Supplemental Document

DRAFT

to the

Idaho

Pronghorn

Management Plan

March 2023

Recommended Citation:

Idaho Department of Fish and Game. 2023. Supplemental Document to the Idaho Pronghorn Management Plan, 2023–2028. Idaho Department of Fish and Game, Boise, USA.

Additional Copies:

Additional copies can be downloaded from the Idaho Department of Fish and Game website at idfg.idaho.gov

EXECUTIVE SUMMARY

Pronghorn (*Antilocapra americana*) are found only in North America, preferring open rangelands, prairie, grasslands, and sagebrush steppe habitats. A majority of pronghorn habitat in Idaho centers around sagebrush steppe communities throughout the southern portion of the state, but pronghorn are often found in most, if not all, of southern Idaho's open landscapes including mountain valley and alpine grasslands. Pronghorn eat a variety of grasses, forbs, and shrubs, but their preferred forage for much of the year is forbs. Pronghorn are known for their speed and long-distance migrations. Rangewide, pronghorn may have exceeded 30 million individuals prior to European settlement, followed by a decline to around 30,000 in the early 1920s (O'Gara and Yoakum 2004) and a conservation-driven rebound to current estimates of approximately one million individuals (Schroeder 2018). In Idaho, the statewide population estimate is reported at 13,000 pronghorn but populations are not currently monitored at a level to provide a precise estimate. Several factors may be impacting pronghorn populations including habitat change (e.g., fire, development), movement barriers (e.g., fences, roads), predation, changing climate, and combinations thereof.

The Idaho Department of Fish and Game (IDFG) was established to preserve, protect, perpetuate, and manage all of Idaho's fish and wildlife. As such, species management plans are written to set statewide management direction to help fulfill IDFG's mission. Objectives in Idaho's prior pronghorn management plan (1991-1995, Crenshaw 1991) were broad and primarily focused on maintaining or increasing populations, hunter satisfaction, buck quality, improving habitat, and data collection efforts. The intent of this revision is to provide guidance for IDFG and their partners to implement management actions that will aid in conservation and management of pronghorn populations and guide harvest season recommendations for the next 6 years. As such, much of this plan is intended for wildlife managers and is largely reference material for their benefit. This plan directs IDFG to maintain or increase pronghorn populations and maximize hunting opportunity across the state while being cognizant of depredation concerns and changing habitat conditions. To accomplish these goals, IDFG has identified statewide management directions and strategies. IDFG will ask stakeholders to engage in pronghorn management, including hunters, federal and state agencies, conservation organizations, American Indian tribes, and other interested individuals and groups. Partnerships can help IDFG accomplish goals to maintain sustainable populations, improve habitat, and provide hunting opportunities.

Pronghorn distribution is divided into summer range distribution (SRD) and winter range distribution (WRD) areas based on current knowledge of habitat, movements and connectivity among populations, harvest, and other management concerns. Data collected from radio-collared pronghorn indicate they are highly mobile and their long-distance migrations between seasonal ranges often cross regional, Game Management Unit (GMU), and state boundaries. The SRD and WRD groupings will help IDFG better manage pronghorn populations, hunting opportunities, and challenges.

During the development of this current plan, a formal hunter opinion survey was conducted by IDFG and the University of Idaho. The human dimensions survey focused on pronghorn hunter experiences, preferences, satisfaction, and perception of pronghorn populations. Results of this survey suggest pronghorn hunters, overall, are generally happy with their hunting experiences. Two areas of potential improvement are a desire to see drawing odds improve and hunter crowding issues in some areas, primarily during archery-only hunts.

The intent of the current plan is to provide guidance for IDFG and their partners to implement management actions that will aid in conservation and management of pronghorn populations and guide harvest season recommendations for the next 6 years. A critical need is to improve techniques to estimate population size and productivity and address changes in these measures over time. Designing management strategies to provide technical assistance to land managers and local and state agencies and municipalities to benefit pronghorn habitat and protect migration routes is also a priority.

Overarching objectives and priorities of this plan include:

- Improve the quality of pronghorn population monitoring data to better estimate population size and understand population trends.
- Collaborate with private landowners, land management agencies, and others to incorporate measures in land use and resource management plans that benefit pronghorn habitat.
- Increase knowledge of pronghorn survival, habitat use, genetics, and other factors affecting pronghorn populations, movements, and migrations.
- Maintain or increase pronghorn numbers statewide while considering depredation concerns and changing habitat conditions.
- Maximize harvest opportunity and provide a diversity of hunting experiences.

The Idaho Pronghorn Management Plan is the Commission-approved document used to set statewide management direction. This Supplemental Document provides additional reference material and data.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The Idaho Department of Fish and Game (IDFG) was established to preserve, protect, perpetuate, and manage all of Idaho's fish and wildlife. As such, species management plans are written to set statewide management direction to help fulfill IDFG's mission. Overall guidance for the Management Plan and this Supplemental Document is provided by the Idaho Fish and Game 2015 Strategic Plan (IDFG 2015) and the annual Direction document (IDFG 2022a). Additional information is provided by the Idaho Action Plan (V4.0) for Implementing the Department of the Interior Secretarial Order 3362 (IDFG 2022b), the policy for avian and mammalian predation management (IDFG 2000), the draft Idaho State Wildlife Action Plan (SWAP, IDFG 2022c), and the previous pronghorn management plan (Crenshaw 1991). We also incorporated insights from current scientific literature, state/province pronghorn management plans (AZ, CO, MT, NV, NM, SD, UT, WY, provinces of AB, SK), and guidelines from the Western Association of Fish and Wildlife Agencies (WAFWA).

Pronghorn (see Appendix A for scientific names) are endemic to North America, historically occupying open sagebrush and grassland communities across the central and western half of the continent (O'Gara and Yoakum 2004). A majority of pronghorn habitat in Idaho centers around sagebrush steppe communities throughout the southern portions of the state, but pronghorn are often found in most, if not all, of southern Idaho's open landscapes including mountain valley and alpine grasslands. Due to changes in these habitats and other stressors, pronghorn are proposed as a species of greatest conservation need (SGCN) in the current 2022 draft of the Idaho SWAP (IDFG 2022c).

Rangewide, pronghorn may have exceeded 30 million individuals prior to European settlement, followed by a precipitous decline to around 30,000 in the early 1920s (O'Gara and Yoakum 2004) and a conservation-driven rebound to current estimates of approximately one million individuals (Schroeder 2018). In Idaho, statewide population are not currently monitored at a level to provide a precise statewide estimate. However, estimates from past Western Association of Fish and Wildlife Agencies (WAFWA) pronghorn workshops report a statewide population of around 13,000 animals in recent years (Schroeder 2018) with long-term trends being somewhat variable (Walker 2012).

Pronghorn males, females, and young of the year are known as bucks, does, and fawns, respectively. Bucks are characterized by a black cheek patch and horns. Does can also have horns, although they tend to remain much smaller than those of bucks. Horns are made up of a bony core and an outer sheath that is shed every year (Davis et al. 2011). Pronghorn bucks typically attain maximum horn size by age 3 (O'Gara and Yoakum 2004, Morton et al. 2008, Monteith et al. 2013), which is earlier than other ungulates. Pronghorn in Idaho generally breed from mid-September to early October, with bucks defending harems or a territory (Deblinger and Alldredge 1989). Gestation is around 250 days with most fawns being born from late May to early June (Pojar and Miller 1984). Pronghorn does generally give birth to twins, but singles and triplets do occur to a far lesser degree (O'Gara 1978). Although mobile at birth, fawns hide from predators during the first few weeks of life (Alldredge et al. 1991).

Pronghorn are the smallest big game ruminant in North America (Yoakum and O'Gara 2000) with a body adapted to speed. Pronghorn have evolved the largest respiratory capacity (scaled to body size) of any North American ungulate to support increased oxygen uptake and endurance. Although their smaller size provides some advantages when it comes to speed, it also comes with disadvantages including a smaller digestive system which limits the quantity of food pronghorn are physically capable of ingesting. Thus, pronghorn require forage higher in carbohydrates, fats, protein, and digestible energy such as forbs and younger grasses (Bleke 2022). This need for high-quality forage can lead to reduced survival during harsh winter weather as they cannot eat enough lower quality forage to limit body fat loss (Hofman 1989, O'Gara and Yoakum 2004).

Pronghorn are highly mobile, often covering extensive distances during migrations (Kauffman et al. 2022). Migrating animals are exposed to multiple anthropogenic barriers including roads, fences, and development, as well as natural obstacles (e.g., land cover, topography, rivers). For example, pronghorn have difficulty navigating fences unless those fences are built with wildlife passage in mind. Across their current range, pronghorn can be seen sliding under fences, often at high speeds, with significant scarring on their backs from barbed wire. In heavy snowstorms, deep snow can prohibit pronghorn from navigating under fences and significant numbers of pronghorn have died as a result (O'Gara and Yoakum 2004).

Long-distance migrations between seasonal ranges make it difficult to manage pronghorn populations based on Game Management Units (GMUs). Recent research on Idaho pronghorn indicates management planning will likely be most effective if focused on subpopulations (Gese et al. *in review*). Thus, in this plan, groups (or herds) of pronghorn and the area they inhabit are divided into summer range distribution (SRD) and winter range distribution (WRD) areas approximating subpopulations (Figure 1, extent = 35,596 mi^2 [92,192 km^2]). These biologically meaningful units are based on current knowledge of habitat, seasonal ranges, migration patterns, and connectivity among herds, including results from Kauffman et al. (2022) and Bergen et al. (2022). Additional information on population structure, connectivity, and interactions would be beneficial for management. The SRDs and WRDs are described individually in the last chapter of this document.

Pronghorn research in Idaho has addressed basic life history, survival, behavior, habitat, predator-prey interactions, migrations, hunting season structures, population survey techniques, and management strategies. IDFG incorporates results from this research with the best available information on habitat conditions and population metrics (e.g., population size, trend, herd composition, harvest) when developing harvest management frameworks. Data documenting the timing and routes of seasonal pronghorn migrations demonstrate how individual pronghorn could be exposed to hunting pressure in different hunt areas throughout the migration period. Seasonal migration data would be useful when coordinating harvest management among Idaho populations and with other states.

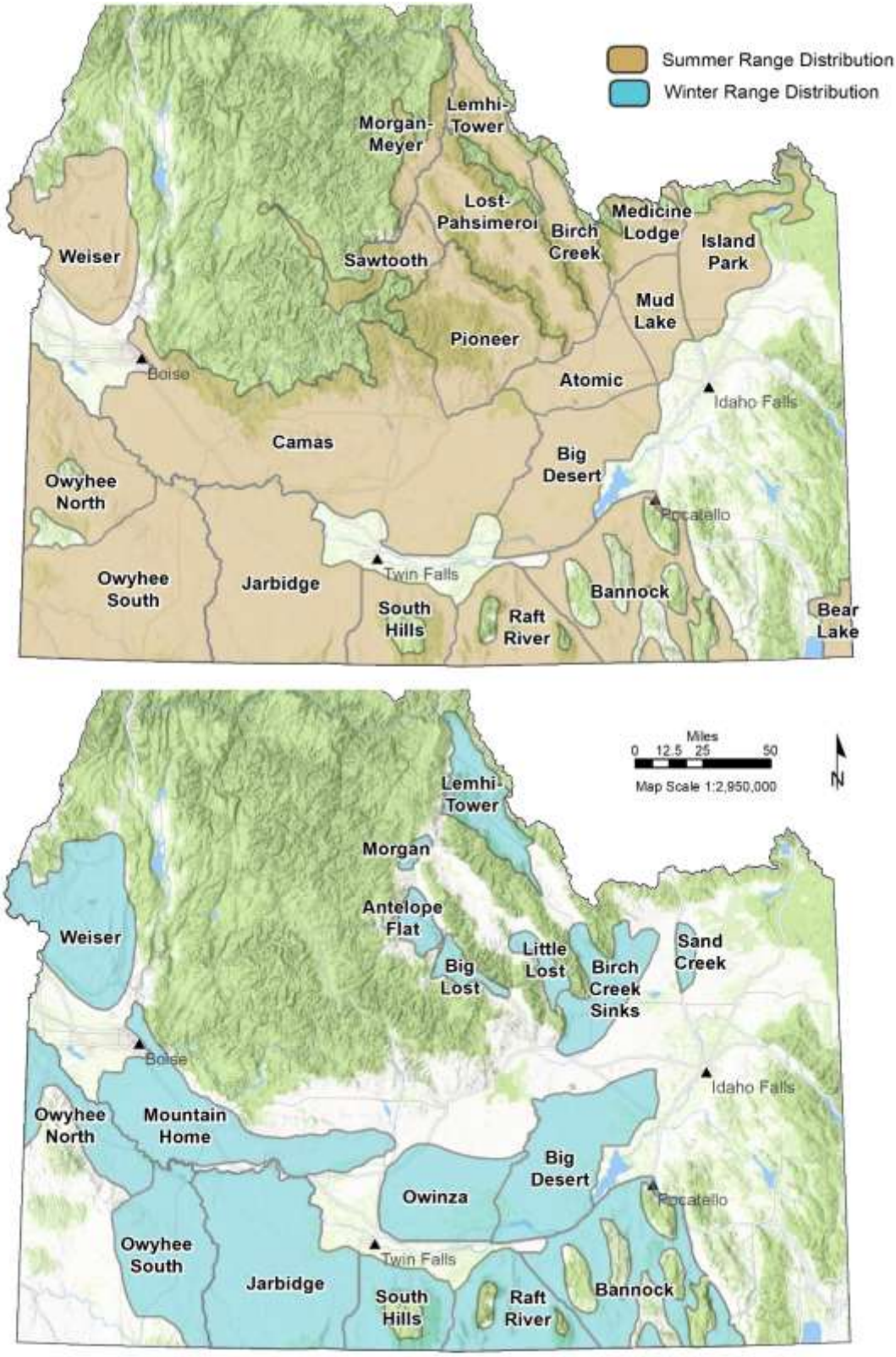


Figure 1. Pronghorn summer (top) and winter (bottom) range distributions in Idaho.

During Idaho's last pronghorn plan (1991–1995, Crenshaw 1991) objectives were broad and primarily focused on maintaining or increasing populations, hunter satisfaction, buck quality, improving habitat, and data collection efforts. Hunting opportunities during the last plan centered on maintaining preseason buck:doe ratios at or above 40–50:100, maintaining an average horn length of 12.0 inches on buck harvest, and reducing agriculture depredation conflicts.

Overarching objectives and priorities of this current plan include:

- Improve the quality of pronghorn population monitoring data to better estimate population size and understand population trends.
- Collaborate with private landowners, land management agencies, and others to incorporate measures in land use and resource management plans that benefit pronghorn habitat (e.g., fire rehabilitation, wildlife-friendly fencing).
- Increase knowledge of pronghorn survival, habitat use, genetics, and other factors affecting pronghorn populations, movements, and migrations.
- Maintain or increase pronghorn numbers statewide while considering depredation concerns and changing habitat conditions.
- Maximize harvest opportunity and provide a diversity of hunting experiences.

The Pronghorn Management Plan is Commission-approved and provides management directions and strategies used to set annual work plan activities and establish funding priorities, subject to available funding and personnel. This Supplemental Document provides additional reference material and data.

HABITAT

Pronghorn habitat in Idaho includes a variety of open vegetation types including sagebrush steppe, mountain valley grasslands, alpine grasslands, and agricultural fields. Typically, use across these landscapes varies by season with many pronghorn herds migrating from low elevation, drier winter ranges, to high elevation, wetter summer ranges. Winter movements are often driven by factors such as snow depth, while spring and summer migrations are primarily a product of pronghorn seeking forage that is higher in carbohydrates, fats, protein, and digestible energy (see Movement & Migration chapter). Pronghorn shift their diet from these more nutritious grasses and forbs during the growing season to shrubs during winter. Agricultural crops (e.g., alfalfa, winter wheat) may supplement or subsidize some populations during different times of the year, particularly where native habitat is degraded or unavailable (e.g., Camas Prairie [Smyser 2005, Panting et al. 2021]).

As with most ungulates, population viability is influenced by adult female and fawn survival, both of which are often variable and linked to habitat condition and other factors (O'Gara and Yoakum 2004). Habitat structure (i.e., canopy cover and height) plays a significant role as fawns use a hiding strategy for the first 3 weeks of life and require horizontal obstruction (e.g., areas with taller herbaceous vegetation or slight depressions in the ground) to avoid predators (Barrett 1981, Tucker and Garner 1983). Shrub canopy also likely provides some additional protection from golden eagles, a significant predator of pronghorn fawns in some systems (Bodie 1979, Panting et al. 2021).

