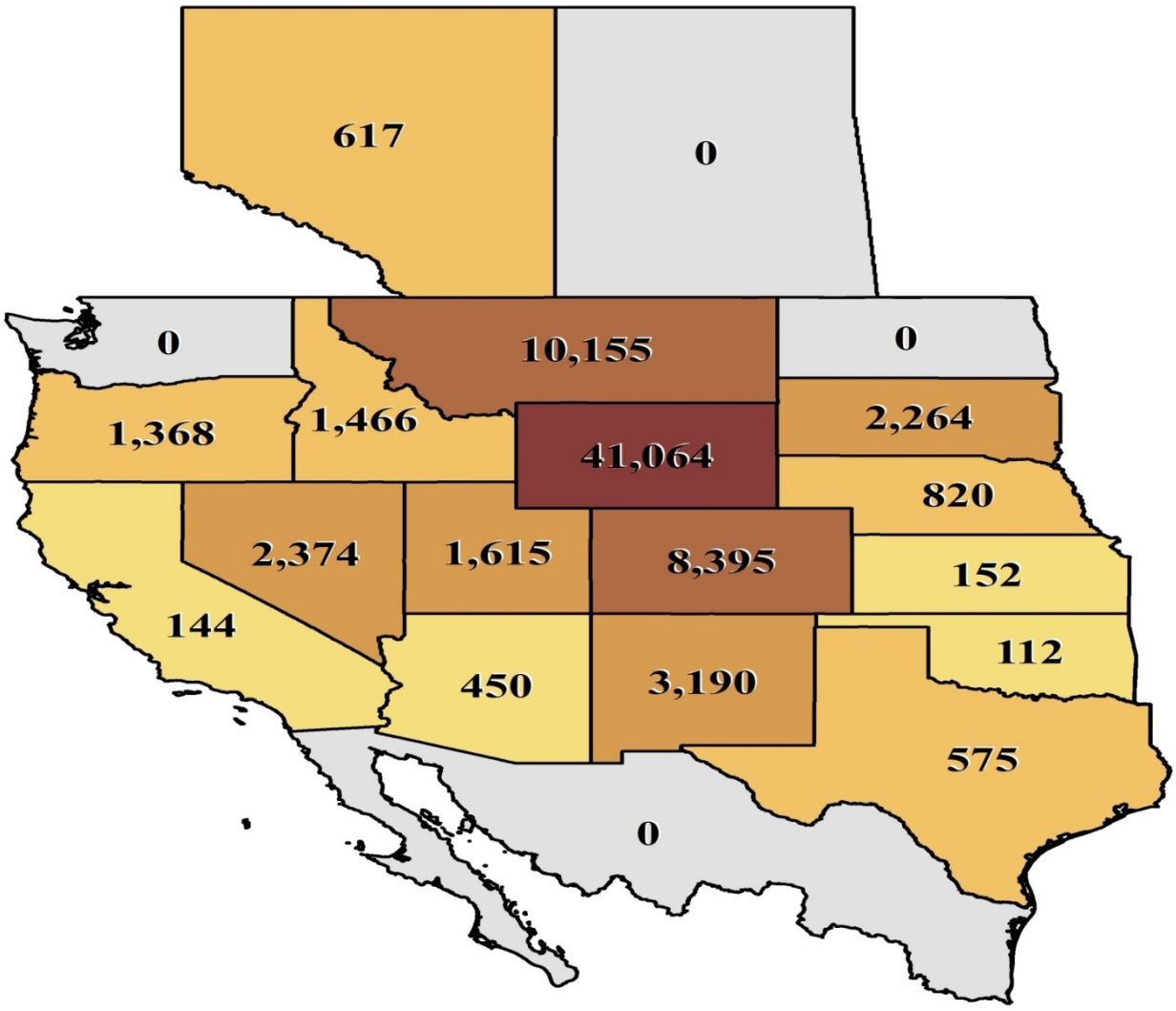

Figure 4. Total pronghorn harvest estimates by jurisdiction across North America in 2013.

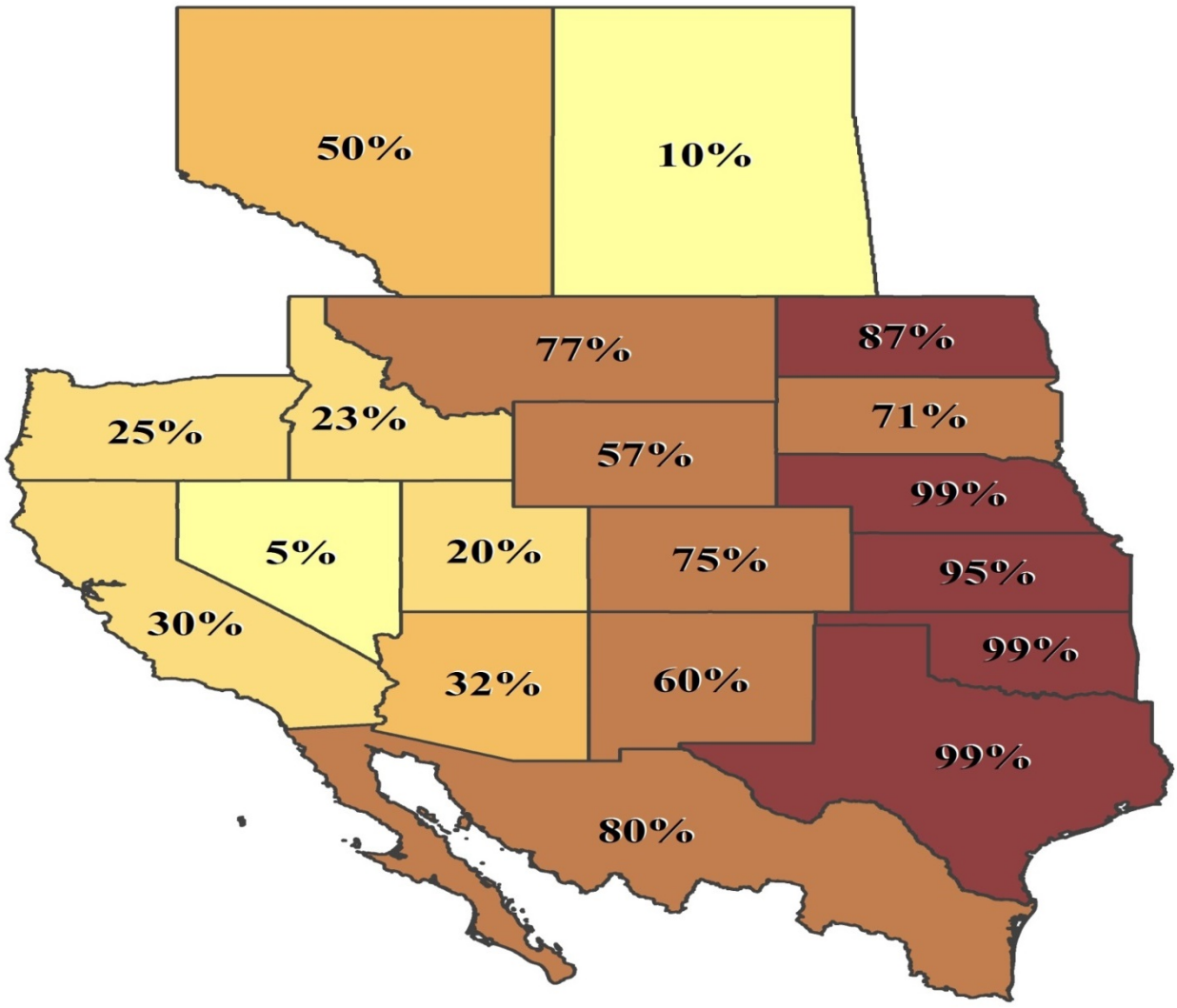

Figure 5. Percent of pronghorn habitat on private lands by jurisdiction across North America in 2013.

Table 1. Pronghorn hunting season availability and length (# of days) by jurisdiction across North America in 2013.

Jurisdiction	Rifle Season	Muzzleloader Season	Archery Season
AB	9	0	21
AZ	10	10	14
CA	9	0	14
CO	30	9	35
ID	30	30	30
KS	4	8	30
MT	30	0	88
NE	16	16	133
NV	15	0	21
NM	3	4	9
ND	16.5	0	37
OK	55	0	14
OR	16	9	30
SD	16	0	61
TX	9	0	0
UT	23	55	28
WY	30	20	30

Table 2. Predator management practices implemented by jurisdictions throughout North America in 2013.

Jurisdiction	Predator Management Practice(s) – Estimated Benefit
AZ	Targeted fawn survival – aerial gunning & leg-hold traps – increase in fawn & overall population numbers
BS	Targeted fawn survival – coyote proof fences and shooting of territorial coyotes
MT	Targeted fawn survival – aerial gunning through Wildlife Services – increase in fawn & overall population numbers
SK	For livestock damage
SD	For livestock damage
TX	Targeted translocation effort and fawn survival – Wildlife Services aerial gunning and trapper, also private trappers – higher transplant and fawn survival
UT	Wildlife Services and a statewide bounty system was used to control coyotes – increase in fawn production

Table 3. Research projects that are being conducted by jurisdictions across North America in 2013.

Jurisdictions	Research Activities

AZ, CA, ID, MT, SD, TX	Pronghorn movements and habitat use
ID, KS, TX	New survey methods or sightability model
NM, NV, TX, UT	Translocation success
NM, TX	VIT/fawn mortality study, modified fence camera study
NE	Impacts on winter wheat and spread of invasive plants by pronghorn
WY	Pronghorn response to increase in energy
NM, SD, TX, UT	Survival

Alpine, TX

May 12–14, 2014

Sanctioned by the Western Association of Fish and Wildlife Agencies

2013 State and Province Pronghorn Status Questionnaire

This questionnaire is to summarize current pronghorn population data across its range for the 26th Biennial Pronghorn Workshop. Please fill out the questionnaire with your most recent (2013) pronghorn data for your state/province and email the completed questionnaire by **March 15, 2014** to:

James Weaver
Texas Parks and Wildlife Department
Phone: (432) 426-2801
james.weaver@tpwd.texas.gov

Results from this questionnaire will be summarized in a status report and presented at the 26th Biennial Pronghorn Workshop in Alpine, TX by James Weaver and included in the workshop proceedings.