Modeled Potential Habitat

Although several modeling approaches have been used to improve understanding of pronghorn habitat use and distribution elsewhere (e.g., Leu et al. 2011, Poor et al. 2012, Duncan et al. 2016, Jakes et al. 2020, Zeller et al. 2021), none provide potential distribution information for pronghorn in Idaho using the most current Idaho observation data. To aid in development of this management plan, we developed a model of pronghorn annual distribution using a subset of current location data and several environmental variables likely to influence distribution in a maximum entropy analysis (see Appendix B for more information). Modeled potential habitat using this approach included 37% (30,792 mi^2 [79,750 km^2]) of Idaho (Figure 2). Little observation data are available outside of SRD boundaries which may indicate that few pronghorn regularly occur in these areas despite the presence of modeled suitable habitat. Accurate mapping of important habitat is a critical factor in facilitating habitat management, although modeled distributions may over- or under-estimate actual use due to local variation in habitat quality or other site-specific factors (e.g., invasive plants, fire, fences, competition, vegetation structure).

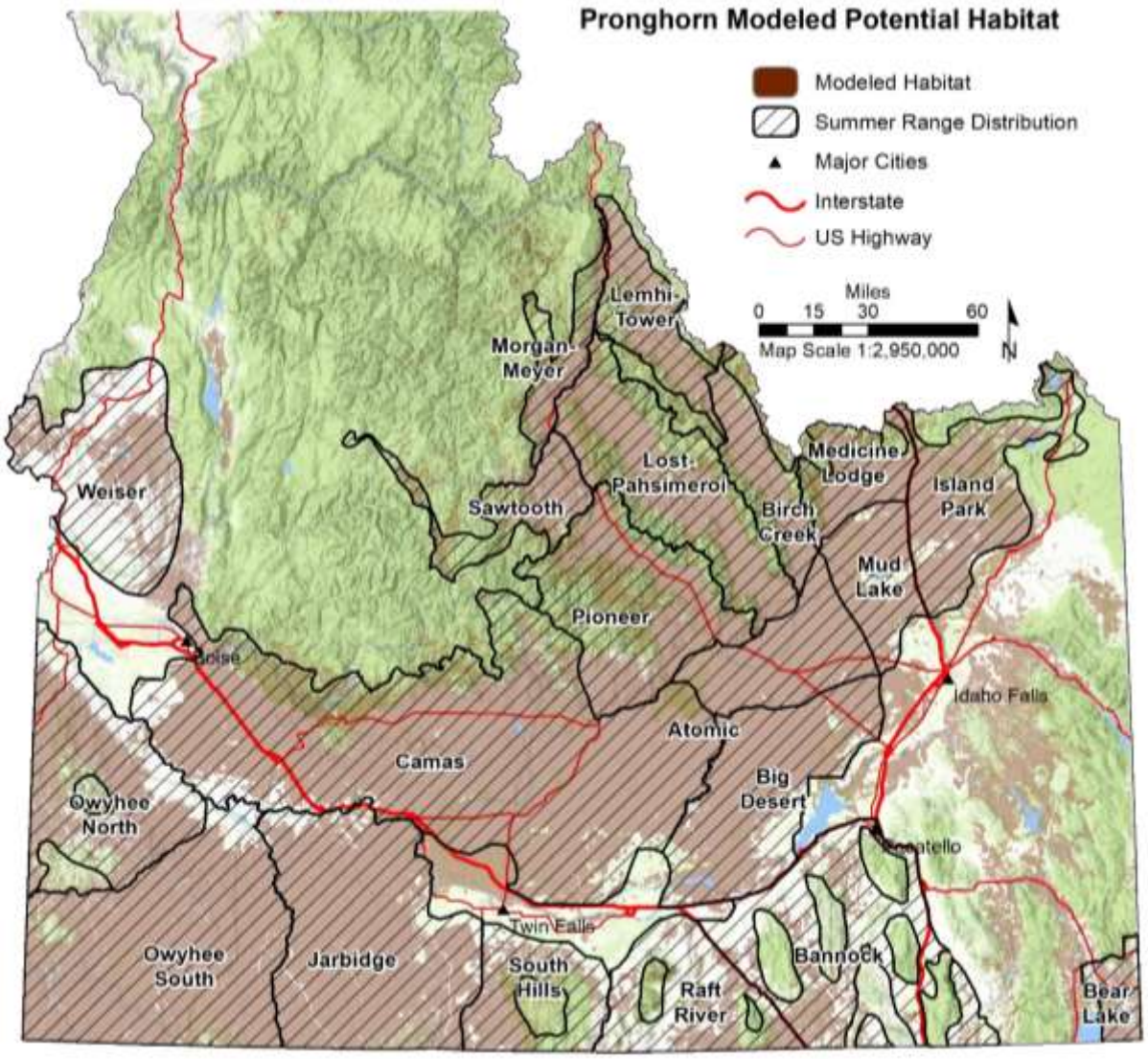


Figure 2. Pronghorn modeled potential habitat in Idaho. The model was developed using maximum entropy methods and a subset of observations (see Appendix B for more information).

Potential Challenges to Pronghorn Habitat

Any loss or fragmentation of native grassland and sagebrush habitat can affect pronghorn to some degree (Christie et al. 2017, Jakes 2021). In Idaho, increasingly significant stressors to pronghorn habitat include residential and agricultural development (including cropland conversion, roads, and fences), outdoor recreation, mining and energy development, wildfire, encroachment of invasive plants, climate change, and competition.

Residential & Agricultural Development

Idaho is currently one of the fastest growing states in the US, increasing over 17% between 2010 and 2020 with an annual projected growth rate of 1.1% (IDOL 2021). As Idaho's human population grows so does urban and suburban expansion. While just

over half (54%) of pronghorn habitat in Idaho is on public land, which generally precludes urban and agricultural development, many private lands within pronghorn SRD and WRDs are experiencing the effects of human population growth including urban, suburban, and rural-residential development. This trend can negatively affect pronghorn through the direct loss and fragmentation of habitat and can lead to increases in other stressors such as invasive plants, wildfire ignitions, and human disturbance.

Conversion of native grassland and sagebrush habitats to cropland is also increasing with all SRDs and WRDs experiencing at least some conversion and several experiencing >5% conversion (one, Bannock SRD, experienced almost 15%) between 2007 and 2021 (USDA 2021). Cropland conversion and the associated infrastructure (e.g., roads, fences) primarily affect pronghorn through fragmentation and loss of habitat and changes to, or loss of, migration routes. Cropland conversion can benefit pronghorn in some instances by providing additional forage resources (Torbit et al. 1993, Hoffman et al. 2010, Christie et al. 2015). However, extensive pronghorn use of cropland may result in depredation conflicts and reduced landowner tolerance. Croplands are extensive in Bannock SRD, Camas SRD, Mud Lake SRD, Owinza WRD, and Sand Creek WRD, with depredation issues particularly challenging in Mud Lake SRD and Sand Creek WRD.

Much of Idaho's pronghorn habitat is grazed by domestic cattle or sheep. Well-managed moderate livestock grazing may help mitigate effects of the fire-cheatgrass cycle in some instances (Davies et al. 2011). However, improper livestock management can affect pronghorn habitat through loss of native plant species, degradation of soil and water quality, reduced water availability, and increased invasive plant species, depending on local factors such as precipitation, soils, and plant communities (Chambers et al. 2017a, Monroe et al. 2021).

Infrastructure (e.g., fences, roads, railroads) associated with urban and agricultural development cover extensive areas of southern Idaho (Monroe et al. 2021). These linear barriers can significantly affect pronghorn directly through injury or death (Harrington and Conover 2010, Gates et al. 2012, Jones et al. 2020b), or indirectly through prolonged or curtailed migration routes and increased rates of movement, ultimately diminishing survival and production by increasing the energy needed to navigate these barriers (Jakes 2015, Seidler et al. 2015, Jones et al. 2020a, Jakes 2021). Road density can be negatively associated with pronghorn abundance (Christie et al. 2015) or survival (Eacker et al. 2023) and fencing structures, specifically those with woven wire and low bottom strands, exclude pronghorn from certain areas and markedly alter migration routes (see section on Potential Challenges to Movement & Migration). Mitigating the effects of infrastructure on pronghorn will continue to be a primary objective for managing this species.

Outdoor Recreation

Over 90% of Idahoans participate in one or more forms of outdoor recreation, including hiking, biking, motor boating, rafting, snow and water skiing, snowmobiling, and off-highway vehicle (OHV) use (IDPR 2022). For example, OHVs such as off-highway motorcycles, all-terrain vehicles, and utility vehicles, have become quite

popular with both recreationists and sportsmen across the western US (Switalski 2018) and in Idaho (Figure 3). Pronghorn herds in Idaho are exposed to different amounts of outdoor recreation and areas once considered remote and difficult to access are now more accessible. Potential effects of various outdoor recreation, based on pronghorn studies and known impacts to other ungulates, include but are not limited to stress-related population declines, increased daily movements, displacement into poorer habitat, increased vulnerability to harvest and predation, spread of invasive plant species, and loss of fat reserves (Taylor and Knight 2003, Rowland et al. 2004, Wisdom et al. 2004, Gavin and Komers 2006, Switalski 2018).

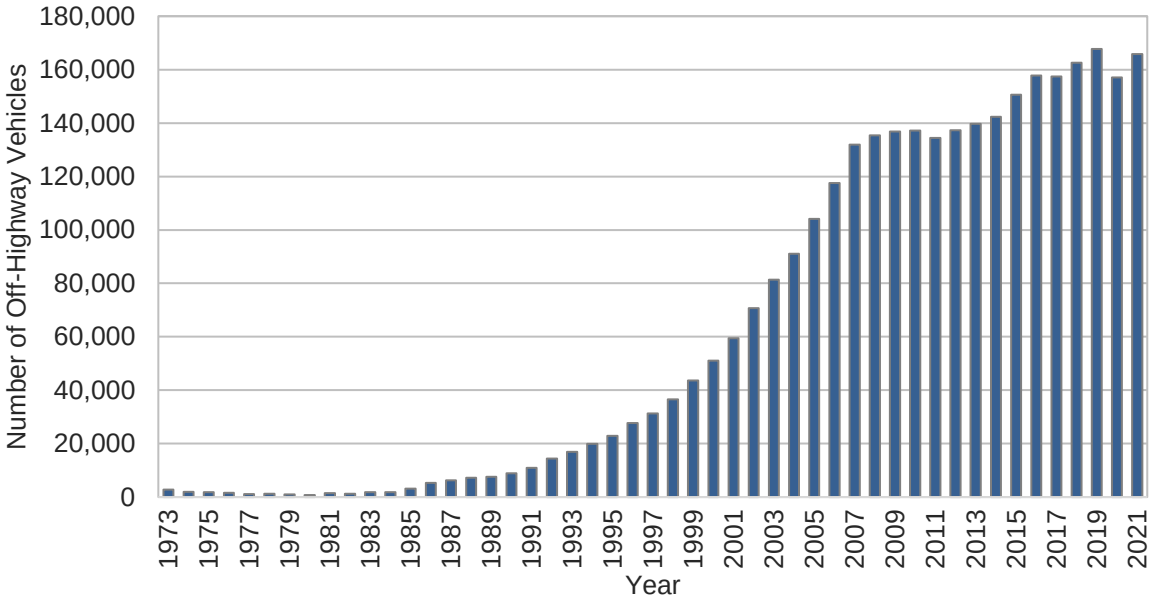


Figure 3. Registration of Off-Highway Vehicles (OHVs) in Idaho, 1973–2021. Data provided by the Idaho Department of Parks and Recreation (IDPR) Registration Information System Database, July 2022. The increase in registrations is due to both increased participation rates and increased compliance rates.

Mining & Energy Development

Development associated with mining, oil and natural gas extraction, and renewable energy (i.e., solar, wind, geothermal) has increased across much of pronghorn range in the western US (Allred et al. 2015, Jones et al. 2015, Chambers et al. 2017a). This demand has led to tremendous investments in energy infrastructure in Idaho, including transmission lines associated with the increased development (OEMR 2022).

The long-term cumulative impacts of mining and energy development on sagebrush-associated and -obligate wildlife populations, including pronghorn, are not fully understood (see Aldridge et al. 2021 for review) and the significance of population level-effects on pronghorn herds will likely depend on the location, extent, and context of development. Immediate effects to pronghorn can include loss and degradation of habitat, avoidance of infrastructure, changes in migratory behavior, and at least partial abandonment of traditional ranges (Sawyer et al. 2019, Jakes et al.

2020, Lambert et al. 2022, Milligan et al. 2023). Cumulative effects of habitat fragmentation and loss, as well as changes in movement and migration behaviors, may occur due to associated infrastructure development (e.g., fences, roads, transmission lines, increased human presence, invasive plant species).

Energy development projects, solar and wind in particular, tend to affect large areas and can fragment and disrupt pronghorn ranges and migration routes (Sawyer et al. 2022); however, population-level effects of such developments are variable. For example, in south-central Wyoming, wind energy infrastructure did not affect winter survival of female pronghorn (Taylor et al. 2016) but did lead to avoidance and abandonment of traditional winter ranges (Smith et al. 2020, Milligan et al. 2023). Similarly, Beckmann et al. (2016) failed to detect differences in adult female pronghorn condition and survival between developed and undeveloped areas in western Wyoming but did document changes in movement behavior. While broad-scale developments are often the focus of concern, even small-scale developments may have significant effects if located within important migration or stopover habitat (Sawyer et al. 2022).

Wildfire & Invasive Plants

Historical fire regimes in southern Idaho sagebrush ecosystems are thought to have been highly variable depending on local conditions (see Crist et al. 2021 for review). The spread of invasive annual grasses, climate change, and increased prevalence of human-caused fires have contributed to increases in total area burned, fire size, severity, frequency, and lengthened fire seasons across nearly all sagebrush communities in the Snake River Plain, particularly in the lower elevations (Crist et al. 2021). Fire return intervals across these areas have declined from a historical estimate of 60–110 years to estimates of 3–5 years in the 1960s–1980s (Whisenant 1990) and approximately 7.5–15 years from 1984–2015 (Brooks et al. 2015). Larger and more frequent fires typically result in a loss of sagebrush and increased extent and abundance of invasive annual grasses. Large areas of sagebrush communities in the Snake River Plain are particularly vulnerable to such conversions, mainly in hotter, drier, lower elevation sites (Chambers et al. 2014, 2017b). In contrast, fire now occurs less frequently than it likely did historically in higher elevation mountain big sagebrush communities, leading to expansion of juniper and pinyon pine in some areas (Romme et al. 2009, Bukowski and Baker 2013).

The greatest impact of these fire regime changes to Idaho pronghorn is the conversion from native sagebrush-perennial grass habitat to more fire-prone invasive annual plants. From 1970–2021, 31% of pronghorn SRDs and 38% of WRDs burned at least once, 13% of SRDs and 18% of WRDs burned 2 or more times, and some areas burned as many as 10 times (Table 1) based on mapped perimeters of large >1,000-acre wildfires (Weber 2021). Ranges experiencing the greatest percent of area burned include Jarbidge SRD/WRD, Big Desert SRD/WRD, Owinza WRD, Mountain Home WRD, and Camas SRD (Figure 4 top).

Once converted, the value of these sagebrush landscapes as pronghorn habitat is significantly reduced. Postfire restoration and recovery are logistically difficult, expensive, and success is extremely variable due to limited precipitation, site

differences, prefire composition, and other factors (Crist et al. 2021). In addition, sagebrush recovery to preburn condition is exceptionally slow (several decades to more than 100 years; Nelson et al. 2014, Shinneman and McIlroy 2016) and, once converted to invasive annual grass, risk of reburning is high, further perpetuating the grass-fire cycle (see Crist et al. 2021 for review). Even so, treatments to inhibit recolonization by invasive annual grasses and noxious weeds, and replanting with beneficial native and possibly nonnative grasses, forbs, and shrubs may improve pronghorn habitat. Forbs, in particular, are a critical component of pronghorn diet and quality habitat (Bleke 2022).

Although numerous invasive plant species affect areas of pronghorn habitat in Idaho (see Boyd et al. 2021 for review), cheatgrass and medusahead have the greatest impact, particularly in more arid Basin big sagebrush and Wyoming big sagebrush communities (Miller et al. 2011, Chambers et al. 2014). These species can drastically alter grassland and sagebrush communities by displacing native plant species, increasing wildfire occurrence, and fragmenting and degrading habitat (Miller et al. 2011, Balch et al. 2013). The reduced forage availability and lower quality nutrition may ultimately affect pronghorn reproduction and survival, although early growth stages of cheatgrass can be a preferred forage when seasonally available (Beale and Smith 1970, Schwartz and Nagy 1976, Murray et al. 1978, McInnis and Vavra 1987). Continued changes in climate (e.g., warmer temperatures, drought, rising carbon dioxide) are likely to benefit cheatgrass, medusahead, and other invasive plants such as red brome and ventenata (Miller et al. 2011, Bansal et al. 2014, Bradley et al. 2016).

Of the 29 SRDs and WRDs, 12 have large areas of moderate to high (>30% canopy cover) annual herbaceous forbs and grasses mapped (Table 1). Although these data represent cover of all annual herbaceous plants, they are a useful surrogate for invasive annual plants (e.g., cheatgrass) given that native annuals typically represent a small proportion of vegetation cover on arid rangelands in most years (Maestas et al. 2020). Areas in southwest and southcentral Idaho are most affected, including Atomic, Big Desert, Camas, Jarbidge, Owyhee South, and Weiser SRDs (Figure 4 bottom) and Owinza WRD. Although these data are broad in scale, they provide a means for highlighting areas most affected, as well as those areas potentially at greatest risk of invasion (Maestas et al. 2020).

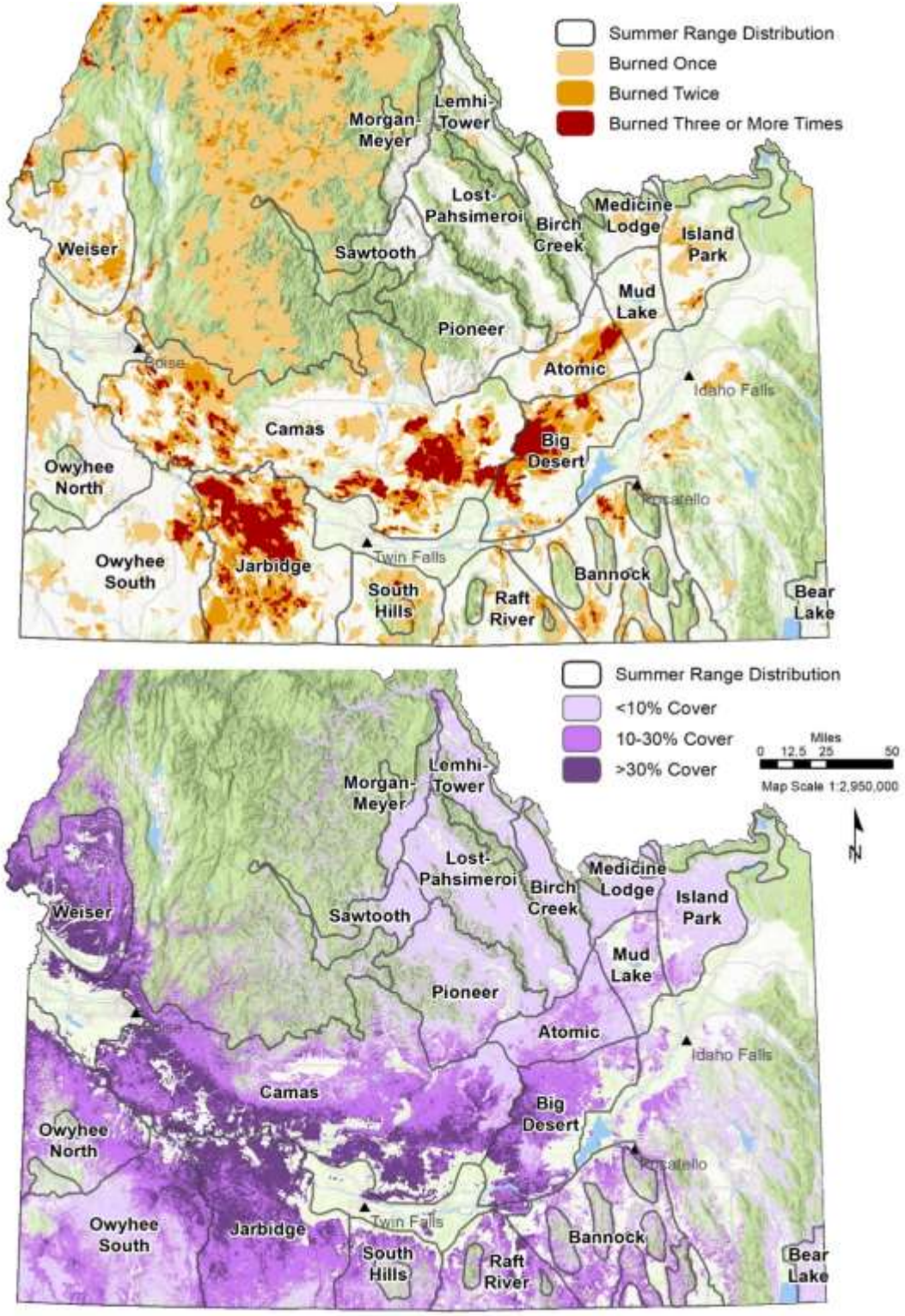


Figure 4. Frequency of large (>1,000-acre) wildfires, 1970–2021 (top), and percent annual herbaceous cover categories (a surrogate for invasive annual plants), 2016–2018 (bottom), in pronghorn summer range distributions in Idaho. Data from the Historic Fires Database, version 3.0 (Weber 2021) and Rangeland Analysis Platform, version 3.0 (Maestas et al. 2020).

Table 1. Percent of each pronghorn summer range distribution (SRD) and winter range distribution (WRD) burned in large (>1,000-acre) wildfires (1970–2021, Weber 2021) and mapped in annual herbaceous vegetation cover categories (2016–2018, Maestas et al. 2020).

Summer and Winter Range Distributions	Total Area (km^2)	Fire Frequency			Annual Herbaceous Cover Category[a]		
		% Burned 1X	% Burned 2X	% Burned ≥3X	% Low	% Mod	% High
Antelope Flat WRD	648	0.0	0.0	0.0	76.5	0.2	0.0
Atomic SRD	2,950	24.9	8.1	5.3	64.1	31.5	0.3
Bannock SRD/WRD	5,066	15.1	4.1	1.6	9.4	30.1	3.0
Bear Lake SRD	796	3.2	0.0	0.0	61.1	4.3	0.0
Big Desert SRD/WRD	5,168	19.4	17.8	17.2	9.4	43.9	18.3
Big Lost WRD	555	0.0	0.0	0.0	58.8	0.6	0.0
Birch Creek SRD	1,967	0.0	0.4	0.0	58.0	0.4	0.0
Birch Creek Sinks WRD	2,448	8.6	1.2	0.0	65.6	12.2	0.0
Camas SRD	19,162	25.5	12.1	9.2	12.1	35.6	27.7
Island Park SRD	3,898	18.5	3.9	0.4	63.6	5.5	0.0
Jarbidge SRD/WRD	8,156	24.8	21.9	21.7	6.9	44.2	37.0
Lemhi-Tower SRD/WRD	2,176	4.0	0.0	0.0	59.0	4.7	0.0
Lost-Pahsimeroi SRD	5,255	2.4	0.0	0.0	62.5	0.7	0.0
Medicine Lodge SRD	1,726	15.0	0.2	0.0	71.5	3.0	0.0
Morgan WRD	216	1.3	0.0	0.2	89.1	1.6	0.0
Morgan-Moyer SRD	1,353	9.7	0.0	0.0	57.1	1.9	0.0
Mountain Home WRD	5,695	29.1	15.1	6.2	0.6	31.7	50.0
Mud Lake SRD	2,082	12.8	1.4	0.2	42.1	14.6	0.0
Owinza WRD	3,673	16.0	14.5	23.0	1.2	20.0	39.7
Owyhee North SRD	5,049	22.7	2.7	0.1	7.5	50.0	14.1
Owyhee North WRD	2,467	24.0	5.0	0.3	0.8	51.6	24.6
Owyhee South SRD	9,354	14.8	2.9	1.5	44.4	36.3	9.6
Owyhee South WRD	4,553	18.9	5.2	3.2	35.6	39.1	18.0
Pioneer SRD	5,338	3.0	0.2	0.0	55.0	8.7	0.4
Raft River SRD/WRD	3,200	21.4	2.7	0.1	16.1	39.6	8.6
Sand Creek WRD	386	27.1	2.9	0.0	44.1	9.3	0.0
Sawtooth SRD	1,976	6.2	0.1	0.0	54.8	0.4	0.0
South Hills SRD/WRD	2,433	31.8	3.4	2.3	21.9	45.7	8.3
Weiser SRD/WRD	5,086	25.2	7.8	0.4	0.1	32.0	46.2

[a] Cover categories defined as Low (≤10%), Moderate (11–30%), and High (>30%).

Competition

When multiple species depend on the same limited resources, such as forage or water, interspecific competition can occur if one species is better at exploiting the resource or interferes with the other species' ability to use the resource, and as a result, the species population performance is lower than it would be otherwise (McInnis and Vavra 1987). Differences in physiology and forage preferences typically result in some partitioning of resources among pronghorn, other ungulates, and domestic livestock (Hofmann 1989); however, competition for either forage or access to water may occur in some seasons or in areas compromised by wildfire, invasive plants, or extended drought.

Because pronghorn forage mostly on forbs and shrubs, there is usually little opportunity for interspecific competition between pronghorn and other ungulates (e.g., mule deer, elk) (Hofmann 1989, O'Gara and Yoakum 2004). However, competition may occur in areas of high mule deer or elk densities or limited forb or shrub availability, due to increased pressure on preferred browse species (Mackie 1976). Increased competition may also occur in areas of limited water availability (e.g., the Big Desert). Similarly, pronghorn dietary overlap with cattle and horses is usually low (Johnson 1979, McInnis and Vavra 1987, Yoakum et al. 2014). However, when conditions require pronghorn to switch to diets higher in perennial grasses (e.g., drought, lack of forbs and shrubs), dietary overlap and potential competition are much greater (McInnis and Vavra 1987). In these situations, increased cattle density may result in reduced doe condition and fawn production (Ellis 1970, Hoffman et al. 2010). Dietary overlap with domestic sheep is greater, particularly with preferred forage species such as common winterfat and black sagebrush (Johnson 1979, Clary and Beale 1983, O'Gara and Yoakum 2004), and may result in reduced pronghorn density when key forage plants are limited during winter (Clary and Beale 1983).

Competition with feral horses for access to limited water sources may directly affect pronghorn populations (Gooch et al. 2017, Hall et al. 2018). Behaviorally dominate over native ungulates, feral horses may outcompete pronghorn for access to water. Co-occurrence at water sources results in increased avoidance (Hall et al. 2018), increased vigilance (Gooch et al. 2017), and decreased foraging and drinking (Gooch et al. 2017) by pronghorn. The resulting increase in energy costs could ultimately affect pronghorn survival and production (Gooch et al. 2017, Hall et al. 2018, Hennig et al. 2021). In Idaho, feral horses are known to occur in Owyhee North and South SRD/WRDs, Pioneer SRD, Weiser SRD/WRD, Sawtooth SRD, and Antelope Flat WRD.

Habitat Management Direction

Management Direction — Engage with land management agencies and other stakeholders to improve the quality and quantity of pronghorn habitat throughout Idaho.

> Strategy: Work with appropriate agencies to ensure important pronghorn migration habitat, routes, and stopovers are considered in management decisions.

Strategy: Coordinate with land management agencies, American Indian tribes, and others to promote practices that benefit pronghorn habitat, such as invasive plant control and other habitat management practices to maintain important seasonal habitats, especially those that improve pronghorn ability to withstand a range of environmental conditions.

Strategy: Coordinate with land management agencies on postfire rehabilitation, promote the establishment of beneficial grasses, forbs, and shrubs (native and potentially nonnative), and limit the establishment of invasive plants.

Strategy: Work with land management agencies, private landowners, and others to evaluate water availability, identify where and when access to water might be limiting, and assess feasibility of maintaining, improving, or developing other water sources (e.g., stock tanks or springs and riparian areas).

Strategy: Actively engage public and private partners to identify, prioritize, and participate in invasive annual grass treatments (e.g., NRCS cheatgrass challenge grant program) that promote the resilience of native bunchgrass and shrub steppe plant communities across the landscape.

Strategy: Identify important areas for pronghorn conservation and management (e.g., key migratory routes and summer or winter range concentrations critical to local populations), and work with land management agencies to develop and implement strategies and cooperative agreements (e.g., conservation easements, land exchanges) to protect and enhance these areas.

Strategy: Participate with federal and state agencies, private landowners, and other stakeholders in cooperative habitat restoration and enhancement projects as opportunities occur and are appropriate, including postfire restoration, native vegetation restoration, conifer encroachment, invasive weed control, diversification of crested wheatgrass monocultures, and wildlife-friendly fencing.

Strategy: Participate with partners (e.g., agencies, private landowners, NGOs) as opportunities occur and are appropriate in cooperative conservation easements and Farm Bill habitat conservation programs for pronghorn winter range and migration habitat.

Management Direction — Use data from GPS-collared pronghorn to better identify changes in seasonal habitat use.

Strategy: Improve habitat suitability models to help evaluate long-term viability of pronghorn populations. Consider agricultural land use and potential migration routes in this evaluation.

Strategy: Assess potential for modeling fawning habitat using recent GPS location data.

Management Direction — Provide technical assistance to local and federal agencies, industries, and others in response to challenges or stressors with the potential to affect pronghorn.

Strategy: Collaborate with others to gather new or augment existing data (e.g., GPS collar locations) to better understand effects of energy development, land use change (e.g., housing development, cropland conversion), or land management decisions on pronghorn populations.

Strategy: Assist industry, resource managers, regulatory authorities, and other stakeholders with planning and implementing approaches to avoid, minimize, or offset adverse effects of energy development on pronghorn populations.

Strategy: Provide technical assistance to land managers to develop plans for road management and OHV use (e.g., implement strategic road closures, evaluate impacts of disturbance, promote monitoring, enforcement, and signage to curtail new user-created routes).

Strategy: Continue to educate the public on the impacts of outdoor recreation on wintering wildlife and evaluate opportunities to expand outreach efforts.

Management Direction — Work with land management agencies, private landowners, American Indian tribes, and other interested parties to maintain preferred forage species on the landscape for pronghorn.

Strategy: Where pronghorn habitat is used by domestic livestock or feral horses, work with land management agencies and private landowners to maintain access to preferred forage species and water resources.

Strategy: Work with federal and state partners to incorporate a mixture of forbs, legumes, and other species that benefit pronghorn and other wildlife species into range rehabilitation and postfire seed mixtures.

Strategy: Evaluate effects of limited forage or water availability on pronghorn in areas where habitat use overlaps with other wild ungulates.

MOVEMENT & MIGRATION

Many ungulates migrate seasonally (i.e., use distinct areas for winter and summer) across large areas of the western US to avoid severe winter conditions and access key resources, such as forage (Kauffman et al. 2020, 2021, 2022). As forage quality and quantity shift across the landscape with temperature and precipitation changes, migration behavior shifts as well, typically resulting in animals moving to higher elevations in the spring and summer to obtain higher quality forage and lower elevations in autumn and early winter to avoid deep snow. It is believed that migratory behavior allows populations to exist at higher numbers relative to species with less mobile life histories. In theory, this occurs because migrating ungulates can exploit more nutritious vegetation resources over longer periods of time by "surfing the green wave" of younger plants throughout the growing season (Aikens et al. 2020). Extended access to high-quality forage typically results in improved body condition, leading to increased survival and reproductive output of migratory individuals (Barnowe-Meyer et al. 2017, Aikens et al. 2020, Jones et al. 2020a, Kauffman et al. 2021). For example, seasonally migratory pronghorn have an increased survivorship relative to resident individuals (7% on average, Jones et al. 2020a).

Recent research has shown that the composition and position of vegetation on the landscape often dictates the length and duration of seasonal migration for ungulate species (Aikens et al. 2020). In general, spring migration for Idaho pronghorn occurs from mid-March to late April and autumn migration from early October to early December (Kauffman et al. 2022). However, pronghorn tend to show variability in timing of migration and some flexibility in migration distances depending on environmental conditions (Hoskinson and Tester 1980, Barnowe-Meyer et al. 2017, Collins 2016, Jakes et al. 2018). Further, short-distance daily movements are common (Dalton 2009, Jones et al. 2017, Reinking et al. 2019) and individual pronghorn in Idaho have been known to move >20 mi (32 km) during winter to find snow-free areas (Bergen et al. 2022).