State or Province:
Agency:
Report submitted by:
Email:
Phone:

Population Survey Methodology

Aerial survey type and method (Line transect via fixed-wing, opportunistic via helicopter, etc.):

Ground surveys (Consistent route, targeted area, etc.):

How many years has your agency been using the aforementioned technique(s)?

Aerial timing (by month):

Ground timing (by month):

Population Survey Information

2013 Mean Population Estimate	
2013 Mean Population Management Objective	
2013 Average Bucks per 100 Does	
2013 Average Fawns per 100 Does	
Long-term Average Bucks per 100 Does	
Long-term Average Fawns per 100 Does	

Is population estimate pre-hunt or post-hunt?

Is population objective pre-hunt or post-hunt?

Do you correct for sightability of pronghorn?

☐ Yes ☐No If yes, how?

Are you satisfied with your survey methods and results? Why or why not?

Harvest Information

How are total harvest numbers collected in your state or province (web-based, phone/mail survey, etc)?

Is harvest reporting mandatory for pronghorn in your state or province?

Approximately what percentage of landowners/hunters report their harvest annually?

Does your agency collect ages and horn measurements from harvested pronghorn?

☐ Yes ☐No If yes, explain?

Does your agency have specific areas that are managed for quality than for opportunity? What proportion? What biological parameters designate each area (quality and opportunity)?

2013 Rifle Hunts:

Buck or Either-sex permits/licenses issued	
Bucks harvested	
Doe permits/licenses issued	
Does harvested	
Number of resident hunters	
Number of non-resident hunters	
Overall hunter success rate (%)	
Long-term hunter success rate (%)	

During which months are rifle hunts conducted (list all)?

What are the season lengths for rifle hunts?

2013 Muzzleloader Hunts:

Buck or Either-sex permits/licenses issued	
Bucks harvested	
Doe permits/licenses issued	
Does harvested	
Number of resident hunters	
Number of non-resident hunters	
Overall hunter success rate	
Long-term hunter success rate (%)	

During which months are muzzleloader hunts conducted (list all)?

What are the season lengths for muzzleloader hunts?

2013 Archery Hunts:

Buck or Either-sex permits/licenses issued	

Bucks harvested	
Doe permits/licenses issued	
Does harvested	
Number of resident hunters	
Number of non-resident hunters	
Overall hunter success rate	
Long-term hunter success rate (%)	

During which months are archery hunts conducted (list all)?

What are the season lengths for archery hunts?

Does your agency allow the general use of crossbows as legal archery equipment?

Hunter Participation

How are licenses issued in your state or province (through public drawing, via landowner authorizations, over-the-counter, etc.), if mixed what is the approximate % of each?

Can a hunter legally harvest >1 pronghorn in a given license year in your state or province, if so what is the bag limit?

Does your agency limit the number of non-resident hunters by statute or rule? If so, what is the limit?

Does your agency reserve licenses for youth or have special youth seasons, if yes how many or what % (please explain)?

What other means does your agency use to recruit hunters (especially youth), if any?

Habitat Enhancement

Is your agency actively involved with pronghorn habitat enhancements on federal, state, and/or private lands?

If so, what specific work is being done for each land category?

Private Lands

What percentage of occupied pronghorn habitat is privately owned?

Is there a portion of pronghorn permits/licenses that are issued to private landowners annually? If yes, what proportion and how are they issued?

Does your agency have a program that provides monetary compensation for private landowners to grant access for public pronghorn hunters? If yes, provide a brief description of the program.

In 2013, approximately how many acres of private land was opened to public pronghorn hunting in your state or province through this program?

Does your agency currently provide any type of incentive to private landowners engaging in habitat enhancements/restoration projects that target pronghorn?

How are depredation issues dealt with in your state or province (landowner tags, population management hunts, fencing, etc)? (Please explain).

Predator Management

What types of predator management measures and actions are currently being implemented by your agency?

What are the objectives of these measures and actions?

Does the data indicate a measurable response from these predator management actions? Please provide some detailed information to explain.

Do you believe your current predator work is cost effective?

Miscellaneous

What current management issue(s) is your agency working to resolve?

Is your agency currently transplanting pronghorn? If yes, explain (please include reasons for transplanting, source populations, trapping methods, average mortality rates, etc.)

Is your agency currently conducting pronghorn research? If yes, explain (please include title and main objectives of each research project).

Are there any research needs your agency would like to address in the future? (Please provide a brief description of each).

What do you consider to be the most significant factors that limit pronghorn population growth in your state/province?

Contributed Abstracts

Finding New Ways to Manage Pronghorn Populations in the Texas Panhandle

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The current method of issuing pronghorn permits in the Texas Panhandle, an area with a healthy and stable population of about 12,000 animals, requires knowledge of pre-season pronghorn population parameters and detailed information about current landownership. To gain this knowledge, extensive pre-season aerial surveys must be conducted and accurate documentation of ever-changing landownership must be meticulously maintained. Both of these tasks are extremely labor intensive and expensive. To address these and other issues with Texas Parks and Wildlife Department's (TPWD) current method of pronghorn permit issuance, an experimental season is currently being implemented in three separate pronghorn herd units of the Texas Panhandle (high, moderate and low density units). In these 3 units landowners are not limited by permit issuance but have complete control over hunting intensity/pressure on their property. Although the landowners are provided with harvest guidelines for a sustainable population, the actual harvest may be independent of pronghorn survey results or acreage owned, which is very similar to hunting regulations for other big game species in Texas. We plan to test the experimental season over a 3-year period. TPWD is closely monitoring this experimental season by implementing mandatory check stations to monitor buck harvest intensity and age structure, as well as conducting intensified population surveys for these areas. Following the first year of implementation, some preliminary results will be presented regarding age structure, harvest intensity and landowner perception. We will continue with the experimental season in the three designated areas over the next two hunting seasons and intensively monitor pronghorn populations to determine effects, if any.

History of the Natural Resources Conservation Service's Pronghorn EQIP and WHIP Initiative in Texas

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The Environmental Quality Incentives Program (EQIP) is a voluntary based conservation program that is administered by the Natural Resources Conservation Service (NRCS). It is available to producers that are engaged in livestock or agriculture production who are seeking financial assistance to implement conservation practices that address resource concerns. Twenty plus years ago pronghorn (*Antilocapra americana*) population estimates in the Trans-Pecos area of Texas were upwards of 15,000 animals according to Texas Parks and Wildlife Department (TPWD) records. Unfortunately, more recent population estimates by TPWD show the numbers to be around 3,000 animals. There are several factors that may be contributing to the recent decline in numbers that include, but are not limited to drought, disease, predation, movement barriers, and grassland degradation. NRCS along with other partners such as local Soil and Water Conservation Districts (SWCD) and TPWD believed there was a need to start addressing pronghorn habitat issues. Therefore, in 2007 a statewide priority area was created in the Trans-Pecos and approved for funding through the NRCS State Technical Advisory Committee for a new initiative to help facilitate range improvements within pronghorn habitat. Fiscal year 2009 was the first year contracts were funded, which summed $695,141 on just over 100,000 acres of pronghorn habitat. In 2010, the EQIP Pronghorn Initiative transitioned its way into the Wildlife Habitat Incentives Program (WHIP). WHIP was designed with an emphasis on wildlife, but other agriculturally productive operations could also qualify for funding. From fiscal year 2009–2013 EQIP and WHIP Pronghorn Initiatives have funded 65 contracts on 625,930 acres for $3,519,798 to implement conservation practices that benefit pronghorn habitat in the Trans-Pecos. Conservation practices that have been utilized include pronghorn-friendly fence, prescribed grazing, brush management, and water development. These federal dollars have allowed landowners to improve Trans-Pecos pronghorn habitat in an effort to reverse the region's declining pronghorn population trend.

Habitat Selection of Translocated Pronghorn in the Trans-Pecos, Texas

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Translocation and reintroduction efforts of pronghorn (*Antilocapra americana*) have been employed in an effort to counter long-term population declines in the Trans-Pecos region of Texas. However, habitat preference and selection are poorly understood in this region and better information is needed to assess potential reintroduction sites and manage habitats. The influence of desirable forage on habitat selection in particular needs to be assessed to guide assessment of future release sites and maximize survival of translocated animals. In January of 2013, 125 pronghorn, 59 of which were equipped with store-on-board GPS collars, were released into the Marathon Basin, TX. Vegetation sampling was conducted seasonally throughout the study area following release. Seasons were defined as Warm Dry (April – June), Warm Wet (July – October), and Cool (November – March), based on a Newhall Soil Climate Model of the Marathon Basin as well as pronghorn fawning and breeding seasons. The Warm Dry and Warm Wet seasons were represented in collar data. Visual obstruction, basal cover of live plants, and relative species composition data were taken at 30 random points within each Ecological Site. Averages from the collected habitat data were used to represent the habitat structure of each Ecological Site in each season. Logistic regression was used to determine preference of each site by pronghorn. Used locations were derived from collar data and availability was derived from random points generated throughout the study area. The number of random points generated was equal to number of pronghorn location points for each season. Results are pending; however, we hypothesize that higher availability of desirable forb species and higher basal cover of live plants will correlate to a higher probability of use of a given habitat type.

Brush Density Selection of Pronghorn in the Marathon Basin, Texas

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Pronghorn (*Antilocapra americana*) habitat is mostly characterized by rangelands with little to no brush species. However, there is an unknown level of brush composition in the Marathon Basin, TX, that pronghorn will select for and against. Brush composition can be significant for predator avoidance and fawning cover as well as a source of browse. The objective of this project was to identify the brush species composition and prevalence that pronghorn will and will not utilize. The methods to achieve our goals were to create fifty points that were randomly generated, using ArcMap, in the Marathon Basin to measure visual obstruction and plant species prevalence. Visual obstruction measurements were recorded by using the Robel range pole method at four intervals of 25 meters (25, 50, 75, 100) at each of the four cardinal directions from a random point. At each random point, a 100 x 5 meter modified-belt transect and line intercept was randomly assigned to one of the four cardinal directions. From the belt transect we were able to estimate shrub density and canopy cover of plant species within a 100 m radius of a given point. Using the 100 m buffer, we generated a density-cover map of the study area. We subsequently overlaid pronghorn point data, obtained from a companion study, onto the density-cover map. Each random point was assigned a value of 1, if pronghorn locations occurred within the buffer, and 0 if they did not. We then generated a matching set of random locations to represent availability. Logistic regression was used in RStudio to analyze the probability of pronghorn use across the range of available brush variables. The final results of this data will be helpful in brush management for pronghorn, and will expand our ability to manage pronghorn habitat in the Trans-Pecos region of Texas.

Winter Resource Selection by Pronghorn at the Northern Limit of Their Range

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The pronghorn (*Antilocapra americana*) is considered a native prairie obligate, yet in Alberta, we routinely see pronghorn in a variety of habitat from native prairie to cultivated lands. The objective of our study was to examine the resource selection patterns of pronghorn in Alberta and Saskatchewan. We captured 74 individual female pronghorn in Alberta in a variety of land cover types between 2003 and 2007. There were three distinct groups of pronghorn based on the results of the detrended correspondence analysis, which we labeled as Native, Cultivated, and Mixed, referring to the dominant land cover in their fawning ranges. We used logistic regression to model the resource selection patterns of three groups of pronghorn during the winter at the landscape (2^{nd} order) and home range (3^{rd} order) scales. At the landscape scale, each group of pronghorn had top models consisting of the variables land cover, land form, distance to express highways and the quadratic terms for distance to arterial roads and distance to collector roads. The k-fold cross validation indicated good model performance. The Native and Mixed groups were less likely to use annual cropland and perennial cropland, whereas the Cultivated group was more likely to use annual cropland and perennial cropland when compared to grassland. At the home range scale, the top models for each group consisted of one or more road variables, but the top models did not perform well. In Alberta and Saskatchewan, pronghorn are exhibiting top - down selection patterns with the strongest patterns occurring at the landscape scale, with little evidence for selection at the home range scale.

Response of Pronghorn Population Productivity in the Red Desert, Wyoming to Anthropogenic and Environmental Change

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Pronghorn in the Red Desert of southwestern Wyoming have declined by approximately 50% over the past two decades as this region has experienced persistent drought, episodes of harsh winter weather, and a dramatic increase in energy extraction. Such environmental and anthropogenic stressors have the potential to influence pronghorn by compromising availability and quality of forage, degrading body condition, and altering movement patterns, habitat selection, behavior, and demography. In fall 2013, we captured and equipped 130 adult female pronghorn with GPS or VHF transmitters to initiate a new study to evaluate the impact of multiple factors on pronghorn population productivity in the Red Desert. Our study will evaluate measures of pronghorn herd productivity (fawn production, adult female survival), resource selection, behavior, and physiological response (stress levels, body condition) to environmental and anthropogenic change for adult female pronghorn in the Wyoming Game and Fish Department Baggs and Bitter Creek herd units, which are exposed to natural gas development, as compared to those of pronghorn in the northern portion of the Red Desert, where energy development is minimal. Our work will increase knowledge of pronghorn populations in the face of energy development. As environmental conditions change and energy infrastructure expands, our ability to assess the effects of climate change and resource extraction on pronghorn will be critical to guide mitigation and management of pronghorn.

Prediction of Pronghorn Stress During Translocation

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Animal populations in severe decline can be prevented from local extirpation through supplementation of individuals from stable source populations. This process involves the capture and translocation of individuals from viable populations, and their subsequent release and integration into a population at risk. Despite the anticipated benefits to the supplemented population, capture and translocation of wild animals can induce considerable stress to individuals being captured. Prolonged levels of stress, or events causing acute stress in the individual, may cause death resulting from capture myopathy. Estimates of non-capture related cortisol can be obtained from fecal samples collected from individuals at capture. Glucocorticoids produced approximately 10–12 hours prior to capture can be estimated from fecal glucocorticoid metabolites (FGM). Fecal samples collected from the individual at the time of capture can represent FGM prior to handling and can be assumed to be the baseline glucocorticoid measure for that individual. Therefore, levels of stress in an individual can be quantified by comparing serum cortisol to baselines estimated from fecal samples collected at time of capture. In an effort to bolster pronghorn numbers in the Trans-Pecos, the Texas Parks and Wildlife Department in conjunction with the Borderlands Research Institute initiated a pronghorn translocation program in 2011. Our goal was to identify factors that may help to predict individuals most at risk of capture myopathy, so that special focus may be directed to their survival. Our objectives were to; 1) establish cortisol baselines in captured individuals, 2) assess relative stress in individuals at time of capture by comparing serum cortisol to fecal cortisol, 3) using creatine kinase (CK) and aspartate aminotransferase (AST) as indicators of myopathy, quantify the relationship of serum cortisol to capture myopathy, 4) determine if elevated serum cortisol reliably predicts mortality and, 5) identify physiological correlates with serum cortisol. Results from fecal analyses are pending. Serum cortisol concentration was not significantly different between genders or age classes. Serum cortisol was not a reliable predictor of AST or mortality, but was a reliable predictor of CK. Increasing body temperature reduced the likelihood of mortality. At the time of capture, individuals surviving to 4 weeks post-release had

an average body temperature of 39.3 ºC and individuals who died had an average body temperature of 38.6 ºC. The administration of Banamine® to high temperature individuals at capture stations may have had the result of reducing the effect of CK, AST, and temperature – thereby influencing our model results.

Post-release Survival of Translocated Pronghorn in the Trans-Pecos Region of Texas

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Restoration has been a key component in maintaining pronghorn (*Antilocarpa americana*) populations and preventing extirpation across suitable habitat since the early 1900's. Approximately 30,000 pronghorn have been trapped and relocated in the past century throughout the western states. Post-release monitoring for capture related mortality and survivorship was limited by cost, logistics, lack of technologies, and other factors. Ultimately success was measured by the transplanted animals either prospering or perishing. Recently, (2008) populations in the Trans-Pecos region of Texas began a significant decline to a degree that translocating pronghorn to bolster existing brood-stock became a tenable option. Contributing to the decline was ultimately nutritional deprivation, the result of droughty periods and subsequent decreased habitat quality, resultant poor fawn recruitment, intense predation, and disease (*Haemonchus spp.*). To supplement these declining populations we translocated a total 432 pronghorn in 2011 (n = 200) and 2013 (n = 130) utilizing helicopter net-gun capture methods. Texas Parks and Wildlife Department (TPWD) and Borderlands Research Institute at Sul Ross State University (BRI) took this opportunity to closely monitor all aspects of our translocation efforts with the goal of documenting true survivorship, updating/improving survivorship information and capture/transplant protocols, and increasing success of future efforts. Our objectives included (1) investigate effects of capture on translocated pronghorn and (2) monitor survivability and identify causes of mortality. We deployed 139 radio-collars (ATS GPS G2110D = 87, ATS VHF M2510B = 52) on translocated pronghorn. In 2011, we estimated 15% survival 300 days (programmed dropped release of GPS collars) post-transplant. A total of 68

mortalities out of 80 radio-collared were documented. Identified causes were transport (*n* = 2, 2.5%), capture myopathy (*n* = 8, 10%), predation (*n* = 17, 21.3%), car collisions (*n* = 2, 2.5%), Haemonchosis (*n* = 2, 2.5%), and unknown causes (*n* = 37, 46%). During our 2013 translocation effort, we documented 14 of 59 (23.7%) GPS radio-collared mortalities 300 days post-release. Causes of mortality were transport (*n* = 1, 1.7%), capture myopathy (*n* = 5, 8.4%), predation (*n* = 4, 6.8%), lightning strike (*n* = 1, 1.7%), and unknown causes (*n* = 3, 5%).

There is a significant reduction in the number of mortalities from 2011 compared to 2013. We attribute this to improved range conditions and intensive site preparation measures not undertaken prior to 2011 release (e.g. fence modifications, predator control), as well as capture and transport protocol adjustments made after the 2011 translocation effort. Intense post-release monitoring has helped TPWD and BRI develop a modern capture/transport protocol for pronghorn and sound requirements for site preparation prior to release. Other invaluable information has been gleaned from these studies that have given biologists, landowners, and managers greater insight when making management decisions regarding pronghorn.

Post-release Movements of Translocated Pronghorn in Trans-Pecos, Texas

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Pronghorn (*Antilocapra americana*) are an iconic big game species in North America. Populations have significantly declined over the last 5–6 years in the Trans-Pecos region of Texas because of a variety of factors. To supplement severely depleted pronghorn populations in the Trans-Pecos, a translocation program was initiated in January of 2011. Sources of pronghorn have come from the northern Texas Panhandle. These pronghorn were released in the Marfa Plateau and Marathon Basin areas of the Trans-Pecos. In 2013, a total of 125 pronghorn (108 F, 16 M) were captured from the northwestern Panhandle (near Dalhart, TX) and released in the Marathon Basin of the Trans-Pecos (near Marathon, TX). Of the total released, 52 F and 6 M were equipped with Global Positioning System (GPS) collars (ATS G2110D) designed to obtain one location/hour with a 300-day battery life to estimate home ranges, dispersal from release site, and daily movements. After 300 days, 44 collars dropped and were retrieved from the remaining collared pronghorn. We removed four collars (9%) from analysis because of collar malfunction. Therefore, 40 collars were used to estimate home ranges, dispersal distances, and daily movements of translocated pronghorn post-release. Estimates for home range will be obtained by Geospatial Modeling Environment (GME) using Least Squares Cross Validation. Dispersal distances from release and daily movements will be analyzed using Geographic Information Systems (ESRI). The results provided from this study will allow us to compare movements of pronghorn from 2 years of translocation (2011 and 2013) and provide needed information to help bolster pronghorn populations in the Trans-Pecos region.