Along migration routes, animals may spend extended time foraging or resting in specific areas known as stopovers (Sawyer and Kauffman 2011). Not all herds, nor even individuals within the same herd, use the same routes or the same stopovers. Knowledge of migratory routes for ungulates appears to be learned behavior, making restoration of lost migrations extremely difficult and taking 30–80 years for reintroduced populations to develop migratory behaviors in a new landscape (Jesmer et al. 2018). Thus, conservation of the diverse migratory behaviors of animals in an area may be as important as conservation of the migration route itself (Kauffman et al. 2021) and may promote more stable populations (Lowrey et al. 2020). Furthermore, identifying locations of stopovers is equally important for guiding future land management decisions as these areas can be extremely important for migrating individuals. Methodology for accurately mapping stopover locations for pronghorn needs to be developed (Bergen et al. 2022).

The Idaho Action Plan (IDFG 2022b) provides a framework for habitat and technical assistance on big game migrations in the state. The plan identifies priority areas and corresponding management efforts across jurisdictions and is intended to be updated

on an annual or biennial basis. It also establishes opportunities for partnership with Idaho Transportation Department (ITD) and others. The current version identifies 5 priority areas for managing pronghorn, mule deer, and elk winter range and migration habitat in Idaho and highlights ongoing and new priority management needs. Pronghorn SRDs and WRDs that overlap these priority areas include Atomic, Bear Lake, Birch Creek, Camas, Island Park, Medicine Lodge, and Mud Lake SRDs, Birch Creek Sinks, Mountain Home, and Sand Creek WRDs, and Big Desert and Lemhi-Tower SRD/WRDs.

General Migration Strategies of Idaho Pronghorn

In Idaho, pronghorn appear to have adapted their migration strategies according to the resources and habitats available and display a variety of tactics. Based on our current knowledge, Idaho pronghorn appear to follow 3 general strategies: (1) relatively nonmigratory residents or short-distance migrants with partially to completely overlapping summer and winter ranges, (2) animals from multiple isolated winter ranges converging on a single summer range, or 3) animals from a single winter range dispersing to multiple isolated summer ranges (Figure 5). Current GPS data (Figure 6) suggest examples of each strategy include Owyhee North and Big Desert SRD/WRDs (strategy 1), Mountain Home and Owinza WRDs with Camas SRD (strategy 2), and multiple SRDs with Birch Creek Sinks WRD (strategy 3).

While some individuals occupy the same range year-round, others travel extensive distances (>209 km, >130 mi) during migrations (Kauffman et al. 2022). Switching tactics (e.g., resident to migrant) or seasonal range locations have also been documented in adjacent states (White et al. 2007, Barnowe-Meyer et al. 2013, Jakes et al. 2018). Although IDFG has been acquiring pronghorn location data with GPS collars since 2004 (Figure 6), data are still limited in many areas and other seasonal migration tactics and strategies of pronghorn may exist. Complementary to population-level analyses, long-term data on individuals are needed to evaluate the fidelity of seasonal migration tactics, and whether individual animals may migrate some years, but forgo movements in others. Continued development and refinement of range and migration routes will be instrumental in prioritizing areas for conservation and management, designing appropriate hunt structures, and implementing habitat improvement projects, as well as improving IDFG's ability to provide technical services to land management agencies.

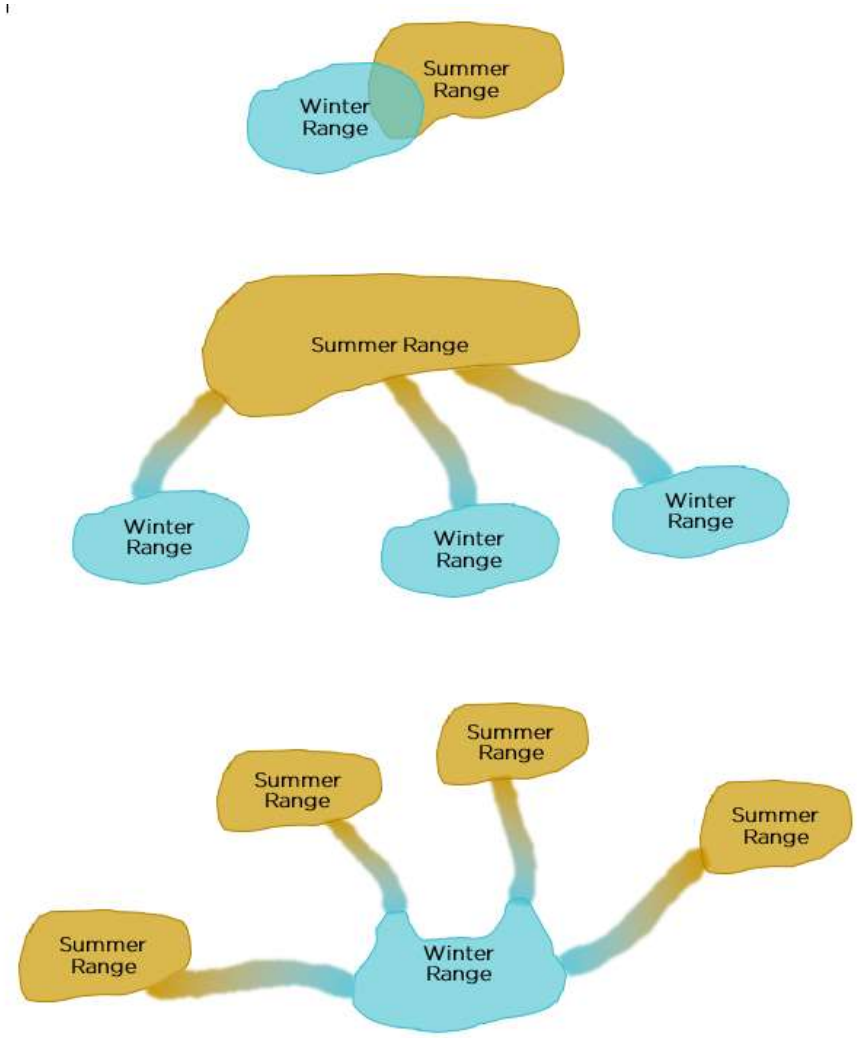


Figure 5. General pronghorn migration strategies evident in Idaho populations include relatively nonmigratory residents or short-distance migrants (top), animals from multiple isolated winter ranges converging on a single summer range (middle), or animals from a single winter range dispersing to multiple isolated summer ranges (bottom).

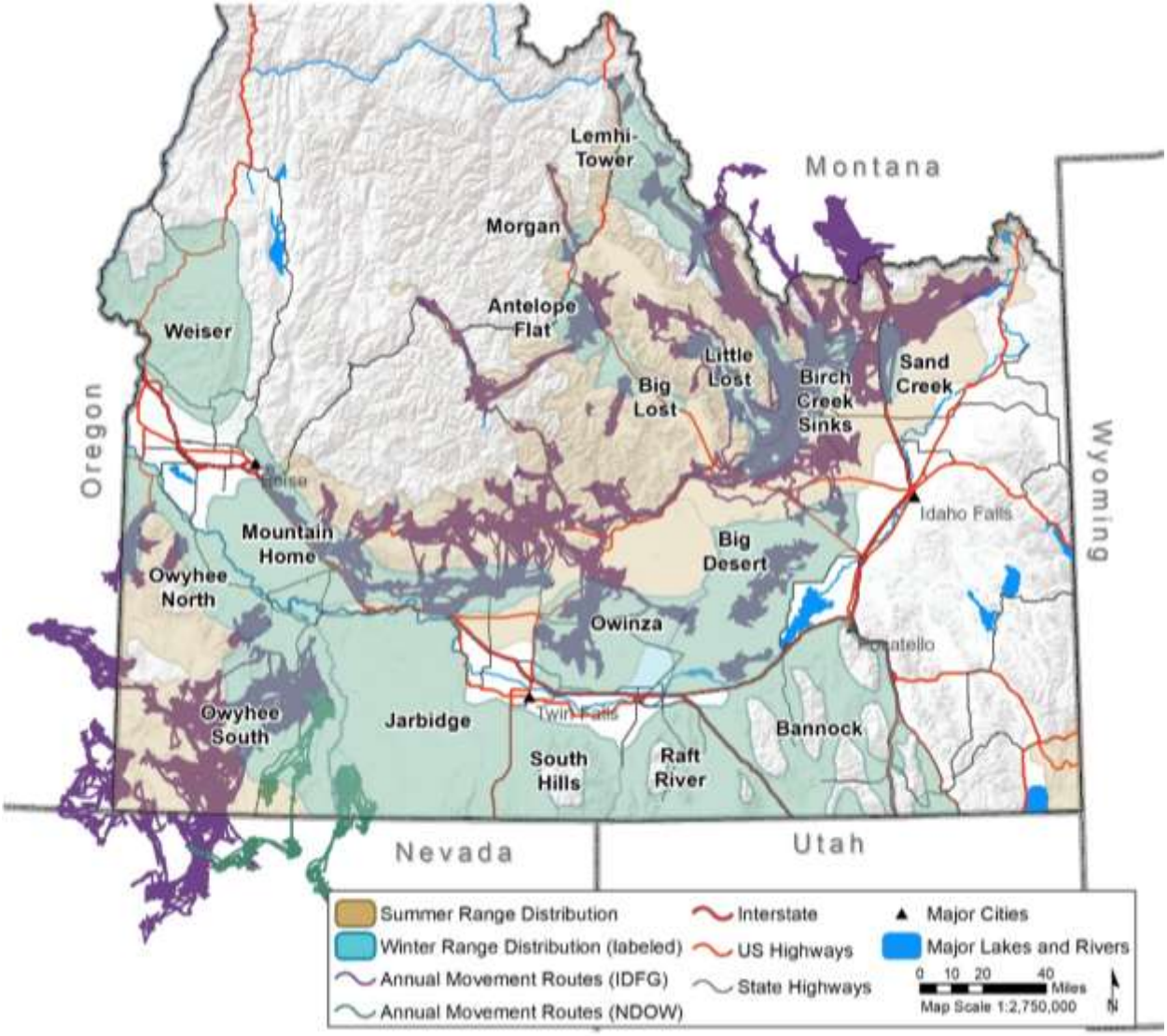


Figure 6. Biologist-identified summer and winter (labeled) range distributions of pronghorn overlaid with annual movement routes of GPS-collared animals (n = 283) in Idaho, 2004–2022. Data provided by Nevada Department of Wildlife (NDOW) (n = 5) identified separately. Additional movement routes have not yet been mapped.

Potential Challenges to Movement & Migration

Pronghorn evolved over the last 30,000 years to travel across large, contiguous landscapes. Only in the last few hundred years have anthropogenic barriers appeared, and these have undoubtedly changed or eliminated migration routes and behavior in some pronghorn herds. Often covering extensive distances, migrating animals are exposed to multiple anthropogenic barriers including roads, fences, and development, as well as natural obstacles (e.g., land cover, topography, rivers). Pronghorn seasonal migrations can be constrained or "bottlenecked" by these natural or manmade features in the landscape (Gates et al. 2012; Seidler et al. 2015; Kauffman et al. 2020, 2021, 2022). For example, near Craters of the Moon National Monument and Preserve

pronghorn migrations are constrained by lava beds, the foothills of the Pioneer Mountains and US Highway 20/26, whereas in the Boulder Mountains pronghorn are constrained by the natural topography (Figure 7).

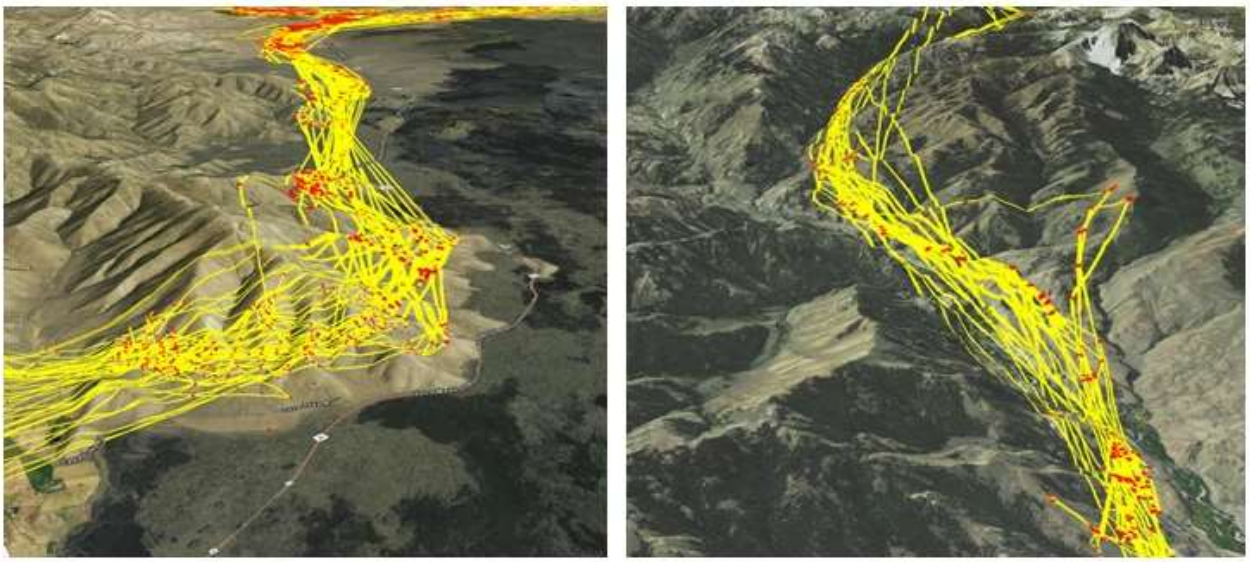


Figure 7. Migration bottlenecks of pronghorn near Craters of the Moon National Monument and Preserve (left) and within the Boulder Mountains (right), Idaho. Red dots are pronghorn GPS locations used to generate migration paths (yellow lines), 2020–2021.

Roads, Railroads, & Fences

Pronghorn can be affected by manmade linear features such as roads, railways, and fences (Seidler et al. 2015, Robb et al. 2022), which can result in direct mortality or indirect effects such as diminished survival and productivity due to the increased energy needed to navigate these barriers. Roads and railways in Idaho have been associated with several pronghorn mass mortality events (Table 2), predominantly in winter when they provide shelter or relatively snow-free areas during extreme weather. Increasing traffic volumes on roadways may also lead to increased pronghorn-vehicle collisions (Gavin and Komers 2006, Robb et al. 2022, Xu et al. 2023). Indirect effects of highway fences built with the purpose of preventing vehicle collisions with wildlife and domestic animals may negate the increased survivorship of migrant individuals by limiting access to preferred habitat and increasing cost of migration (Jones et al. 2020a, Van Moorter et al. 2020, Jones et al. 2022).

Multilane highways have high traffic volume and wildlife barrier fences reduce wildlife-vehicle collisions but, by preventing pronghorn crossings, these fences can disrupt migrations. These types of highway obstacles occur in the Upper Snake River Plain along I-15, the vicinity of the Raft River along I-86, and along I-84 between Burley and Boise. For example, I-15 likely impedes traditional east-west pronghorn migration between winter and summer ranges (IDFG 2022b). Despite what could be 40 years of separated seasonal migration routes, both herds still use areas directly opposite one another with no movement of GPS-collared pronghorn across I-15. East of I-15, autumn migrations may have been shortened with animals that historically wintered in

the Birch Creek Sinks WRD now wintering in the Sand Creek WRD (Figure 8). West of I-15, spring migrations may have also been shortened such that animals historically summering in the Island Park SRD now summer in Medicine Lodge and Mud Lake SRDs (Figure 8).

Table 2. Documented pronghorn mass mortality events (>10 animals) due to train or vehicle collisions in Idaho, 1976–2022.