Home Range, Habitat Use, Survival, and Limiting Factors of Pronghorn Ten Years Post-reintroduction

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Archaeological evidence suggests that pronghorn (*Antilocapra americana*) were once common in small bands in Grand Staircase-Escalante National Monument (GSENM). By the end of the 19th century, there were none. Between 1999 and 2004 GSENM and Utah Division of Wildlife (UDWR) had reintroduced several hundred pronghorn back to this native range. The apparent decline in number and the inability of the reintroduced herd to reach population objectives prompted GSENM staff to conduct a tracking study to determine home ranges, seasonal movements, survival rates, and if possible, limiting factors on this herd. In January 2012, 25 adult does were captured and fitted with store-on-board GPS tracking collars. Capture related death and myopathy was very high (28%), possibly due to repeated capture attempts due to low density pronghorn. After two years of collecting four points daily, the collars were collected and the data analyzed. Data revealed that the pronghorn initially dispersed in all directions, crossing highways and other barriers and colonized three distinct geographic areas. Since initial colonization, these three herds have become isolated from one another and appear to have no gene flow between herds. Two of the three herds may not be viable without augmentation. Annual survival rate was 89% and 94% in years one and two of the study. Highways, once crossed during dispersal, now appear to be total barriers to movement among all three herds. Parturition coincides with the driest climatic period, resulting in low reproductive rate and poor recruitment. A 'boom or bust' recruitment cycle is occurring in all three herds, booming with precipitation and busting on dry years. Lack of water resources appears to be a major limiting factor in two of the three herds. An extended drought could prove to be the last straw for the pronghorn. These findings have potential major implications for land managers. Future augmentations may be needed to sustain a viable population. Highway underpasses may be necessary to promote movement between herds. As the climate begins to become hotter and drier, wildlife species such as pronghorn may rely to a greater extent on man-made water sources such as guzzlers, troughs, and ponds for herd recruitment during periods of drought. An extended drought of 5-10 years could potentially devastate the fragile few pronghorn residing within the Monument.

Prevalence of Disease in Texas Pronghorn

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Diseases such as blue-tongue virus (BTV) and epizootic hemorrhagic disease (EHD) can cause large scale die-offs in some pronghorn populations. Prevalence of EHD has been reported to be as high as 78% in Arizona pronghorn populations. In certain populations high prevalence of these diseases with low mortality may indicate some level of resistance. The stomach parasite *Haemonchus* is a highly prolific nematode afflicting both wild and domestic ruminants. *Haemonchus* can cause a wide variety of infections in ruminants, and has previously been reported in many species such as deer, bighorn sheep, and pronghorn. Almost all of Texas' pronghorn reside in the Panhandle and Trans-Pecos regions. Prevalence of BTV and EHD in Texas pronghorn was unknown. Studies from the 1960's documented low prevalence of *Haemonchus* in the Trans-Pecos, but no recent data existed. The objective of this study was to determine prevalence of BTV, EHD, and *Haemonchus* in Texas pronghorn. Prevalence of BTV and EHD were determined from blood samples collected from pronghorn harvested in the Trans-Pecos in 2010 and 2011. Additional blood samples were collected from pronghorn harvested (2010) and translocated (2011, 2013, 2014) from the Texas Panhandle. Prevalence of *Haemonchus* was determined from fecal samples collected directly from the rectum of hunter-harvested pronghorn in 2009–2011 in the Trans-Pecos, and in the Panhandle from harvested or captured pronghorn in 2010, 2011, 2013, and 2014. Fresh fecal samples were also collected from animals that were observed on native ranges in both regions. Prevalence of BTV and EHD from hunter harvested Trans-Pecos pronghorn was over 90% in 2010 and 2011. Prevalence of BTV ranged from 87–93% during the study in pronghorn translocated from the Panhandle. While EHD prevalence was 51%, 84% and 98% respectively in 2011, 2013, and 2014 for the translocated pronghorn. The presence of *Haemonchus* was very high in Trans-Pecos pronghorn

with 96%, 98%, and 88% of the sampled pronghorn infested with the worm respectively in 2009, 2010, and 2011. The occurrence rate of *Haemonchus* in Panhandle pronghorn harvested or captured was lower than the Trans-Pecos (90%, 53%, 42%, and 30% in 2010, 2011, 2013, 2014). From 2010 to 2014, the average number of *Haemonchus* eggs in the feces was 264 eggs/gram for pronghorn captured in the Panhandle compared to 1,189 eggs/gram in the Trans-Pecos. The high prevalence of BTV and EHD in pronghorn populations in Texas suggests pronghorn have some level of resistance to the diseases. Data indicate that with poor nutrition levels Trans-Pecos pronghorn appear more susceptible to *Haemonchus* infection, which may be an additive factor contributing to population declines in the region.

Texas Pronghorn: What Produces a Trophy?

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Pronghorn (*Antilocapra americana*) are an iconic big game species in North America that provide many sportsmen opportunities for meat, a hunting challenge, and trophy horn quality. Pronghorn are the only known ungulate with the sheath shedding from a bony core annually, a feature that adds even more value to this truly unique animal. However, little is known about how horn growth is regulated through nutrition or climate. The Texas Big Game Awards (TBGA), a hunting program in Texas formed through the Texas Wildlife Association and Texas Parks & Wildlife Department, has accepted entries of Boone & Crockett (B&C) scores from native Texas big game since 1991. We conducted retrospective analysis of spatial patterns of TBGA qualifying pronghorn with B&C scores >80 since the beginning of the program. Our chief interest was to identify geographic clustering of trophy pronghorn within the state and investigate spatial aspects (soils, habitat, and precipitation from Geographic Information System coverages) that could play a role in trophy production. An important aspect of this study was to understand the weight of entries entered per county. Totals included 224 entries where 147 were entered from Hudspeth County, 30 from Dallam County, and 13 from Hartley County. Other counties had ≤5 entries.

Towards a Universal Method for Estimating Ruminant Diet from Faeces

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Methods of determining diet selection in herbivores, such as direct observation, pasture analyses before and after feeding trials, tracheal bags, and stomach content analyses can be useful tools in some circumstances. However, these methods may have limitations such as if animals cannot be directly observed, feeding occurs in unsecured pastures, tracheal bags cannot be fitted, or killing the animal to obtain stomach contents is not feasible. Microhistological fecal analysis presents an unobtrusive method for the determination of diets in ruminants. To date, proposed microhistological fecal analyses methods have been largely species specific and have been developed using domesticated livestock or captive animals as study species. Differential digestibility of 'wild' forage, and differences in the digestive tract of wild animals compared to domestic animals, often results in inadequacies of microhistological methods when applied to wild species. The objective of this study was to develop a consistent set of methods that would be widely applicable to a range of wild ruminants occupying different landscapes and habitats. We analyzed 75 fecal samples from sable antelope in the Kruger National Park, South Africa; 35 and 30 fecal samples respectively from puku and lechwe in the Chobe National Park, Botswana; and we are currently in the process of analyzing samples collected from pronghorn in the Trans-Pecos region of west Texas. Our method proved to be appropriate at clearing mesophyll pigments from the epidermis allowing identification of the plant species through stomata, silica bodies, silica cells, guard cells, trichomes, and various other epidermal structures. This method

allowed us to determine seasonal and locational differences in the contribution of *Panicum maximum, Themeda triandra,* and *Digitaria eriantha* to the diets of sable in the Kruger National Park. When assessing the diet of puku and lechwe in the Chobe National Park, significant differences were detected between estimates of dietary contributions made from fecal analysis and direct observation, thereby highlighting the need for a correction index. Analyses of pronghorn samples are currently underway with initial indications showing this method to be suitable. Assuming some measure of correction is made for differential digestibility of plant species in the diet; our method of microhistological fecal analyses appears to accurately quantify the relative dietary proportion of plant species consumed by various ruminant species occupying diverse habitats and landscapes across two continents.

The Determination of the Leading Causes of Pronghorn Fawn Mortality throughout the Trans-Pecos Region

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Texas Parks and Wildlife Department (TPWD) has shown through the use of fixed-wing aerial surveys a constant decline in pronghorn (*Antilocapra americana*) fawn recruitment throughout the Trans-Pecos. From 2008–2012, TPWD surveys indicated that fawn crops averaged 15% in the Trans-Pecos. However, in 2013 there was an increase in fawn production with an average of 28% for the region. Fawn recruitment is critical for pronghorn populations to thrive and chronically low fawn crops appear to be contributing to the overall pronghorn decline in the Trans-Pecos. We conducted a pronghorn fawn mortality study from 2011–2013 to determine causative factors leading to poor fawn survival. A total of 26, 34, and 40 fawns were captured and radio-collared with expandable VHF collars (ATS M4210 Expandable Breakaway Collar) in 2011, 2012, and 2013, respectively. Twenty-three mortalities and 2 surviving fawns were recorded in 2011. One fawn died from unknown causes (4%), while another fawn was censored (e.g., transmitter malfunction) and was never located after capture. Coyote (*Canis latrans*) and bobcat (*Lynx rufus*) predation were equal, with both accounting for 26% (n = 6) of all mortalities in 2011. Unknown predation accounted for another 44% (n = 10). In 2012, 27 mortalities and 7 surviving fawns were documented. Bobcats were the most prolific predator accounting for 37% (10/27) of the mortalities. The second greatest mortality factor was coyote predation at 22% (6/27), while unknown predation was 15% (4/27). Other mortality factors including grey fox (*Urocyon cinereoargenreus*) and golden eagle (*Aguila chrysaetos*) predation, abandonment, and unknown causes accounting for 26% (7/27). In 2013, 50% (20) of the 40 radio-marked fawns perished, while the other 50% (20) survived through the study period. Coyote predation was 40% (8/20) of all mortalities, while bobcat predation was 25% (5/20). Grey fox and unknown predation were 5% (1/20) and 25% (5/20), respectively. Another 5% (1/20) was undetermined mortality. The main mortality factor throughout the 3-year study was predation, which

accounted for 87% (64/74) of all mortalities. Fawn weight was another factor that appeared to affect fawn survival. In 2011, fawns weighed an average of 2.4 kg at 12.6 days old. We observed an increase in weight and survival in 2012, where fawns averaged 3.8 kg at 9.8 days old. In 2013, our survival was the greatest and fawn weights averaged 3.5 kg at 8.5 days. Data suggest nutrition and predation have the greatest impact on fawn survival in the Trans-Pecos.

Modelling Pronghorn Population Dynamics in the Texas Panhandle

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Pronghorn populations in the Texas Panhandle are evaluated on an annual basis by the Texas Parks and Wildlife Department (TPWD) for the purpose of monitoring populations and determining harvest numbers for each pronghorn herd unit. Herd units are representative of the occupied pronghorn habitat in the Panhandle wildlife district and each herd unit is delineated by natural and man-made barriers. Fixed-wing aerial surveys are the primary means for gathering demographic data for pronghorn populations in Texas. Many state agencies, including TPWD, often use mathematical models to estimate the size of a given pronghorn population. However, a variety of modeling methods and computer simulation programs are available to wildlife managers for the purpose of estimating pronghorn population dynamics. The proposed project seeks to analyze pronghorn population data from the Texas Panhandle for trends in population demographics and size by using different population modeling methods and comparing the outputs from each model. The results of the model comparison may be used by landowners, stakeholders, and wildlife agencies to evaluate their current population estimation techniques as well as select the model that best fits their individual datasets and management needs.

A Comparison of Two Release Methods for Pronghorn Reintroduction in Coahuila, México

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The pronghorn (*Antilocapra americana)* has been extirpated over much of their former range in Mexico and is listed as endangered. El Carmen Project in collaboration with New Mexico Department of Game and Fish and Mexican natural resource entities began a pronghorn reintroduction in northern Coahuila, México at Los Pilares on 9,000 ha of restored desert grasslands. The first capture, n=45 (20F, 25M) was in February 2009 near Logan, New Mexico and the second capture, n=55 (50F, 5M) took place near Clayton, New Mexico in March 2010. The first group of 45 pronghorn, were hard-released and the second group of 55 were soft-released. We compared the hard release method where animals were immediately liberated into the release area to the soft-release method, which involved holding the pronghorn in a 7 ha pen for 18 days with food and water before liberating them into the release area. Pronghorns were monitored over a two year period. Results of the hard release were a 23% mortality rate, 46% dispersal rate, with 31% remaining in the release area. The soft release method resulted in a 4% mortality rate, 13% dispersal rate and 83% remained in the release area. Our data suggests that the soft-release method lessened mortality, especially from capture myopathy, and developed stronger site and herd fidelity.

Winter – Spring Movements of Satellite GPS Collared Pronghorn in the Texas Panhandle in Relation to Barriers and Agriculture

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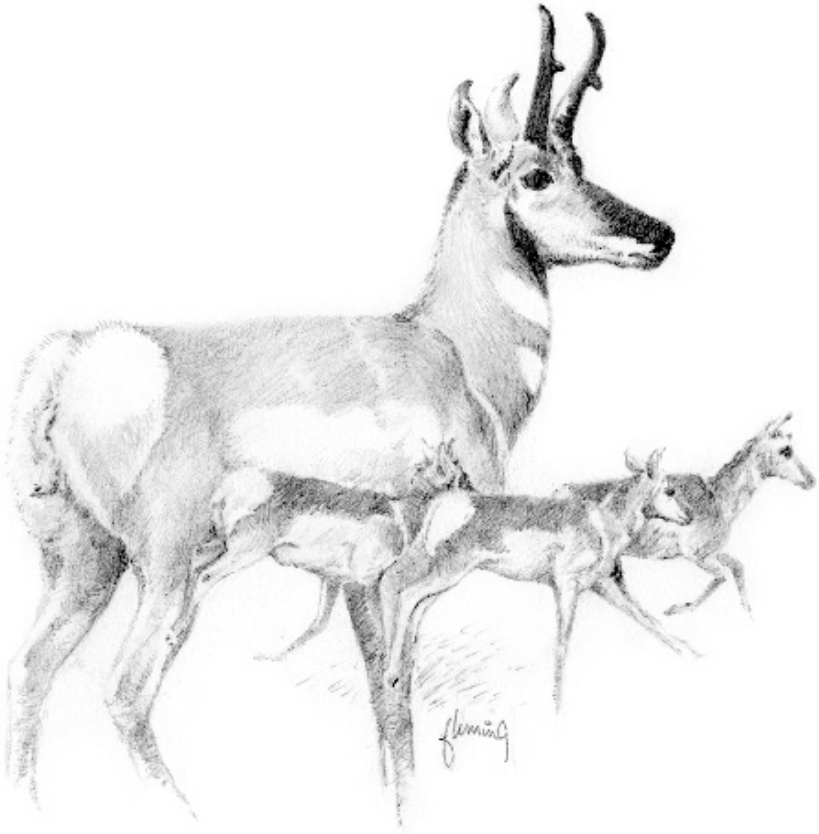
Pronghorn have large home ranges and are capable of making long distance movements both daily and seasonally. However, not much is known about seasonal movements or habitat use in the southern Great Plains, or the animals' use of agriculture fields. Although it is well documented that barriers influence pronghorn movements, there is little information on the influence of the various types of barriers in an area that is a mosaic of irrigated agriculture and livestock production. Information regarding these factors is valuable in pronghorn management. In March 2014, we captured and fitted 50 pronghorn with GPS collars. We collared 17 females and 8 males at each of two sites in Pampa and Dalhart, Texas. Of the 25 collars on each site, 10 were Sirtrack Pinnacle Iridium satellite GPS collars placed on 7 females and 3 males. Preliminary data from the satellite collared animals indicates that U.S. Routes 87 and 54 near Dalhart may be barriers, with only one male pronghorn crossing Route 87 twice. State highway 70 appears to be a barrier within the Pampa study site, with 6 of the 10 collared pronghorn approaching the highway, but never crossing it. The other 4 collared animals avoided the highway completely. All collared pronghorn in the Dalhart area moved through agricultural units, specifically center pivot fields. Additional analyses to be conducted will provide finer scale data on resource selection, movement, home range sizes, interaction between collared animals, and fawning movements.

Awards



Berrendo Award

This award is the most significant award offered through the WAFWA sanctioned Pronghorn Workshop. One award per workshop is given to an individual or a group of collaborators who have made great contributions to management or research for pronghorn. The award is named for a desert pronghorn, an animal that epitomizes the difficulty of being a pronghorn.

Nomination Criteria

1. An individual, organization, or group of collaborators that has gone well beyond normal job expectations in a project related to pronghorn.

2. These contributions need to afford significant scientific advances in the management or research of pronghorn.

3. These contributions can represent a single event or a long-term commitment to pronghorn.

Previous Winners

2002 Jim Yoakum (deceased)

2004 Bart O'Gara (deceased)

2006 Tom Pojar

2008 Richard Ockenfels

2010 Rich Guenzel

Nomination for 2014 Pronghorn Workshop Berrendo Award–Tommy Hailey

By Billy Tarrant

Tommy Hailey was born and raised near Ivan, Texas, on property that has been in his family since 1870. His passion for wild things fostered at a young age, and after high school he attended Tartelton State University before transferring to Texas A&M University. After graduation, Tommy hired on with Texas Parks and Wildlife Department (TPWD - Texas Game and Fish Commission at the time) and was stationed in Alpine in 1957. After a two year break to serve in the military, Tommy and his family moved back to Alpine in 1959 to reassume his duties as TPWD Wildlife Biologist working on numerous projects in the Trans-Pecos. In 1973 he was able to return to his family's place near Ivan and begin work as one of TPWD's first Technical Guidance Biologists, serving 73 counties in north-central Texas. After 40 years of service with TPWD, Tommy retired and began an 11 year career as a private Wildlife Biologist providing recommendations and guidance to landowners. Tommy's long term commitment to natural resource management is summarized by his statement that he never looked at it as work, but as a way of life that he always enjoyed.

Tommy's greatest contributions to pronghorn management came during the years he was employed in the Trans-Pecos. In spite of other wildlife responsibilities (deer, quail, dove, nongame, wildlife management area operations, and a fledgling desert bighorn sheep restoration program), Tommy accomplished an astonishing amount of research, monitoring and outreach specifically for pronghorn.

Tommy and fellow TPWD biologists/game wardens worked with numerous local cooperating ranchers to access pronghorn populations for the purpose of collection and monitoring. From 1966 through 1971, Tommy and his team captured, tagged, released and monitored 367 fawns throughout the Trans-Pecos. Between 1965 and 1967 they collected adult pronghorn during every month of the year and analyzed rumens to quantify seasonal food habits. From 1960 to 1970, Department personnel collected blood films and kidneys from hunter harvested pronghorn carcasses to ascertain disease prevalence. Annual surveys during Tommy's Trans-Pecos tenure required several months of flying 7 days a week, and numerous years Tommy was forced to fly the entire time due to staff shortages. In the early 1970's pronghorn translocations resumed in earnest and Tommy and his team captured and moved several thousand animals throughout Texas. In addition to these (and other) specific projects, Tommy spent countless hours in the field observing and documenting pronghorn behavior. All of these efforts cumulated in the "Handbook for Pronghorn Management in Texas" that Tommy completed in 1979, and revised in 1986. To this day, this resource is still utilized by pronghorn managers in Texas, and the research findings from Tommy's initiatives have provided the basis for continued research and management of pronghorn throughout North America.

Much of Tommy's efforts also included convincing some landowners (and others) that pronghorn were a valuable asset that could help supplement their ranch income. He personally met with local chambers of commerce to help them understand the economic opportunities associated with pronghorn hunting. Historically, even though the state issued pronghorn permits to landowners, ranchers were not allowed to realize the full financial advantage acquired through the sale of each hunt. The state required a significant percentage of the proceeds of the sale of every hunting opportunity to be given back to the state. Even though this might sound logical, since pronghorn were in fact a resource of the people of the state, it hampered the overall management of the species by minimizing potential economic gain by the actual habitat managers (ranchers). Tommy worked hard to get this law changed in the Texas Legislature and was successful in doing so. This in turn led to landowners recognizing a true economic benefit in pronghorn hunting.

Tommy also strived to dispel myths associated with pronghorn. Many ranchers at that time believed that pronghorn were vectors of disease that could affect their domestic livestock, or that pronghorn significantly competed with livestock for forage. Much of Tommy's research focused on these issues, and he demonstrated that, in fact, pronghorn did not pose any actual threat to domestic livestock operations, either from a disease or resource competition perspective.

While Tommy may have initially strove to show Trans-Pecos ranchers that pronghorn provided an economic benefit, his true passion for pronghorn planted a seed that transcends simple financial gain. Many area ranchers that Tommy worked with became good friends that trusted him greatly, and many of them and their descendants are still on the landscape, operating as trustworthy stewards of the treasured desert grasslands of Texas. Their remarkable response to the recent decline of pronghorn has illustrated a devotion to pronghorn, born not of economic resource, but of admiration for a cherished creature that they are dedicated to preserve. While his modesty may compel him to explicitly credit Trans-Pecos ranchers with their unwavering commitment to pronghorn, Tommy Hailey undoubtedly helped facilitate a true appreciation for an extraordinary natural resource across an entire landscape.