Month Year	Number Killed	GMU	Location (County)	Comments	Source
17 Feb 1976	132	68	Wapi (Blaine)	Train collision	Thiessen 1978
Winter 1983–1984	13	32, 32A	Unit 432 (Washington)	Killed in a highway accident	Trent et al. 1986
Jan 1984	66	63A	Market Lake (Jefferson)	Train killed east of I-15	Trent and Naderman 1986
Winter 1985–1986	45	52	East of Shoshone (Lincoln)	Killed in 2 train incidents	Trent et al. 1986
Winter 1985–1986	15	53	Wendell (Gooding)	Killed by a truck	Trent et al. 1986
Winter 1992–1993	Unk	60A, 63	Multiple	"Significant numbers… lost to train and vehicle collisions…"	Kuck 1994
Feb 2004	47	52A	East of Dietrich (Lincoln)	Train collision	Casper Star Tribune, 19 Feb 2004
25 Jan 2019	11	52	West of Picabo (Blaine)	Killed by a pickup	IDFG Roadkill Database
3 Feb 2020	64	60A	Hamer (Jefferson)	Train collision	IDFG Press Release, 14 Feb 2020
14 Feb 2020	32	60A	Hamer (Jefferson)	Train collision	IDFG Press Release, 14 Feb 2020

Construction of wildlife overpass structures can decrease wildlife-vehicle collisions and mitigate the effects of fencing that impede migrations. Successful overpass structures used by pronghorn during seasonal migrations have been designed and constructed at numerous locations in adjacent states (e.g., Trappers Point Wildlife Crossing on US Highway 191, Wyoming) for federal and state highway systems and decreased wildlife-vehicle collision by 80% or more (Beckmann et al. 2010, Ament et al. 2021). However, overpasses are costly to construct and not always a viable option. Other wildlife crossing structures, such as underpasses or bridges, are typically avoided by pronghorn, presumably because underpasses impair their vision and constrain movements (Sawyer et al. 2016).

The distribution of barbed and woven wire fencing across southern Idaho can impede daily and seasonal movements of pronghorn. Fences that prevent movement under the lowest wire are known to delay pronghorn and may increase energy expenditures as they seek a path around it, which may lead to increased mortality during severe winters (Jones et al. 2020a). Where possible, fences should be removed or altered to improve passage by pronghorn with particular attention to areas where woven wire fences exist but are no longer needed. A pronghorn-friendly fence consists of a smooth top wire at no more than 40–42 in (102–107 cm) above the ground, a smooth

bottom wire at 18 in (46 cm), and 2 intermediate barbed wires with at least 12 in (30 cm) between the top 2 wires (Figure 9; Jones et al. 2020b, Paige 2020). Pronghorn will use fences with bottom wires <18 in (46 cm), but higher bottom wires reduce injuries. Other modifications to existing fences can also improve passage. For example, if 18 in (46 cm) is not a reasonable minimum to use throughout the fence, clips can be used to raise the bottom wire at frequently used crossings to allow for pronghorn passage and including PVC pipe on the top wire to improve visibility can improve successful crossing (Jones et al. 2020b, Paige 2020). However, any modifications to the bottom wire should be done without the addition of PVC or other highly visible material as this can dissuade pronghorn from crossing (Jones et al. 2018, Jones et al. 2020b). Crossings can also be accommodated for all types of fences with the strategic placement of seasonal gates that can be left open when domestic livestock are not present. Let-down fences that can be lowered during migration periods are also a good option for all species, including pronghorn.

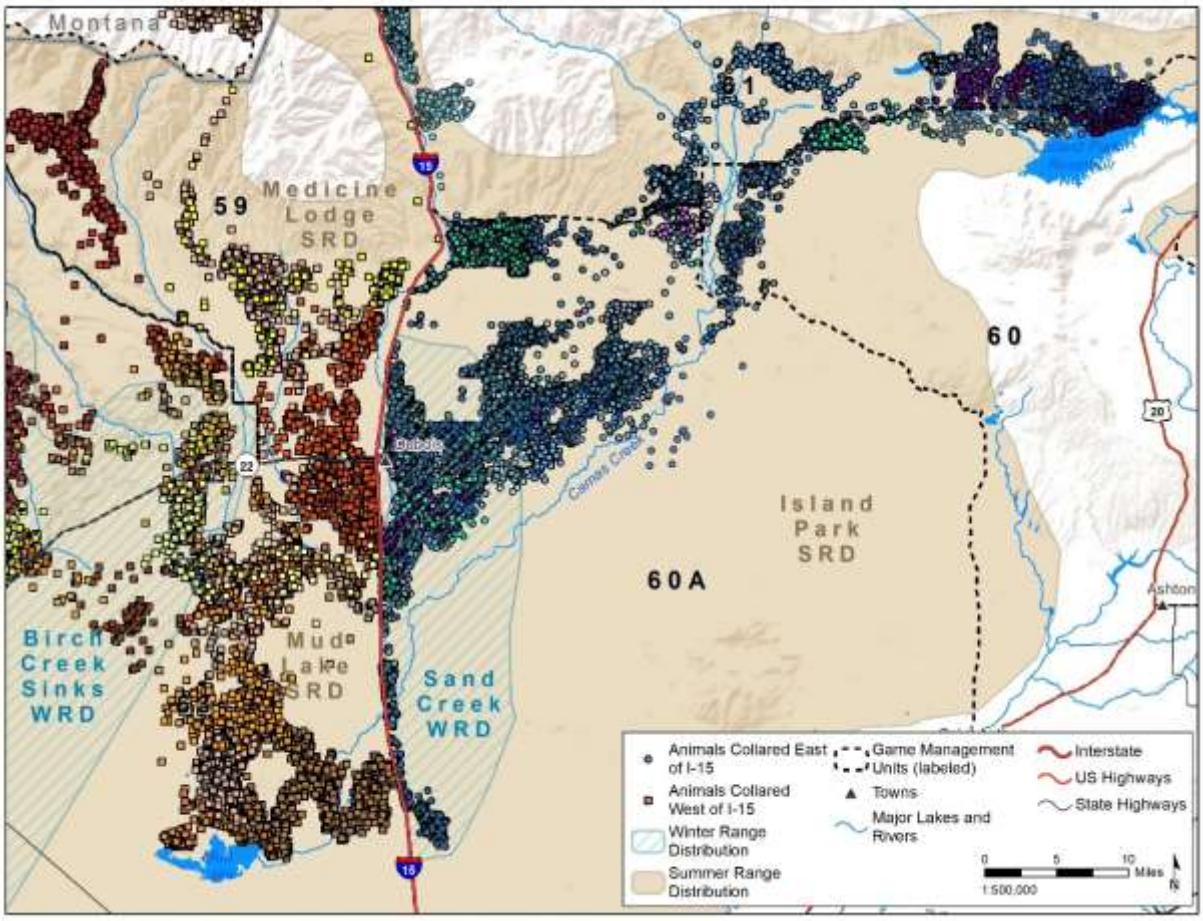


Figure 8. Separation of known seasonal migration routes for pronghorn due to I-15 and associated fencing. Cool colors (circles) represent individual animals collared east of I-15 (n = 32) and warm colors (squares) represent individual animals collared west of I-15 (n = 23), 2011–2022.

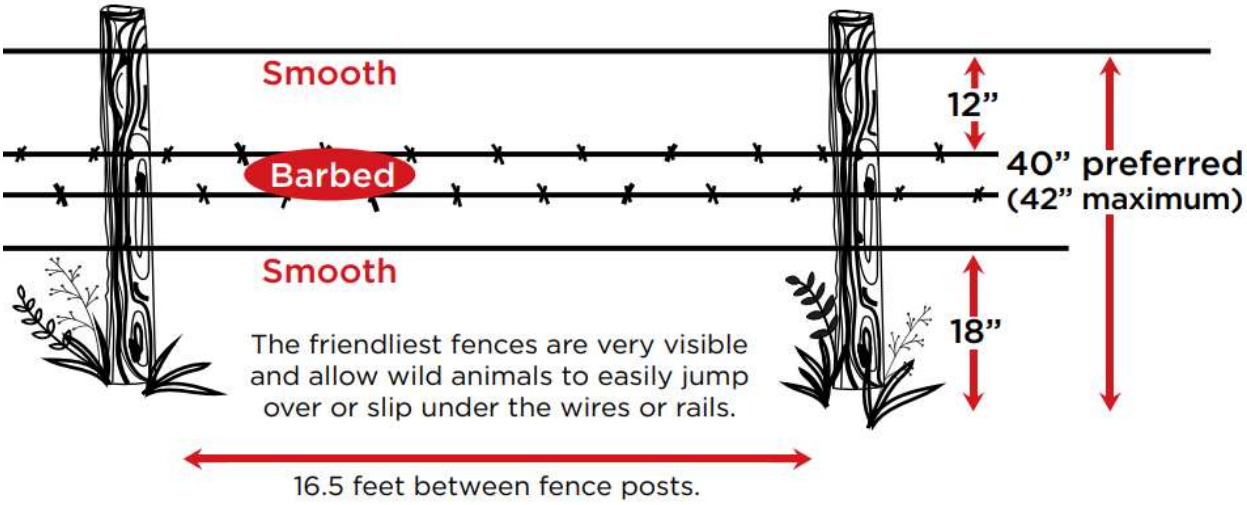


Figure 9. Diagram of a wildlife-friendly fence for pronghorn. Other wildlife-friendly options available (see text, adapted from Paige 2020).

Infrastructure & Energy Development

Research has shown that energy development and associated infrastructure have the potential to hinder pronghorn movements and migrations (Sawyer et al. 2019, Jakes et al. 2020, Smith et al. 2020, Lambert et al. 2022, Sawyer et al. 2022). While broad-scale developments are often the focus of concern, even small-scale developments may have significant effects if located within important migration or stopover habitat (Sawyer et al. 2022). As Idaho's human population and associated infrastructure continue to grow, pronghorn migration routes could be compromised without thoughtful planning and collaboration with county, state, and federal agencies. Sound scientific data collection and analysis will be crucial for guiding such efforts, as well as for proposing and implementing mitigation measures.

Snow, Weather, & Extreme Storms

Snow depths exceeding 11 in (30 cm) inhibit pronghorn movement (O'Gara and Yoakum 2004) and greater snow depth, density, and hardness can influence use of traditional winter range (Bruns 1977, Barrett 1982). For example, animals near Craters of the Moon National Monument and Preserve have become trapped on summer range when early snowstorms have occurred along the migration route (John Abel, National Park Service [NPS], personal communication). Similar events have occurred in Wyoming, where deep snow limited pronghorn migration to the Upper Green River Basin (Koshmrl 2014). Pronghorn are also frequently seen wintering in the upper Big Wood River drainage near Ketchum, an area not typically considered pronghorn winter range. It is unknown whether these animals are trapped by snow during migration, or if anthropogenic development has blocked their historical migration route.

Similarly, extreme storm events can be associated with pronghorn movements to areas outside traditional ranges. For example, during the 2001–2002 winter

approximately 70–80 pronghorn are believed to have crossed American Falls Reservoir on the ice to the vicinity of the Pocatello Regional Airport. In January 2017, approximately 300 pronghorn crossed the ice on American Falls Reservoir into GMU 68A between I-86 and the reservoir (see Big Desert SRD/WRD). That same winter, approximately 50 pronghorn became stranded on the ice on Lake Walcott as deep snow pushed them farther south than normal. Twenty pronghorn were euthanized by IDFG due to injuries sustained on the slick ice and 10 were killed by coyotes. Ice conditions in 2017 also allowed pronghorn to cross the Snake River from Oregon into the town of Payette and 50 died of yew poisoning when they consumed ornamental shrubs used for landscaping.

Reduced snow cover extent and duration may benefit pronghorn through improved forage availability. However, the increased variability and frequency of extreme conditions may be a hinderance. Both factors may result in changes in the timing, duration, or distance of migrations (see Climate Change chapter). Overall, maintaining connectivity across the landscape is key to sustaining pronghorn herds and providing opportunities for animals to respond to the effects of climate change. This may be particularly important in areas of more extreme environmental conditions (e.g., at periphery of range).

Movement & Migration Management Directions

Management Direction — Collaborate with federal and state agencies, American Indian tribes, counties, nonprofit organizations, private landowners, and others to incorporate important pronghorn migration habitat and routes in management decisions.

> Strategy: Collaborate with federal and state agencies, landowners, and other stakeholders to reconnect seasonal ranges where migration routes have been interrupted (e.g., crossing structures, wildlife-friendly fencing, and conservation easements as appropriate).
>
> Strategy: Implement the Idaho Action Plan (IDFG 2022b).
>
> Strategy: Collaborate with partners to reduce negative effects of fencing on pronghorn, especially along known migration routes, by considering fence placement, using wildlife-friendly fencing specifications, and removing unnecessary fences.
>
> Strategy: Collaborate with ITD to continue to collect wildlife-vehicle collision data and identify areas of concern.
>
> Strategy: Participate as requested by ITD in design, engineering, and public input processes for planned highway wildlife crossing structures and funnel fencing.
>
> Strategy: Develop and implement strategies and cooperative agreements (e.g., conservation easements, land exchanges, and Land and Water Conservation

Fund) to protect and enhance key migration routes and other important habitat use areas.

Management Direction — Use data from GPS-collared pronghorn to develop information regarding important migration routes, seasonal ranges, and stopover locations.

Strategy: Identify data gaps and prioritize pronghorn populations for GPS-collaring efforts to develop migration and range maps.

Strategy: Identify areas of elevated pronghorn mortality associated with movement barriers and work with appropriate agencies and others to facilitate pronghorn movement in these areas.

Strategy: Develop methodology for accurately mapping stopover locations for pronghorn.

Strategy: Coordinate with adjacent states to better understand interstate pronghorn migrations and habitat use.

POPULATION MONITORING

A variety of methodologies exist to survey and inventory pronghorn, each with different strengths and limitations. Pronghorn populations in Idaho generally occur at lower densities with sporadic distribution on the landscape, as compared to places like Montana or Wyoming. They can display nomadic behavior in winter and some populations inhabit higher elevation and rugged terrain in the summer. These factors in combination with the highly migratory and mobile nature of pronghorn degrade the reliability of aerial survey methods traditionally used for most of Idaho's big game species (e.g., elk, mule deer, bighorn sheep, mountain goats). Currently, no standard statewide monitoring protocol or survey design exists for pronghorn. Instead, monitoring methods are tailored to fit data needs, staff availability, funding, and survey area conditions. These data are then combined with hunter numbers, hunter success, and depredation concerns when allocating tag numbers and structuring hunting seasons. An informal survey of regional wildlife managers and regional supervisors in 2020 indicated a population estimate or, in the very least, a population trend, would be the most beneficial and foremost need to manage pronghorn. Strategies aimed at improving pronghorn population estimates are a priority for this plan moving forward the next 6 years.

Monitoring pronghorn populations in Idaho has been challenging and a diverse approach has been taken. In the 1950s and 1960s, biologists flew pronghorn ranges annually in fixed-wing aircraft. These flights were often in late winter or early spring, but also flown in September, just prior to hunting seasons. These flights documented animals seen without collecting age or sex ratios. There was no standard procedure for conducting these flights and they did not produce a population estimate—but it did provide a minimum count and were used to document population trends.

In the 1970s, Idaho started using helicopters to annually survey pronghorn across the state. One benefit from using the helicopter was it allowed managers to collect age and sex ratios of animals surveyed and were typically flown in late summer. But there was still no standardized approach to pronghorn surveys, nor was there a way to account for animals missed on a survey, so these flights were still considered a minimum count in the survey area and did not produce a population estimate. Helicopter composition flights continued annually until 1983 as part of the Statewide Antelope Ecology research project (Authenrieth 1983). Helicopter surveys were largely curtailed after 1983 due to budget restrictions (Kuck et al. 1990).

In the early 1980s, managers began using line transects with fixed-wing aircraft to obtain pronghorn population estimates (Burnham et al. 1980, Johnson et al. 1991) as fixed-wing reduces the cost compared to helicopter surveys. A fixed-wing aircraft flew specific transect lines, and observers counted pronghorn on different sides of the plane. Distances marked on the struts allowed each group of pronghorn observed to be placed in 1 of 4 distance categories away from the plane to aid in analysis (Kuck et al. 1990). Line transects were discontinued in the early 1990s, possibly because decreased populations following the severe winter of 1992–93 made this method unfeasible due to low densities of pronghorn on the landscape.

In the 1990s and 2000s, pronghorn monitoring has been largely sporadic. While a few formal aerial surveys have been attempted, most pronghorn information collected from aircraft has been incidental to deer, elk, or bighorn sheep surveys. A few regions started monitoring pronghorn by conducting herd composition surveys from the ground. Several studies were also completed during this time to compare the efficacy of ground counts with aerial surveys, to develop standard survey methodologies for estimating sex and age ratios, and to identify factors influencing the wide range of reproductive performance observed in pronghorn populations (Compton 2005, Smyser 2005, Smyser et al. 2016, Bleke 2022). Ground surveys have the advantage of being more affordable and safer than aerial surveys. However, both methods exhibit biases (Bleke 2022), and ground surveys may not be comparable to aerial surveys due to displacement of pronghorn from roads (Oyster 2014). Anecdotal evidence suggests displacement of pronghorn away from roads and subsequent declines in pronghorn observed during ground composition surveys in several Idaho SRDs when the survey is done after August 5 (first day archery hunters can place blinds in the field). Today, a valid viable standardized method for estimating and monitoring total pronghorn numbers is still lacking.