Tommy Hailey collecting pronghorn tissue samples, *circa* 1960's.

Tommy Hailey with his 2014 Berrendo Award.

Tommy Hailey presented with his 2014 Berrendo Award by Texas Parks and Wildlife Department, Wildlife Division, Region 1 Director, Billy Tarrant.

2014 Berrendo Award winner, Tommy Hailey (center), with previous Award recipients Richard Guenzel (left) and Thomas Pojar (right).

Special Recognition Award

Many people or organizations make significant contributions that aid in the management of pronghorn. These can include projects that are oriented to pronghorn management or research. The Special Recognition Award is a certificate recognizing the accomplishments of an individual or group. Up to 4 awards can be presented per Workshop.

Nomination Criteria

1. The individual, organization, or group of collaborators nominated should have made an important contribution to aid in management of pronghorn.

2. The contribution can be a single event or the accumulation of long-term contributions.

Previous Winners

2002: Karl Menzel, NE, Jorge Cancino, BCS, MX, Bill Rudd, WY, and Richard Ockenfels, AZ

2004: Rich Guenzel, WY, Alice Koch, CA, John Hervert, AZ, and Arizona Antelope Foundation

2006: Rick Danvir, UT, Fred Lindzey, WY, and Rick Miller, AZ

2008: Morley Barrett, AB, David Brown, AZ

2014 Special Recognition Award Recipients

The special recognition award went to Joe Riis, Hall Sawyer, and Emilene Ostlind for award-winning efforts to document and bring international attention to the conservation needs for pronghorn migrating between Grand Teton National Park and Red Desert of Wyoming.

Joe Riis is perhaps the world's foremost camera trap expert documenting wildlife migrations throughout the world. He often shoots for National Geographic. Joe is from South Dakota but spends most of the year on location. Joe's efforts to photograph the path of the pronghorn have provided incredible images supporting the science behind the migration research on pronghorn in Wyoming. Joe just completed a similar effort on a 150 mile migration of mule deer in the same region of Wyoming.

Hall Sawyer is a research biologist with WEST-Inc, and an Adjunct Professor at the University of Wyoming, working with the Wyoming Migration Initiative. Hall has extensively studied pronghorn movements and responses to oil and gas development in Western Wyoming using GPS collars. Hall's work provides a large component of the science documented by Joe's imagery.

Emilene Ostlind is a free-lance writer based in Lander, WY who specializes in writing about wildlife conservation. In conjunction with Joe's photography, Emilene's essays compel the reader to take action to conserve essential migration corridors and habitats.

Supplementary Information

Agenda

Monday, May 12 — Museum of the Big Bend at Sul Ross State University

http://www.museumofthebigbend.com/visit/

4:00 – 6:00 PM	On-Site Registration and Check-in
5:00 – 8:00	Welcoming Reception and Joint Social with Texas Wildlife Association at the Museum of the Big Bend at Sul Ross State University (refreshments and heavy appetizers provided)

Tuesday, May 13 — Morgan University Center at Sul Ross State University

http://www.sulross.edu/section/1779/morgan-university-center

8:00 – 9:00 AM	On-Site Registration, Check-In, and Exhibitor Set-Up
9:00 – 9:10	Welcoming Comments
9:10 – 10:40	Plenary Session
10:40 – 11:00	Break (coffee, refreshments, pastries)
11:00 – 12:00 PM	Presentations
12:00 – 1:30	Lunch at SRSU (lunch provided)
1:30 – 2:50	Presentations
2:50 – 3:10	Break (coffee, refreshments, snacks)
3:10 – 4:30	Presentations
4:30 – 5:30	Open Discussions/Poster Session
6:00 – 9:00	Social and Dinner at SRSU Kokernot Lodge (refreshments and dinner provided)

Wednesday, May 14 — Morgan University Center at Sul Ross State University

8:00 – 9:00 AM	Business Meeting
9:00 – 10:00	State and Provincial Status Report
10:00 – 10:20	Break (coffee, refreshments, pastries)
10:20 – 11:40	Presentations
11:40 – 2:30 PM	Free Time (box lunches will be provided at the conclusion of the sessions)
2:30 – 6:00	Registrants will reconvene in the north parking lot and board buses for the driving field tour of the Marfa Plateau and Mimms Ranch (http://dixonwater.org/), banquet, and star party. Buses will return registrants at 11 PM (options for early return may be available)

6:00 – 8:00	Social and Banquet at H.E. Sproul Ranch (refreshments and steak dinner provided) http://www.sproulranch.com/
8:30 – 10:00	Star Party at McDonald Observatory http://mcdonaldobservatory.org/

2014 Pronghorn Workshop Business Meeting
May 14, 2014

- Business meeting called to order by Shawn Gray at 8:05 AM

- Roll call for jurisdictional representation was conducted: Representatives from TX, WY, MT, AZ, KS, OK, ND, SD, NM, CA, UT, ACA, BRI-SRSU, NRCS, CIBNOR, and CEMEX attended meeting

- Approval of 2012 meeting minutes

- Shawn Gray emphasized the need of coming up with an official document with guidelines to select nominees for awards
    - He pointed out a draft from 2010 that he wants to finalize
    - Responses were positive
    - Rich Guenzel will get Shawn an electronic copy he will flesh out and send a draft for review

- Role of WAFWA's (Western Association of Fish and Wildlife Agencies) support for this workshop
    - Shawn wants to contact WAFWA to promote more exposure for this workshop.
    - WAFWA seed money has strings attached and is hard to utilize for workshop planning
    - Other workshops such as the Deer & Elk, Northern Wild Sheep and Goat Council, and Desert Bighorn Council have websites that are sponsored or linked to by WAFWA
    - Discussion was in favor of pursuing getting the Pronghorn Workshop information onto WAFWA's website
    - Rich mentioned that WAFWA has links to various past workshops through 2000, but has not been kept up since then. He also thought that WAFWA has a website manager that might be able to link the Pronghorn Workshop's information onto the WAFWA website if we gave them the material
    - Shawn will work with Clay Brewer to check into these possibilities and send out updates to representatives

- Pronghorn Management Guides Update – Paul Jones
    - Many guidelines updated and completed last week
    - 200 hard copies will be printed

- NMDGF will send out hard copies to all attendees of last meeting
- Also available is a CD with a PDF file of the 25th Biennial Pronghorn Workshop
- Paul would like for the bibliography to be a living document which is updated regularly. He would also like to keep a list of ideas for new sections in the future.

- Pronghorn Bibliography – Jorge Cancino
  - It will be finished in 3–4 months
  - The bibliography will include Intro, Keywords, Complete Citations, etc.
  - A goal of 100 hard copies will be printed
  - Hopefully, the document will also be posted on the website

- Host for Next Meeting
  - South Dakota is hosting the Mountain Lion Workshop next week and it would be difficult to host the Pronghorn Workshop in 2016. They would consider hosting the Pronghorn Workshop 2018.
  - Montana Fish, Wildlife & Parks agreed to host the 2016 Pronghorn Workshop
  - Shawn threw out the idea of creating a long term schedule for hosting the workshop and whether the meeting should be done every 2 or 4 years. Shawn mentioned that it was somewhat difficult to get enough presentations to fill the agenda.
    - Most participants did not like the idea of setting a long term schedule for hosting the meeting. They believed that it should continue as is, when different states and provinces have enough time and funding to host.
    - Louis Harveson stated that it should continue to be held every 2 years
    - Rich also believed that it should continue the 2 year cycle which favors minimizing gaps between research and getting information to pronghorn managers among the states and provinces
    - Amber Munig from AZGF agreed with a 2 year cycle
    - Ryan Walker from NMGF also agreed with the 2 year cycle

- Other discussions
  - Rich brought up the need for a scholarship to encourage university participation
    - Louis pointed out that we need to get word out to universities throughout North America
    - Shawn asked if we needed to do something better on terms of getting the word out for the scholarship
    - Misty Sumner volunteered the Southwest Section of The Wildlife Society in publicizing the scholarship opportunity
    - Louis said that we may have some money to offer in MT for a scholarship
  - More discussion occurred about the place in Montana in which the meeting would be held to accommodate people and field tour

- The meeting was adjourned 9:02 AM

2014 Pronghorn Workshop Business Meeting Attendees		
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Miller	Bill	Miller Ranch	billmill52@mac.com
Mills	Homer	Mills Ranch	homer@7vranch.com
Moreland	Mason	Texas Parks & Wildlife Department	mason326@gmail.com
Mowry	Rebecca	Texas Parks & Wildlife Department	rebecca.mowry@tpwd.texas.gov
Munig	Amber	Arizona Game & Fish Department	cweise@azgfd.gov
Newell	Jay	Montana Fish, Wildlife, & Parks	jnewell@midrivers.com
O'Shaughnessy	Ryan	Borderlands Research Institute	roshaughnessy@sulross.edu
Peek	Matt	Kansas Department of Wildlife, Parks, & Tourism	matt.peek@ksoutdoors.com
Petersen	Joe	University of Texas Lands	joe.petersen@utsystem.edu
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Pojar	Thomas	Colorado Parks and Wildlife	tomrajop@gmail.com

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Roth	John	Advanced Telemetry Systems Inc.	vhanzel@atstrack.com
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Smith	Travis	Texas Parks & Wildlife Department	travisc_smith@yahoo.com
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Stockbridge	Dewey	Texas Parks & Wildlife Department	Stockbridged@yahoo.com
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Storer	Weston	Oklahoma Department of Wildlife Conservation	beaverwma@ptsi.net
Sullins	Mike	Texas Parks & Wildlife Department	msullins98@sbcglobal.net
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Sumner	Misty	Texas Parks & Wildlife Department	misty.sumner@tpwd.texas.gov
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Treptow	Achi	Texas Parks & Wildlife Department	Joachim.Treptow@tpwd.texas.gov
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Walker	Ryan	New Mexico Department of Game & Fish	ryan.walker@state.nm.us
Ward	Caroline	Caesar Kleberg Wildlife Research Institute	wardWILD@gmail.com
Weaver	James	Texas Parks & Wildlife Department	james.weaver@tpwd.texas.gov
White	Jim	Brite Ranch	jimwhite@bigbend.net
White	Jeff	University of Texas Lands	jeff.white@utsystem.edu
Wolf	Clayton	Texas Parks & Wildlife Department	clayton.wolf@tpwd.texas.gov
Wrinkle	Jason	The Nature Conservancy	jwrinkle@tnc.org
Zornes	Mark	Wyoming Game & Fish Department	mark.zornes@wyo.gov

Pronghorn Workshop Operating Manual

Recognition Awards

Introduction

Through an awards program at past Pronghorn Workshops, attendees have recognized individuals, official groups or teams, and federally recognized non-profits that have made significant contributions towards pronghorn conservation. The awards program comprises 3 awards: (1) the Berrendo Award, (2) Special Recognition Awards, and (3) the Pronghorn Hall of Fame Award.