Surveys may be designed to (1) estimate population abundance (e.g., sightability surveys), (2) provide an index to population status (e.g., trend surveys), or (3) determine age and sex ratios (e.g., composition surveys). In addition to surveys, harvest statistics and survival monitoring are important metrics for developing comprehensive population monitoring programs. Oftentimes, a combination of these methods is used to gather reliable data given funding constraints and logistical hurdles. Furthermore, one methodology will not work in all situations or locations across Idaho. The following are the most commonly used techniques for addressing overarching population monitoring goals for pronghorn.

Population Abundance

Aerial surveys allow for large sample sizes and therefore more accurate counts. They enable remote segments of populations to be surveyed and can cover large areas in a relatively short amount of time depending on design. The primary disadvantage is the high cost and risk involved to the pilot and crew. Aerial surveys depend on meeting key assumptions and annual variation in population estimates may be the result of variable detection probability and not necessarily the result of a change in population (Terletzky and Koons 2016, Zabransky et al. 2016). Sightability models can help mitigate some of these challenges; however, such a model has not been successfully developed for pronghorn.

Numerous states and provinces across pronghorn range are currently using line-transect distance sampling to generate population estimates. This method has been tried in Idaho on several occasions, but low pronghorn densities and steep topography on some summer ranges reduce the utility of this method to accurately monitor all pronghorn herds in Idaho.

Herd Composition

IDFG has conducted ground surveys for total counts, herd age, and sex composition ratios in several pronghorn populations (Appendix F). Reliability of composition

surveys depends on surveying an adequate proportion of the population, obtaining a random sample, and accurately classifying sex and age (Yoakum et al. 2014). Thus, composition surveys may be influenced by several factors including seasonal changes in group size, composition (e.g., number of does, age or size of fawns, cheek patches on yearling males, growth stage of horns, etc.), and dispersal behavior (e.g., scattered, lone males versus mixed groups) (O'Gara and Yoakum 2004, Hess 2018). Surveys during August (i.e., preseason) are ideal to collect fawn:doe ratios because the fawns are past their hiding stage, are easily distinguishable from adults, and groups are still relatively small and dispersed. Additionally, herds are not likely to have migrated out of an area (O'Gara and Youkum 2004, Yoakum et al. 2014). Summer surveys to collect buck:doe ratios are less conducive because bucks are in bachelor groups and segregated from the does and fawns. Lone bucks and small groups can be easily missed in a survey. Preseason surveys tend to provide stable fawn:doe ratios and, while they may not be correlated with population growth (Hess 2018), they may be an indicator of habitat quality and recruitment. The desired preseason buck:doe ratio depends on management objectives, but Salwasser (1980) and Hailey (1979) reported a buck:doe ratio of 25:100 is desirable to allow for maximum recruitment into a population while a ratio of 50:100 is desirable when trying to achieve maximum trophy buck production (i.e., a relatively large number of ≥ 3-year-old bucks, Yoakum et al. 2014).

Postseason surveys eliminate the concern of summer segregation of bucks and does, but it can be difficult to collect reliable data from large groups as they congregate on winter range. Movements and migrations can also create problems when collecting postseason composition ratios. Additionally, animals may be especially nervous after hunting season and not readily viewable from roads during ground surveys. Salwasser (1980) noted that a postseason buck:doe ratio of 20:100 is biologically safe to achieve complete breeding of reproductive females.

Harvest Monitoring

An important component of pronghorn management in Idaho is harvest-based monitoring, which includes hunter surveys and harvest reports. Harvest reports are collected through mandatory harvest reports and telephone surveys. Harvest per unit effort (i.e., hunter days) is considered most sensitive to changes in animal abundance (Keegan et al. 2011) because it is assumed that as animal numbers decline, hunters will have to spend more days afield to be successful. While understanding harvest is important for managing hunted populations, it has limitations as a population monitoring method as it has many assumptions that must be met to be valid (Keegan et al. 2011).

Emerging Monitoring Methods

With technological and statistical advancements, additional methods for monitoring populations are emerging as potentially practical and reliable options. Trail cameras have been used successfully to collect population demographics for a variety of species (Moeller et al. 2018, Pfeffer et al. 2018, Palencia et al. 2021, Taylor et al. 2021), while machine learning programs can quickly and accurately classify large numbers of images (Tabak et al. 2019). IDFG is currently evaluating statewide and regional estimates for many big game species (e.g., gray wolf, black bear, mountain lion, white-

tailed deer, elk, mule deer, moose) produced with a statewide camera grid. This technology may be useful for producing a valid pronghorn population or herd composition estimate.

Infrared (IR) technology is becoming increasingly popular for animal surveys (e.g., Schoenecker et al. 2018). This technology remains expensive, and requires specific environmental conditions (i.e., early mornings with cold temperatures) that may limit its usefulness. Infrared flights for pronghorn and other ungulates have been tried in Idaho on multiple occasions. Noted issues during these trials included expense, misclassification of animals, rocky terrain with similar heat signatures as ungulates, and inability to survey in rough topography or steep terrain.

Non-invasive genetic sampling, such as fecal DNA, may be an option to obtain cost-effective estimates on small, clustered pronghorn populations with wide distributions (≤ 300 animals, Pfeiler et al. 2020) that are otherwise difficult to survey. Fecal DNA analysis is being used successfully for minimum counts, population estimates, trends, sex ratios, recruitment, and survival estimates in relatively small populations of several ungulate species including Sonoran pronghorn (Woodruff et al. 2016), desert bighorn sheep (Pfeiler et al. 2020), and feral horses (Schoenecker et al. 2021). For example, researchers estimated adult and fawn survival as well as overall population size of Sonoran pronghorn by collecting fecal pellets at water sources (Woodruff et al. 2016). Estimates from non-invasive genetic sampling are most precise when a large proportion of the population can be sampled and detection probabilities are high (Pfeiler et al. 2020, Schoenecker et al. 2021). It may also be a more affordable option then traditional survey approaches (Pfeiler et al. 2020) without the high risk of mortality from capture.

Future Monitoring Needs

Idaho needs an accurate and cost-effective way to monitor pronghorn populations across the state to more precisely determine population trends, maximize hunting opportunity (i.e., better allocate permits and harvest), and evaluate adaptive management strategies. For example, archery harvest has tripled in the last 20 years, but this increase in harvest has not led to decreases in tag numbers or season lengths (other than for some hunter crowding issues during archery-only season). Given limited population survey information, the degree to which this exponential increase in harvest is affecting pronghorn populations is unknown.

The need for better population estimates will likely become more acute as wildfires, human infrastructure and development, and climate change continue to alter pronghorn habitat. However, pronghorn management needs vary among regions and populations. For some populations, monitoring using harvest metrics may be sufficient for estimating trend (Keegan et al. 2011). Other populations need reliable counts or consistent trend data to monitor herd health. Populations with known declines may need cause-specific mortality, migration, productivity, or habitat use studies to inform management actions. For instance, recent mortalities from GPS collar deployments have found that mature does had high mortality rates (up to 27%)

in some regions of Idaho (IDFG, unpublished data). Further, gathering information on vital statistics (e.g., survivorship and recruitment) would ultimately provide necessary data needed for the development of population estimates through time from which more accurate harvest allocations could be derived.

Population Monitoring Management Direction

Management Direction — Improve the quality of pronghorn population data to better evaluate population trend and viability.

Strategy: Develop valid method(s) and a survey monitoring plan that provides for periodic assessments of population status, trend, and distribution, evaluates frequency of surveys needed, and develops pilot projects to test emerging methods.

Strategy: Identify opportunities to engage in research focused on survival, recruitment, and other factors limiting populations.

Strategy: Review results of tooth collection studies conducted in Idaho. Evaluate if collecting teeth or photos of dentition from harvested pronghorn could currently be useful to manage pronghorn population age structure, composition, status, or trends.

Strategy: Continue to use GPS-collared pronghorn or alternative technologies (e.g., remote cameras) to help delineate distribution, identify movement patterns, and develop and refine suitable habitat models.

Strategy: Collect and compile incidental pronghorn locations during deer and elk surveys to improve understanding of pronghorn distribution and abundance.

Strategy: Conduct cause-specific mortality studies in SRDs and WRDs with suspected population declines.

Strategy: Continue to compile historical records (e.g., aerial surveys), including digitizing hardcopy documents, and archiving all records in a centralized location.

HARVEST MANAGEMENT

Wildlife managers incorporate many factors to determine harvest strategies for pronghorn such as habitat conditions, hunter preferences, population size and trajectory, herd composition, population vital metrics, and harvest statistics. These factors, as well as the availability of these data, vary dramatically from year to year and among different geographic areas. It is important for managers to incorporate the best available habitat and population information when developing harvest management frameworks to achieve objectives. For example, this could include increasing female harvest when information indicates increases in fawn:doe ratios, harvest success, and population size or depredations have increased. Conversely if fawn:doe ratios have decreased, habitat has been negatively altered, there is an increase in pronghorn mortality due to harsh winter conditions, or observations indicate a decline in populations, then reducing or eliminating female harvest may be warranted. These same factors could also indicate a need to increase or decrease overall harvest, including buck harvest.

Season timing, length, and weapon types are also factors that can influence harvest rates and pronghorn behavior. In Idaho, males shed horn sheaths in late October through November, making gender identification difficult for hunters during this time. In addition, past hunter preference indicated timing and length of pronghorn seasons interfered with the opportunity to participate in hunts for other big game species. Consequently, the opening of pronghorn seasons has occurred prior to openings of deer and elk hunts, meaning most hunting opportunity occurs during the pronghorn breeding season (mid-September to early October). Most pronghorn season dates (e.g., any-weapon, either-sex, 25 Sept–24 Oct) have been consistent across Idaho for many decades. However, managers may need to consider changes in season length, timing, or weapon type to address population trends, meet management objectives, or provide a diversity of hunting experiences.

Pronghorn hunts are either-sex or doe/fawn only. Bucks are primarily targeted on either sex hunts (93% buck harvest in the 2021 any-weapon hunts). Doe/fawn hunts are offered to provide additional opportunity in areas where populations are increasing, to maintain or reduce population growth, or to address depredation complaints. During periods with favorable weather, environmental and habitat conditions, pronghorn can be highly productive and can withstand high harvest rates. In Wyoming, harvest rates average 20% of the population (range 8-40%) in herds over objective, and average 15% (range 6-28%) of the population in herds below objective (Yoakum et al. 2014). Idaho takes an adaptive approach to allocate doe/fawn harvest. Doe harvest rates vary based on herd status (increasing or decreasing), potential for depredations to stored or standing crops, and reproductive rates (e.g., fawn ratios). For example, when comparing populations surveyed during the same time period, a herd with 120 fawns per 100 does can withstand more harvest than herds with 65 fawns per 100 does (O'Gara and Yoakum 2004). Additionally, harvest metrics (hunter success and days) can be used to adjust doe/fawn harvest opportunities.

Pronghorn have been harvested under a permit system in Idaho since 1934 (Edson 1960), yet data on pronghorn populations is limited and varies depending on the population in question. As a result, managers have relied largely on harvest metrics and hunter preferences to set harvest seasons. Idaho has a mandatory harvest report requirement for big game hunters, and the information reported by hunters is used to generate harvest estimates and other data (e.g., horn length and percent females in the harvest) to evaluate hunter success and possibly provide information on pronghorn population size and trajectory.

Hunting Opportunity & Odds of Drawing

Pronghorn hunting opportunity currently exists in IDFG's Southwest, Magic Valley, Southeast, Upper Snake, and Salmon administrative regions. Several hunt types are offered to meet varied biological needs and social parameters including either-sex hunts, doe or fawn-only, youth-only, and extra tags. Similarly, Idaho provides unique opportunities for hunting pronghorn by weapon type with any-weapon hunts, archery-only hunts, muzzleloader-only hunts, and short-range-weapon-only hunts (Table 3). There are no general season opportunities for pronghorn in Idaho with all tags being allocated through a controlled hunt draw system. Idaho, and other states, have also implemented doe- or fawn-only hunting opportunity to address depredation concerns, provide additional hunter opportunity where appropriate, and reduce or maintain populations at a certain level.

Archery hunting participation and harvest nearly tripled in Idaho between 2002 and 2020, while numbers of all other hunters increased only slightly (Figure 10). Because reliable population data on pronghorn are lacking in many areas, impacts of this increased harvest are unknown. Concerns with the increased archery participation to date have largely been social, such as potential hunter crowding in certain areas and increased hunter competition for water holes. In addition, the increasing number of applicants (Figure 11 top) for a consistent number of any-weapon, either-sex tags have resulted in decreasing draw odds (Figure 11 bottom). Several steps to address this issue have occurred. For instance, pronghorn archery hunting changed from a general season to controlled hunts in 2009. Furthermore, archery-only unlimited controlled hunts were converted to first-choice only applications in 2021. Also in 2021, the Idaho Fish and Game Commission adopted a rule in which hunters who drew an either-sex pronghorn tag became ineligible to apply for any limited pronghorn tag during the first application period of the following year. The biannual season-setting process begins in January and culminates with Idaho Fish and Game Commission approval in March.

Table 3. Pronghorn hunting opportunity, including various hunt types and metrics, during the 2022 hunting season in Idaho.

Hunt Type	Total Tags Available	Number of Hunts	2022 Avg. Drawing Odds	Total Harvest	Avg. Success Rate
Any-weapon (Either-sex)	1,095	24	4.0%	807	76%
Archery-only (Either-sex)	3,195	17	N/A*	490	20%
Muzzleloader-only (Either-sex)	230	5	28.6%	105	52%
Short-Range-Weapon-only (Either-sex)	45	2	15.3%	20	52%
Doe- or Fawn-only Tags (any-weapon)	150	3	21.9%	82	61%
Youth-only (various sex and weapon types)	95	5	19.3%	53	63%
Landowner Permission (extra Doe- or Fawn-only)	75	2	N/A*	39	69%
TOTAL	4,810	56		1,596	40%

*Average drawing odds for archery-only and Landowner permission hunts not calculated because unlimited controlled hunts are included in this summary. For archery-only hunts with limited tags, 2022 average drawing odds equaled 58% for 410 tags.

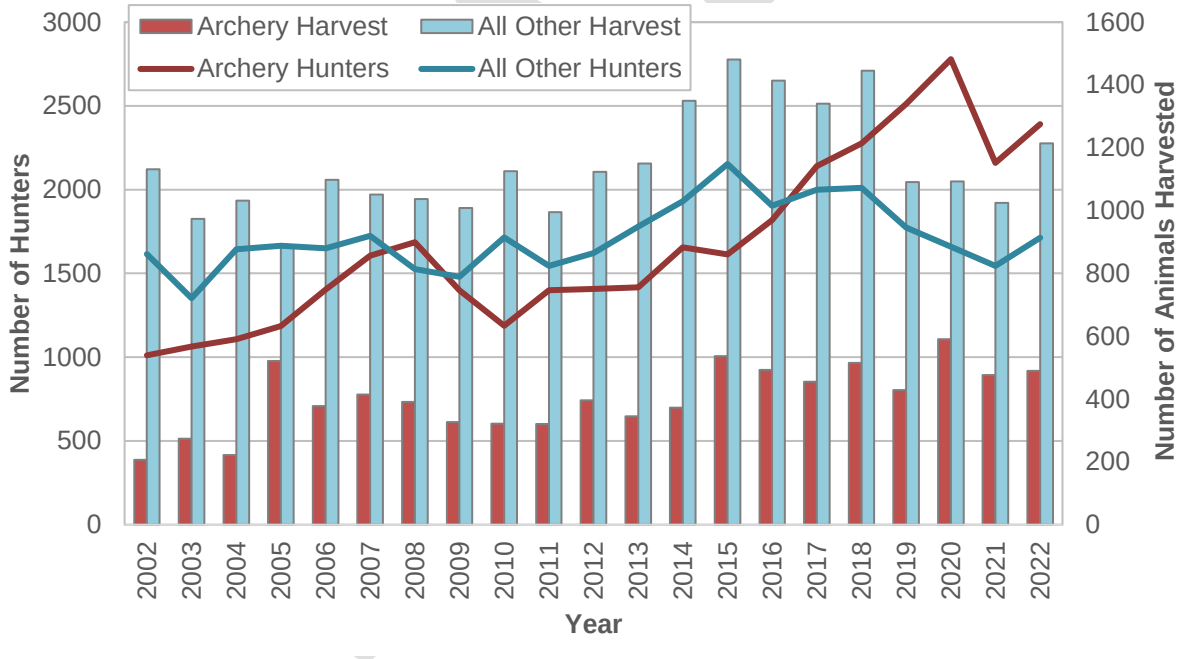


Figure 10. Total number of pronghorn hunters and harvest by weapon type (archery versus all other) in Idaho, 2002–2022. Archery-only pronghorn opportunity switched from a general season across the state to unlimited controlled opportunity in 2009.