History of the Awards Program

The Berrendo and Special Recognition awards originated at the 19th Biennial Pronghorn Workshop annual business meeting in La Paz, Baja California Sur, Mexico in 2000. The idea was accepted with an objective of granting the first awards at the 20th Pronghorn Workshop. An Awards Committee was established and chaired by Jim deVos (Arizona Game and Fish Department) to develop types of awards, award names, criteria, nomination forms, announcements, and to conduct the first program. Consequently, 2 awards were established: The Berrendo Award and Special Recognition Awards. Both awards were subsequently presented for the first time at the 20th Pronghorn Workshop in Kearney, Nebraska in 2002.

At the 21st Pronghorn Workshop held in Bismarck, North Dakota in 2004, a new award titled "Pronghorn Hall of Fame Award" was discussed and approved at the annual business meeting. An Awards Committee was designated and co-chaired by David E. Brown (Arizona State University) and Rob Hitchcock (North American Pronghorn Foundation). It was stipulated that the Awards Committee was to be comprised of up to 5 individuals, including representatives from Canada and Mexico. The committee was charged with establishing standard procedures for nominating candidates and nominating the initial slate of nominees at a future Pronghorn Workshop. During discussions at the 22nd Pronghorn Workshop in Idaho Falls, Idaho in 2006, the initial award criteria were amended and accepted, as well as the initial slate of 3 individuals.

Establishment and Organization of Standing Awards Committee

The Awards Committee (hereafter referred to as AC) shall be a standing committee of the Pronghorn Workshops, comprised of 2 volunteers from past Berrendo Award recipients and an Awards Chair from the host organizing committee for the next Pronghorn Workshop. The Awards Chair shall appoint 2 additional member volunteers from state/provincial agencies or universities currently active with the workshops. The Awards Chair shall maintain close communications among the committee members and the host organizing committee. The Chair will conduct business for the AC. According to "Robert's Rules of Order", the Chair refrains

from voting unless the AC vote is a tie, then the Chair votes to break the tie. Duties and responsibilities of the AC include:

I. Review and be familiar with procedures for conducting the biennial awards program.
II. Conduct an aggressive, timely, and repetitive announcement program encouraging the submission of nominees in accordance with the requirements for all 3 awards.
III. Review, assess, and designate the best qualified recipient(s) for all awards.
IV. Design and procure all awards in a timely fashion to ensure quality awards are produced.
V. Make sure all awards are properly presented at the Pronghorn Workshop annual banquets.
VI. Prepare new releases announcing the winners of the awards to various news sources.
VII. Prepare summaries of the award winners for inclusion in the official Proceedings of the Pronghorn Workshop

Criteria for Awards

I. The Berrendo Award—The Berrendo Award is the most prestigious recognition offered through the Pronghorn Workshop. Berrendo is derived from the Spanish word for a pronghorn—North American's prairie speedster—that epitomizes the difficulty of being a remaining Pleistocene native in a modern world. A **maximum of 1 award is given** to an individual or a group of collaborators/team that made major contributions to pronghorn ecology and management. At times when an appropriate candidate is not nominated, the award may not be granted. The award will be a quality, designated trophy. Following are award criteria:
    A. First choice will be given to a nominee that is either retired or deceased. Additional outstanding and exceptional candidates will also be considered.
    B. Contribution(s) by nominees can be a lifetime (> 10 years) career directly involved in pronghorn research or management.
    C. Contribution(s) can be a major publication(s), including books, chapters of books, special reports, monographs, or other publications that have regional or range-wide significance.
    D. Contribution(s) needs to have afforded significant scientific advancement in the management or research of pronghorn.
    E. The contribution can represent either a single event or a long-term commitment to pronghorn.

II. Special Recognition Awards—The Special Recognition was created to honor the many people, teams, or organizations that have made worthy contributions that aid in the conservation of pronghorn. These can include projects that are oriented to pronghorn management, research, or appreciation. The award is a framed certificate (8.5 x 11 inch) specifically inscribed for the recipients recognizing their

accomplishments. **From 1 to 4 Special Recognition Awards can be given** at any Pronghorn Workshop. Award criteria include:

A. Nominee should be living and currently/recently active and involved in pronghorn conservation.
B. Contribution(s) should be an important event or accumulation of important contributions to pronghorn management, research, or appreciation.
C. Contribution(s) can be a new field or analytical technique that has regional or range-wide application.

III. Pronghorn Hall of Fame—The Hall of Fame was created to honor historic individuals or groups/teams that accomplished outstanding services for pronghorn conservation prior to the establishment of the Berrendo Award (pre-2002). Those involved in pronghorn conservation today owe much to the efforts of pronghorn biologists, managers, researchers, and other conservationists that produced worthy efforts prior to the establishments of any awards. The Pronghorn Hall of Fame awards are an ongoing effort to formally recognize the careers and long-term contributions of our predecessors. There is **no limit as to the number of Hall of Fame awards to be given** at a Pronghorn Workshop, however, it is likely that only 1 or 2 will be granted at any particular Pronghorn Workshop. To date, no trophy or certificate has been developed for these award recipients. Additional work by the AC is needed for this duty. Criteria for presenting this award include:

A. The nominee must be retired or deceased (criteria accepted at 2006 Pronghorn Workshop).
B. An inductee may be a pronghorn advocate, a land manager, an agency biologist, an academic, an artist, or various combinations thereof.
C. Nominee's career should have contributed to increases in pronghorn numbers, distribution, knowledge of, or appreciation.
D. Pronghorn conservation must have been a paramount part of nominee's career (criteria accepted at 2006 Pronghorn Workshop).
E. Contributions must be of historic significance to the management, research, or conservation of pronghorn.
F. Contributions should have regional, national, or international value or application.
G. Contributions can be scientific or popular books, chapters of major books, a monograph, agency/organization special reports, or a number of articles (>5) in scientific or popular journals.
H. Contribution(s) can be an important scientific advancement in either a field or analytical technique.
I. All Berrendo Award winners will automatically be inducted into the Pronghorn Hall of Fame, either upon retirement or passing (criteria accepted at 2006 Pronghorn Workshop).

I. The outgoing host committee is responsible for forwarding an electronic copy of all workshop announcements used to the next host committee. Copies will then be forwarded to the next Awards Chair and AC members to review and modify as needed for the next workshop.

II. The first announcement for award nominations should be at least 12 months prior to the upcoming meeting. At least 1 announcement should be sent to The Wildlife Society office in Bethesda, Maryland for publication in their official newsletter/magazine.

III. Announcements for award nominations should accompany official announcements of the Pronghorn Workshop to Western Association of Fish & Wildlife Agency members with pronghorn populations, other state and federal partners, and universities as required by the bylaws. Conservation organizations interested in the welfare of pronghorn should also be included in any mailings.

IV. Announcements and official forms created by the host state should be placed on the meeting website at least 12 months prior to the meeting.

V. Deadlines for nominations for the 3 awards should be at least 2 months prior to the meeting, to ensure that the awards can be created in time for the meeting. The AC should use electronic communication techniques and/or phone to ensure that a timely decision is rendered.

VI. The AC shall vote (1 vote per member) for acceptance of nominees within 2 weeks of the closing deadline.

VII. The award recipients will be announced at the evening awards ceremony portion of the banquet. The AC Chair is responsible for ensuring short scripts describing each award winner are completed by the AC. The script will become part of the Pronghorn Workshop proceedings as part of the official record of the meeting.

VIII. If possible, arrangement for a photographer to take pictures of the award recipients should occur to accompany the reports in the proceedings.

Record of Previous Award Recipients

I. Berrendo Award

A. 2002—Jim Yoakum (retired BLM), Verdi, Nevada
B. 2004—Bart O'Gara (deceased, Univ. of Montana Cooperative Fish & Wildlife Cooperative Unit), Lolo, Montana
C. 2006—Tom Pojar (retired Colorado Division of Wildlife), Kremmling, Colorado
D. 2008—Richard Ockenfels (retired Arizona Game and Fish Department), Mayer, Arizona
E. 2010—Rich Guenzel (Wyoming Game and Fish), Laramie, Wyoming

II. Special Recognition Awards

A. 2002—Karl Menzel (NE), Jorge Cancino (BCS, MX), Bill Rudd (WY), Richard Ockenfels (AZ)

B. 2004—Rich Guenzel (WY), Alice Koch (CA), John Hervert (AZ), Arizona Antelope Foundation (AZ)
C. 2006—Rick Danvir (UT), Fred Lindzey (WY), Rick Miller (AZ)
D. 2008—Morley Barrett (Alb, Canada), David Brown (AZ)

III. Pronghorn Hall of Fame Awards

A. Jim D. Yoakum and Bart W. O'Gara (2002 and 2004 Berrendo Award recipients) automatically inducted.
B. Tom M. Pojar (2006 Berrendo Award recipient) automatically inducted.
C. 2008—Arthur S. Einarsen (OR), Helmut K. Buechner (TX), and T. Paul Russell (NM) elected as members.
D. Richard A. Ockenfels (2008 Berrendo Award recipient) automatically inducted.

Procedures for Reporting Award Committee Accomplishments

I. A report with photographs of the award recipients for the most recent workshop shall be forwarded by the Awards Chair within 3 months after the Pronghorn Workshop to the host organizing committee's assigned editor of the official Proceedings for documentation of Workshop business affairs.
II. The current AC will update the Awards Program files to include the new award recipients.
III. The current AC will within 1 year following the workshop review and update documents for the Awards Program.
IV. The current AC will draft and distribute a news article with black & white photos of current award recipients to appropriate news sources, including The Wildlife Society.