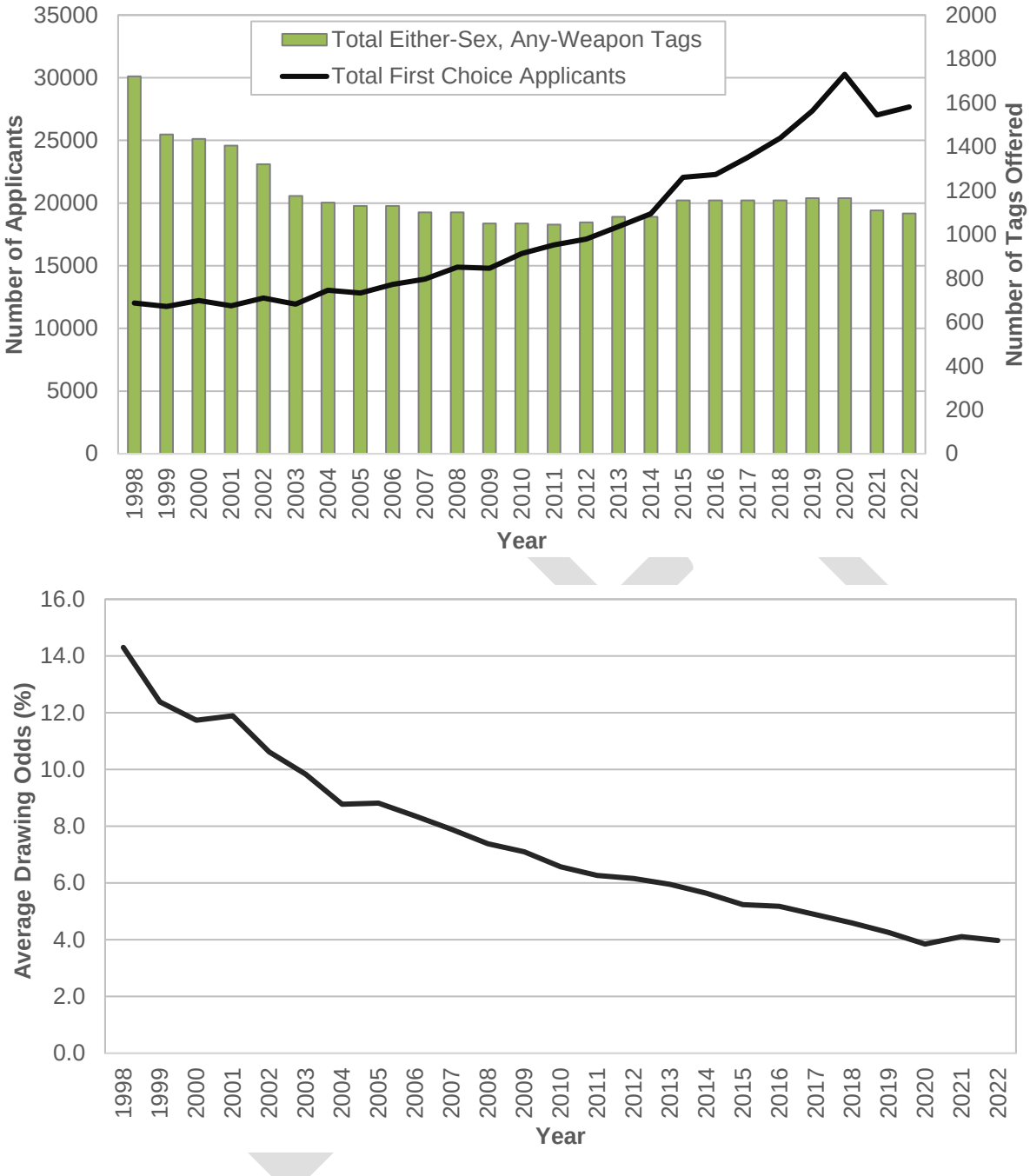


Figure 11. Total number of either-sex, any-weapon controlled hunt pronghorn tags offered (top, green bars), number of First-Choice Applicants for those pronghorn hunts (top, black line), and resulting average drawing odds (bottom) in Idaho, 1998–2022.

Seasonal Exposure to Hunting Pressure

Seasonally migratory pronghorn covering long-distances may experience increased exposure to multiple hunting pressures throughout the migration period. Likewise, the effects of harvest management may be dispersed with implications beyond the

original targeted management action. Therefore, managers need to consider seasonal movements across multiple hunt areas.

For example, GPS location data indicate some animals summering in the Little Wood River basin at the base of the Pioneer Mountains migrate to winter range near Birch Creek from early October through late November. If these animals continue to follow similar paths between summer range (Pioneer SRD) and winter range (Birch Creek Sinks WRD) during similar time periods, an individual animal may be subject to nearly continuous hunting exposure from 15 August to 30 November, over 100 days in 9 different controlled hunt areas based on 2021 and 2022 seasons (Figure 12, Animal A). In comparison, an animal with resident or short-distance migration behavior would only be exposed to the hunt structure of that area. For example, a short-distance migrant from Copper Basin to the Big Lost River would only be exposed 15 August to 15 September (Archery-only, Controlled Hunt Area [CHA] 49-1) and 25 September to 24 October (Any-weapon, CHA 49), a total of 64 days (Figure 12, Animal B).

Given the broad extent of annual pronghorn migration routes and range of migration strategies in Idaho, differences in control hunt exposure are to be expected. Not only are pronghorn exposed to different harvest strategies in 4 IDFG regions, but also 4 other states (Montana, Oregon, Nevada, and Utah). Further coordination among IDFG regions and neighboring states on the timing and placement of control hunts might be warranted to achieve desired results and meet management objectives.

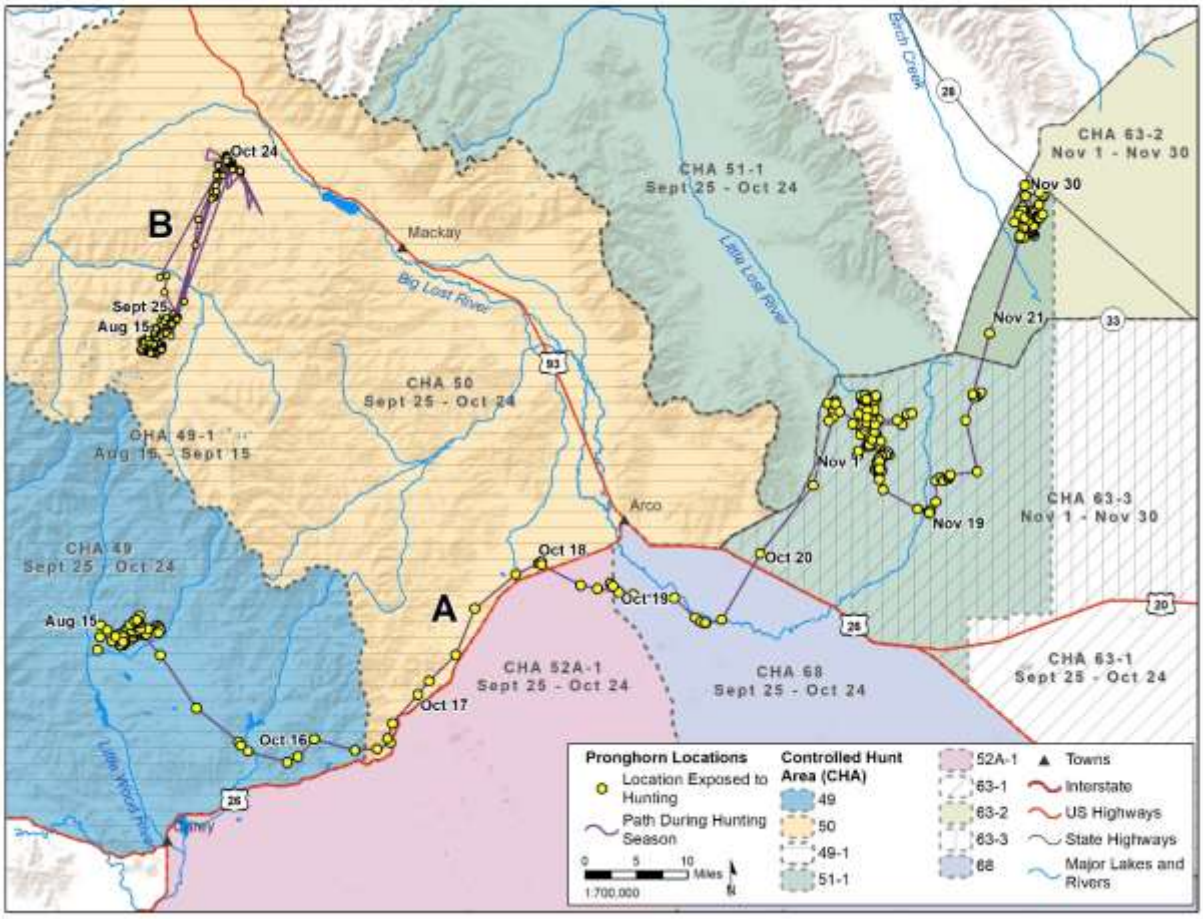


Figure 12. Examples of potential hunting exposure for pronghorn (A) summering in the Little Wood River basin and wintering near Birch Creek, and (B) a short-distant migrant from Copper Basin to the Big Lost River valley. Only hunts during which example animals would be exposed are displayed and labeled.

Illegal Harvest

Although current illegal harvest rates for Idaho pronghorn are unknown, it may be more common than often perceived (Musgrave et al. 1993, Eliason 2020). The number of violations associated with pronghorn has been variable over the last 20 years, but the overall trend has been increasing. Many factors affect these numbers including hunt structure, animal vulnerability, officer staffing, shifting enforcement priorities, and overall number of field patrols. Detecting illegal harvest of pronghorn can be difficult and is complicated by several factors, including their small size, which makes them easy to transport from the field. In areas where compliance is suspected to be an issue, officers have many tools at their disposal to manage compliance.

Hunter Opinion Survey

In 2021, IDFG and the University of Idaho conducted a pronghorn hunter opinion survey to help inform future management and hunting opportunity for pronghorn in Idaho (see Appendix D for detailed methods and results). The target population was purchasers of at least one pronghorn tag between 2015 and 2020. A total of 14,477

eligible purchasers received an email invitation to participate; the effective response rate for the survey effort was 41% and 5,540 fully or partially completed questionnaires were useable for analysis.

The goal of the survey was to gather information about pronghorn hunters such as:

- demographics of Idaho pronghorn hunters,
- pronghorn hunting experience, preferences, and behaviors,
- perception of pronghorn populations,
- perceptions of crowding, access, and interactions with other hunters,
- general satisfaction and motivations, and
- attributes important to satisfaction and their actualization (i.e., do hunters experience the attributes considered important to their satisfaction).

Results from the survey broadly indicate that pronghorn hunters in Idaho prefer the opportunity to observe and hunt pronghorn annually. They are generally satisfied with their overall pronghorn hunting experience (67% satisfied or very satisfied), harvest success, number of pronghorn observed, and amount of pronghorn habitat. Participants reported being dissatisfied with tag drawing odds, which have decreased with increasing number of applicants (Figure 11), compared to other attributes measured.

Pronghorn hunters in Idaho are motivated by the experience and tend to be more appreciative-oriented compared to achievement-oriented. When asked why they hunt pronghorn, 88% indicated "to enjoy nature and the outdoors" and 77% indicated "excitement of pronghorn hunting". Achievement-oriented attributes such as "to get a mature buck" (39%) or "to demonstrate my hunting skills" (31%) were less motivating to hunters.

Compared to other types of big game hunters, participants indicate a lower perception of crowding while hunting pronghorn in Idaho. Because pronghorn hunts are controlled hunts, perception of crowding is likely less compared to over-the-counter opportunities for deer and elk. However, when perception of crowding is broken out by weapon type, 65% of archery hunters perceived crowding to have increased since 2015 compared to 46% of rifle hunters. Opportunity for unlimited archery hunts likely explains the greater perception of crowding among archery hunters compared to rifle hunters.

Pronghorn Horn Size, Age, & Development

Wildlife managers seek to have age and sex ratios within populations that ensure adequate reproduction and recruitment while meeting expectations of hunters. According to the recent pronghorn hunter opinion survey (Appendix D), 65% of respondents reported a desire to observe mature bucks while hunting. While it is difficult to determine what constitutes a "mature" animal, 38% of respondents considered a mature buck as having horn length >12 in (30 cm), whereas 38% of respondents considered a mature buck as having horn length >14 in (36 cm).

Habitat, climate, nutrition, genetics, and age of animals may all play an important role in pronghorn horn development. For example, Brown and Mitchell (2006) found that winter temperature was broadly related to record book quality horn size such that horn growth was greater in warmer, more southern states. Additionally, highest quality and largest horn growth was observed in animals 2–5 years old in Montana and Alberta (Mitchell and Maher 2001, Morton et al. 2008). These findings are counter to populations of other ungulates such as bighorn sheep, moose, mule deer, and elk that achieve maximum trophy potential at much older ages (Bowyer et al. 2001, Monteith et al. 2013). In Idaho, annual winter severity and nutrition may also contribute to overall horn size and quality in pronghorn. Management efforts that address habitat and nutrition for pronghorn populations may influence horn growth more so than trying to achieve an older age structure in the male population.

Harvest Management Direction

Management Direction — Maximize hunting opportunity while providing a diversity of hunting experiences, including doe/fawn and mature buck hunts where appropriate.

> Strategy: Develop guidelines for harvest opportunity using hunter success rates and hunter days, in addition to population indices (e.g., ratios, survival rates, population or trend estimates, etc.), depredation concerns, habitat conditions, winter severity and other metrics.
>
> Strategy: Provide buck-only hunting option in areas where harvesting pronghorn does may decrease populations and objectives are to maintain or increase numbers.
>
> Strategy: Use population metrics (e.g., adult survival, fawn ratios) to determine level of female harvest needed to meet management objectives.
>
> Strategy: Evaluate methods for improving drawing odds, especially for any-weapon opportunities.
>
> Strategy: Assess whether new archery rules are having the desired effect to reduce hunter crowding.

Management Direction — Use information from the 2021 hunter opinion survey to inform pronghorn management.

> Strategy: Analyze the 2021 hunter opinion survey by GMU and by weapon type to better assess localized differences among pronghorn hunters.
>
> Strategy: Evaluate perceptions and attitudes of crowding following changes to the 2021 and 2022 archery-only seasons through random surveys.
>
> Strategy: Conduct a follow-up hunter opinion survey prior to the next management plan.

Strategy: Evaluate methods to reduce hunter congestion such as stratified hunts, spatial separation, and restrictive weapon types. Evaluate effectiveness of changes through hunter surveys.

DEPREDATION

Pronghorn damage to agricultural crops is a concern for both landowners and IDFG. Depredations may occur when populations are high, environmental conditions cause animals to seek high-quality forage or water during drought or heavy snows, or when traditional seasonal ranges are impacted by development or disturbance. Idaho Code 36-1108 outlines statutory requirements for producers and IDFG to control damage by pronghorn, elk, deer, and moose, and requirements to be eligible for damage compensation.

Drought conditions during the summers of 1987 and 1988 and a string of severe winters in the 1980s resulted in extensive big game depredations. One of the areas with the heaviest influx of animals was in and around Mud Lake in eastern Idaho. Pronghorn were one of the primary contributors to the depredation problem in this area (Rimbey et al. 1991). The depredation program for Idaho was developed by legislative action (§36-1108, §36-1110) as a direct result of the damage reported by landowners (Idaho Session Law 1990, Rimbey et al. 1991). Currently, depredation impacts attributed to pronghorn have been minimal. In the last decade, only 1 1 or 2 claims have been filed per year for pronghorn damage. These claims account for <5% of total wildlife claims filed each year and the majority were <$3,000.