Examples of Previous Awards

I. Examples of the Berrendo Award and Special Recognition Award shall be attached to these standard operating procedures. Electronic copies shall be forwarded to the next Awards Chair via the host committee.

Payment of Awards

I. All award expenses are the responsibility of the host organizing committee, to be paid from the operations fund for the workshop. Agencies may volunteer to cover some expenses internally or through donations to the workshop.
II. Receipts shall be retained in the host organizing committee's files for auditing purposes.

Information Regarding Ordering Past Trophies and Certificates

I. The Berrendo Award has been made by Arrow Awards, LLC (602-971-8669) on 16026 N. 32nd Street, Suite B, Phoenix, AZ 85032. However, another vendor may be used in the future.

i. Richard Ockenfels has been the liaison for the production of the award. Richard can be reached by email at richard.ockenfels@yahoo.com , by home phone at 928-632-4325, or by cell phone at 602-300-6822. His mailing address is PO Box 326, Mayer, AZ 86333. Shawn Gray from Texas Parks and Wildlife Department was the liaison for the award production in 2014 and used Arrow Awards, LLC.

ii. The Berrendo Award has historically been a clear, chipped glass replication. However, another type of award may have to be used in the future. Cost of the award should be around $100 regardless of the type of plaque or award chosen by the host committee.

iii. Cost of the award is from the operating funds of the host committee. Expenses should be authorized by the host committee. Receipts should be maintained in the official records of the host committee for audit purposes.

II. The Special Recogniton Awards have been made in partnership with the Publications Section, Information Branch, Arizona Game and Fish Department.

i. The contact person in the Publication Section has been Cindy David cdavid@azgfd.gov .

ii. Richard Ockenfels has been the liaison for the production of the award.

iii. The Special Recognition Award is a standard 8.5 x 11" certificate, placed in a wooden frame.

Adoption of these Awards Program Operating Procedures

These procedures were presented by the AC at the business meeting of the 24th Pronghorn Workshop, conducted in Laramie, Wyoming in 2010. A motion and second to approve was accepted and recorded in the official records for the 24th Pronghorn Workshop. Accepted on 19 May 2010 as amended.

Graphic used (not to scale) for the 2014 Berrendo Award on part #44138 Jade Acrylic.

Example of Special Achievement Award given at the 2014 Pronghorn Workshop.

Bylaws

ORGANIZATION and FUNCTION
of the
PRONGHORN ANTELOPE WORKSHOP

I. Designation

This organization shall be known as the "Pronghorn Antelope Workshop." The official publication of the Workshop shall be known as the Pronghorn Antelope Workshop Proceedings.

II. Goal

The goal of the Workshop is to provide information relative to and encourage the perpetuation of sustainable wild stocks of pronghorn antelope as an ecological, aesthetic, and recreational natural resource on western rangelands, both public and private, at their most productive levels consistent with other proper land uses.

III. Objectives

A. To provide an opportunity for all persons interested in pronghorn antelope to meet and discuss current research and management of the species and its habitat.

B. To provide a vehicle for disseminating research and management findings to the various agencies and organizations concerned with pronghorn antelope management.

C. To promote species-oriented research for development of new information on all aspects of pronghorn antelope ecology, life history, and management on western rangelands.

D. To identify particular problems associated with pronghorn antelope management and to formulate recommendations and resolutions directed to the appropriate agency or organization, including the Western Association of Fish and Wildlife Agencies.

E. To promote cooperation among all agencies and organizations concerned with pronghorn antelope management and research, particularly among the various provincial, state, and federal agencies with the primary responsibilities of managing this species and its habitat.

IV. Organization

A. The Workshop shall be open to any person interested in pronghorn antelope and its management.

B. Voting

Voting members shall consist of one representative of each of the following:

1. States, provinces, and countries.

Alberta, Arizona, Baja California Sur, California, Chihuahua, Coahuila, Colorado, Idaho, Kansas, Montana, Mexico, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Saskatchewan, Sonora, South Dakota, Texas, Utah, Washington, Wyoming.

2. Federal Agencies.

Bureau of Land Management, Canadian Wildlife Service, Forest Service, Fish and Wildlife Service, National Park Service, Natural Resources Conservation Service, Parks Canada, and the Direccion General de Fauna Silvestre.

3. Universities and Colleges.

The chair may appoint up to three people to represent colleges and universities. This appointee shall come from any college or university actively engaged in pronghorn antelope research.

Voting representatives for the states, provinces, and countries shall be appointed by the agency directly responsible for wildlife management within the above named states, provinces, and countries.

The chair shall request that each of the above named federal agencies appoint one voting member. This request shall be directed to one of the regional offices or service centers in the western United States, Canada, and Mexico.

Voting shall be accomplished only by those authorized representatives in attendance at the business meeting of the Workshop.

C. The Workshop will be scheduled biennially on even number years. The host state, province, or country shall select the time and place of the meeting. The host shall appoint one of its representatives who will act as chair. The duties of the chair shall be:

1. To serve as chair for the two-year period following his/her appointment.

2. To call for papers and prepare an agenda for the Workshop and assemble and distribute any recommendations or resolutions made or passed at the Workshop.

3. To prepare and distribute the proceedings of the Workshop for which he/she has been responsible.

4. To organize and conduct the meeting and business of the Workshop.

5. To appoint committees as necessary.

6. To maintain the goals and objectives of the Workshop.

7. To prepare and make a formal report to the Western Association of Fish and Wildlife Agencies.

D. The new host state, province, or country shall be selected and announced at the business meeting of the Workshop. It is the intent of the Workshop that host state, province, or country will be volunteered on a rotating basis among the actively participating member states, provinces, and countries.

E. The mailing list of the Workshop shall be:

1. The Western Association of Fish and Wildlife Agencies.

2. The Director and Game Chief of every member state, province, and country.

3. All biologists known to be conducting pronghorn antelope research.

4. All Bureau of Land Management State Offices and Regional Service Centers in the western United States.

5. All Regional Forest Service Offices in the western United States.

6. All Fish and Wildlife Service Regional Offices in the western United States.

7. All Natural Resources Conservation Service Regional Offices in the western United States.

8. All Cooperative Wildlife Research Units in the western United States.

9. All persons attending the Workshop.

10. Any person or organization requesting a copy of the Proceedings.

F. The chair shall forward the mailing list and other pertinent material to the new Workshop chair upon completion of his/her responsibilities as chair of the current Workshop.

As amended on March 27, 1998, at Prescott, Arizona.
18th Biennial Pronghorn Antelope Workshop
Richard A. Ockenfels, Chair

Ratified by Western Association of Fish and Wildlife Agencies
Jackson, Wyoming
July 2, 1998

Summary of Pronghorn Workshops Held to Date

Dates and Location	Attendance	Chair	Host
14–16 April 1965 Santa Fe, New Mexico	18	W. Huey	New Mexico Department of Game and Fish
16–17 February 1966 Denver, Colorado	32	G. D. Bear	Colorado Game, Fish, and Parks Department
5–6 February 1968 Casper, Wyoming	97	J. L. Newman	Wyoming Game and Fish Commission
27–28 January 1970 Scottsbluff, Nebraska	85	K. I. Menzel	Nebraska Game and Parks Commission
19–22 June 1972 Billings, Montana	85	H. O. Compton	Montana Fish and Game Department
19–21 February 1974 Salt Lake City, Utah	52	D. M. Beale	Utah Division of Wildlife Resources
24–26 February 1976 Twin Falls, Idaho	68	R. Autenrieth	Idaho Department of Fish and Game
2–4 May 1978 Jasper, Alberta	84	M. W. Barrett	Alberta Fish and Wildlife Division
8–10 April 1980 Rio Rico, Arizona	64	J. S. Phelps	Arizona Game and Fish Department
5–7 April 1982 Dickinson, North Dakota	69	J. V. McKenzie	North Dakota Game and Fish Department
10–12 April 1984 Corpus Christi, Texas	45	C. K. Winkler	Texas Parks and Wildlife Department
11–13 March 1986 Reno, Nevada	43	M. Hess	Nevada Department of Fish and Wildlife

Dates and Location	Attendance	Chair	Host
31 May–2 June 1988 Hart Mountain, Oregon	43	D. Eastman	Oregon Department of Fish and Wildlife
22–24 May 1990 Silver Creek, Colorado	45	T. M. Pojar	Colorado Division of Wildlife
8–11 June 1992 Rock Springs, Wyoming	91	P. Riddle	Wyoming Game and Fish Commission
18–21 April 1994 Emporia, Kansas	49	K. Sexson	Kansas Department of Wildlife and Parks
5–7 June 1996 Lake Tahoe, California	75	L. Colton	California Department of Fish and Game
23–27 March 1998 Prescott, Arizona	92	R. A. Ockenfels	Arizona Game and Fish Department
14–17 March 2000 La Paz, Baja California Sur, Mexico	42	J. Cancino	Centro de Investigaciones Biologicas del Noreste–Direccion General de Vida Silvestre
17–20 March 2002 Kearney, Nebraska	85	J. S. Abegglen	Nebraska Game and Parks Commission, U. S. Forest Service–Nebraska National Forest
1–4 May 2004 Bismarck, North Dakota	76	B. Jensen B. Stillings	North Dakota Game and Fish Department, U. S. Forest Service and Bureau of Land Management
16–19 May 2006 Idaho Falls, Idaho	143	B. Compton D. Toweill	Idaho Department of Fish and Game
13–16 May 2008 Canmore, Alberta	57	D. Eslinger K. Morton	Alberta Sustainable Resource Development, Alberta Conservation Association

Dates and Location	Attendance	Chair	Host
18–21 May 2010 Laramie, Wyoming	77	M. Zornes	Wyoming Game and Fish Commission
10–13 December 2012 Santa Ana Pueblo, New Mexico	98	K. Rodden S. Liley R. Walker	New Mexico Department of Game and Fish
12–14 May 2014 Alpine, Texas	123	S. Gray L. Harveson	Texas Parks and Wildlife Department, Borderlands Research Institute