IDFG uses hunters as the primary tool to address depredation concerns proactively by managing pronghorn population size. When responding to complaints, wildlife managers initially use nonlethal techniques such as hazing, scare devices, and fencing to discourage pronghorn use of private land. When nonlethal options are ineffective IDFG will then consider lethal techniques such as depredation hunts, landowner permission hunts, and kill permits.
When these techniques fail to satisfactorily solve the problem, landowners may be eligible to file a claim, as outlined in Idaho Code 36-115, 36-1108 and 36-1110.

Depredation Management Direction

Management Direction — Implement proactive measures to reduce and minimize pronghorn depredations.

> Strategy: Coordinate with land management agencies, American Indian tribes, private landowners, and others to improve pronghorn habitat (e.g., forage and water availability), especially adjacent to private land with chronic depredation issues.
>
> Strategy: Evaluate nonlethal measures and other novel methods to determine effectiveness at reducing depredations.
>
> Strategy: Work with land management agencies, private landowners, and others to evaluate if water availability, or access to water, is contributing to depredation issues.
>
> Strategy: Use harvest to manage depredation issues when and where appropriate.

Strategy: Review current literature for forage consumption and Animal Unit Months (AUM) estimates for pronghorn and determine if more appropriate values are available than are currently being used.

PREDATION

Predation of pronghorn is highly correlated with the age of the pronghorn with neonatal fawns (<3 weeks of age) the most vulnerable (Linnell et al. 1995). A recent two-year study in Idaho found that, depending on year and study site, pronghorn neonate mortality ranged from 38–72% (n = 217), of which 34–81% was attributed to coyotes (Panting et al. 2021). Bobcats, golden eagles, and black bears also contributed to predation of neonates. Because predators that prey on neonates are usually generalists, the presence of alternative prey species, such as lagomorphs (rabbits), can result in increased pronghorn fawn survival rates (Panting et al. 2021). The same study also found that predator densities did not have an impact on fawn survival.

Adult pronghorn are well adapted to detect and escape predators, and have a higher survival rate than neonates. However, adverse weather and habitat conditions can increase the likelihood of predation on adults. Firchow (1986) found that immediately after an extreme snowstorm more adults were killed by predation than in the entire previous 2 years combined. However, deep winter snow can also positively influence fawn survival by providing refugia from coyote predation during spring and early summer (Barnowe-Meyer et al. 2010).

Predator control is a complex and controversial subject. Predation can impact population size but is likely working in concert with other limiting factors. When pronghorn populations are below management objectives, many factors need to be assessed including habitat loss, previous environmental conditions, harvest levels, competition with other species, and limitations to daily and seasonal movements. It is likely that habitat restoration, mitigating impediments to movements, and mild weather conditions will increase long-term pronghorn populations more than a short-term predator control effort. In some unique situations (e.g., small, isolated populations), short-term management of predators may be an important tool for IDFG to aid in pronghorn management.

In 2000, the Idaho Fish and Game Commission adopted a "Policy for Avian and Mammalian Predation Management" to guide IDFG's implementation of predator management activities (IDFG 2000). The policy directs IDFG to develop a predation management plan if there is evidence predation is a significant factor preventing prey populations from meeting IDFG management objectives. If predation is determined to be a contributing factor to pronghorn population decline, the managing region will develop a predation management plan using the best available scientific information to guide their management actions. The predation management plan is intended to address predator and prey population objectives, contributing factors, proposed management actions, monitoring, and public outreach and education. Predation management plans require Director approval prior to implementation and will be reviewed and evaluated annually.

Predation Management Direction

Management Direction — Characterize the extent and evaluate the effect of predation on pronghorn productivity.

Strategy: Evaluate cause-specific mortality and assess the role of predation in pronghorn productivity, recruitment, seasonal movements, habitat use, and survival.

Strategy: Implement the Predation Management Policy when evidence indicates predation is a major cause of pronghorn populations failing to meet management objectives.

HEALTH ASSESSMENT & MANAGEMENT

Disease in wildlife is concerning from a conservation, economic, and public health perspective. The extent to which disease limits wildlife populations is of concern to wildlife managers, particularly when disease could compound the effects of habitat loss and fragmentation, predation, and climate change. Like any other species, pronghorn are susceptible to diseases and parasites (Stauber et al. 1980, Samuel 2001) which may affect populations or be transmitted to other wildlife and domestic livestock. In general, pronghorn populations in Idaho appear to be relatively healthy. However, active disease monitoring has not been conducted regularly, and documentation has been sporadic and mostly opportunistic.

The disease with the most potential to impact pronghorn populations in Idaho is hemorrhagic disease, which is caused by 2 closely related viruses: epizootic hemorrhagic disease (EHD) and bluetongue (BT). Approximately 3,200 pronghorn died of BT in eastern Wyoming during 1976, and 300 died in 1984 (Thorne et al. 1988). Both viruses are transmitted by biting flies (*Culicoides*) and could become more prevalent in Idaho as climate change results in conditions allowing insect vectors to persist longer (Pfannenstiel et al. 2015, Rivera et al. 2021). Thought to be limited by cold weather, biting flies (and thus the diseases) were historically restricted between 35 degrees south and 40 degrees north latitude. In recent decades, extensions northward (up to 50 degrees north latitude) in North America and Europe have been attributed to warmer climate patterns (Purse et al. 2005, Rivera et al. 2021) and projections suggest additional expansion in coming decades (Zuliani et al. 2015).

Other pathogens detected in pronghorn in Idaho include bovine virus diarrhea, infectious bovine rhinotracheitis, bovine adenovirus, *Anaplasma marginale*, parainfluenza virus, bovine rhinovirus, bovine respiratory syncytial virus, and *Pasteurella multocida septica* (Murray 1951, Stauber et al. 1980). None of these have been detected at high rates in Idaho, and while some are commonly detected in surveillance screening, pronghorn rarely present with disease. Wyoming has documented pronghorn losses due to *Mycoplasma bovis*, which is usually found in cattle, and was the primary cause for the deaths of approximately 160 pronghorn during 2019 and 2020 (Johnson et al. 2022). Neither brucellosis nor chronic wasting disease has been detected in wild pronghorn populations.

Although disease does not appear to be a limiting factor in most pronghorn populations, disease surveillance for detecting both known and emerging diseases may be an important component of pronghorn management in the future. Declines in some pronghorn populations have been at least partially attributed to disease or parasites (Bever 1950) and changes in climate patterns have led to more favorable conditions for other diseases and parasites known to affect pronghorn (Samuel et al. 2001), although the magnitude of effects are complex and variable, often depending on many factors (see Rose et al. 2014, Aleuy and Kutz 2020, Buttke et al. 2021, Rivera et al. 2021, for review). Emergence of new pathogens or parasites common in pronghorn populations in other states may pose a risk (Samuel et al. 2001, O'Gara and Yoakum 2004, Weaver 2013). For example, in southern Texas, the barber pole worm has recently become problematic, leading to suppressed reproductive rates and

direct mortality (Weaver 2013). Conversely, extreme weather conditions (e.g., exceeding critical temperature thresholds, extended drought, or flooding) may reduce survival and pathogen transmission of many macro-parasites in local areas (Aleuy and Kutz 2020). The combination of various stressors (e.g., habitat fragmentation, spread of invasive plant species, climate change), along with disease, has the potential to present challenges important to the long-term management and conservation of pronghorn in Idaho.

Health Assessment & Management Direction

Management Direction — Improve understanding of existing and potential effects of disease on pronghorn populations.

> Strategy: Investigate opportunities for disease monitoring and surveillance (e.g., radio-collared, roadkill, harvested animals).
>
> Strategy: Develop a baseline dataset for disease types and prevalence in pronghorn in Idaho.

GENETICS

Wildlife managers are challenged to identify biologically meaningful population units, measure population size and connectivity, and evaluate the capacity of populations to endure and adapt to environmental change. Genetics and genomics can provide baseline information about population structure, genetic diversity, and connectivity, which may help to inform management strategies (Hohenlohe et al. 2021). Loss of genetic diversity may suggest population declines or fragmentation and can reduce a population's ability to survive and reproduce (i.e., fitness) as well as resiliency to changing environmental conditions or disease (Hohenlohe et al. 2021). Genetic markers can also provide an indication of gene flow among populations which may help inform management needs such as delineation of populations and hunt area boundaries, planning translocations, and predicting potential pathogen transmission.

Current management questions that genetic structure analysis could assist in answering include:

- Have current pronghorn populations been isolated from historically larger metapopulations? Has there been a loss of genetic diversity as a result?
- Have translocations influenced genetic structure of pronghorn herds in Idaho?
- Does genetic structure of the population confirm how we currently delineate pronghorn herds in Idaho?
- Do resident and seasonally migrating populations differ genetically?

This information could help inform future translocations (e.g., suitable source herds), as well as measure the effectiveness of current management strategies focused on promoting connectivity across pronghorn range in Idaho (e.g., barrier removals or mitigation). Increasing sampling of hunter harvests, roadkills, and captured pronghorn would improve baseline genetic data for Idaho pronghorn herds.

Genetics Management Direction

Management Direction — Increase knowledge of pronghorn population genetics and genomics in Idaho herds as funding allows.

Strategy: Increase opportunistic genetic sampling (e.g., roadkill, hunter harvest, captured animals).

Strategy: Measure and evaluate genetic diversity of pronghorn herds.

Strategy: Use genetic structure analysis to evaluate how we currently delineate pronghorn herds and connectivity among them.

Strategy: Evaluate how past translocations may have influenced genetic structure in pronghorn herds.

Strategy: Consider genetic ancestry and genetic diversity when conducting translocations.

TRANSLOCATIONS

Wildlife translocations have been broadly implemented for many species to augment, establish, or restore populations to a particular geographic area. Often, these past translocations provide important wildlife-related recreation opportunities for the public that likely would not otherwise be available today. Within pronghorn historical range, translocations have been celebrated as contributing significantly to the dramatic recovery of this iconic species. Between 1920 and 1997, more than 30,000 pronghorn were translocated across 17 states (O'Gara and Yoakum 2004).

In Idaho, efforts to trap and transplant pronghorn began in the early 1940s (Beck 1942) with the first successful transplant occurring in 1946 (Davis 1946, Twin Falls Times News 1946). Since then, IDFG has moved several hundred pronghorn (Appendix C) with the intent to extend the species' range, improve production where suitable habitat existed, or reduce depredations on forage crops. Results of translocations appear to have varied in success, but most lacked detailed post-translocation monitoring to thoroughly assess effectiveness. In fact, consistent detailed records are generally lacking for capture and release sites, sex and age composition of transplanted animals, or sometimes even the total numbers of animals transplanted. For example, summary reports indicate 842–956 pronghorn were translocated in Idaho between 1946 and 1953 (Rutherford 1949, Anonymous 1951, Rutherford 1954), but current available documents only substantiate 754 animals moved (Appendix C).

Successful translocations lead to the establishment of self-sustaining populations, or to increasing the size, growth rate, genetic diversity, or occupied range of existing populations. While translocations have been an important tool in restoring pronghorn, they are expensive, pose risks to animals and humans, and are not always successful. In addition, they may require extensive coordination among many stakeholders such as land management agencies, private landowners, sportsmen groups, and NGOs. Current guidelines intended to improve pronghorn translocation success include conducting a feasibility study, preparation phase, release or introduction phase, and a follow-up phase (Yoakum et al. 2014). Part of the process requires sufficient coordination among stakeholders, as well as an assessment of potential conflicts with current land uses such as agriculture, development, and roadways.

Prior to initiation of any translocation effort, IDFG will follow current procedures and guidelines (i.e., Yoakum et al. 2014) to ensure feasibility studies, preparation, release, and follow-up plans are achieved. IDFG will develop specific translocation management plans for each individual translocation. Pronghorn translocations in Idaho will meet one or more of the following objectives:

- expand pronghorn range to suitable, but currently unoccupied habitat,
- augment existing populations that are below objectives,
- increase genetic diversity in small or isolated populations, or
- consider relocation of animals to address crop depredations.

Although IDFG does not currently have any proposed pronghorn translocations, some areas in the state might be suitable for translocation efforts in the future. For example,

areas thought to have once been occupied by pronghorn but no longer possess a viable population or areas where pronghorn populations are in decline but appear to have adequate habitat to support greater numbers, may be considered for translocations. Populations at or exceeding objectives may be considered as suitable source populations for translocations efforts.

Translocation Management Direction

Management Direction — Develop a protocol to provide direction on when, where, and how to translocate pronghorn to maximize likelihood of translocation success.

Strategy: Evaluate translocations to create new herds or augment small herds with the goal of creating additional hunting and viewing opportunities.

Strategy: Assess potential for conflicts on private lands in areas near translocations.

Strategy: Use habitat models developed to predict pronghorn distributions to evaluate potential translocation areas.

Strategy: Evaluate genetic information from source and destination populations.

Strategy: Evaluate individual population health histories of source, destination, and adjacent (if any) populations to reduce or eliminate potential transfer of pathogens from one location to another.

Strategy: Develop and implement short- and long-term, post-release, monitoring protocols to determine the success of the translocation including an assessment of population persistence and productivity.

Strategy: Work with other state management agencies and review current literature to refine capture and handling protocols as new knowledge, methods, and techniques become available.

CLIMATE CHANGE

Long-term empirical evidence indicating effects of ongoing and projected climate change on pronghorn is generally lacking. However, changes in weather can both directly (e.g., through physiological limitations and reduced energy reserves) and indirectly (e.g., through forage quality and quantity, diseases) affect pronghorn abundance, behavior, reproduction, survival, distribution, and migration (Hoskinson and Tester 1980, Brown et al. 2006, Yoakum 2006, Byers et al. 2006, Dalton 2009, Barnowe-Meyer et al. 2010, Hoffman et al. 2010, Christie et al. 2015, Gedir et al. 2015, Collins 2016, Jones et al. 2020a, Kauffman et al. 2021, Malpeli 2022). Severe winter weather (cold temperatures, heavy snowfall) is often associated with pronghorn population declines, while a positive relationship with precipitation is also common due to increased forage quantity and quality.

In Idaho, mean annual temperature has increased 1.8 °F (1 °C) since 1895 with summer and winter temperatures increasing more than other seasons, extreme events (e.g., heat waves, false springs) becoming more common, and growing season lengthening (Abatzoglou et al. 2021). Trends in precipitation are more variable but suggest statewide decreases in summer and autumn precipitation and increases in spring and winter precipitation with decreases in the proportion of precipitation falling as snow, particularly at low to middle elevations (Mote et al. 2018, Musselman et al. 2018, Abatzoglou et al. 2021). These trends are increasing the overall aridity in many sagebrush and grassland habitats, altering forage phenology (e.g., earlier plant growth in spring, earlier senescence in summer), productivity, and distribution, as well as the frequency, magnitude, and duration of drought conditions, wildfire risk, and invasive plants (e.g., knapweeds, medusahead, cheatgrass).

Following current trends, future projections statewide indicate progressively hotter, drier summers and warmer, wetter winters with greater overall variability (e.g., record cold temperatures even as record highs become increasingly frequent) (Meehl et al. 2009, Rupp et al. 2017). Warming is generally expected to be greatest in the Snake River Plain, and during the summer months. Total annual precipitation is projected to increase slightly (5–10%) although substantial variability in annual and seasonal precipitation is projected with some areas experiencing abnormally wet years or seasons, and others abnormally dry (Abatzoglou et al. 2021). Consecutive years of snow drought, earlier peak snowpack, and an upward elevational shift in snow levels are projected (Catalano et al. 2019, Marshall et al. 2019).

Assessment of pronghorn SRDs and WRDs using a higher emission scenario (resource concentration pathway [RCP] 8.5) suggests mean annual temperatures will increase approximately 5 °F (3 °C) by mid-century (as compared to 1981–2010 baseline using data from Abatzoglou [2013] and Holden et al. [2015]), with average spring temperature increasing 5.2–9.2 °F (2.9–5.1 °C) and summer increasing 6.1–6.3 °F (3.4–3.5 °C) (Table 4). These changes will likely be coupled with increases in total annual precipitation (6.8–14.4 in, 17.3–36.8 cm) across all SRDs and WRDs, although smaller increases are projected in spring (1.5–4.8 in, 3.7–12.2 cm) and summer (2.6–6.2 in, 6.5–15.8 cm). These changes co-occur with a decline in proportion of precipitation falling as snow in all areas (7.6–33.0 in, 19.3–83.8 cm), with the most substantial snow loss

occurring in Sawtooth SRD, Pioneer SRD, and Bear Lake SRD (Table 4). The projected increases in precipitation are small and may not compensate for the loss of snow or increased temperatures in each area. However, estimating these trends in Idaho's topographically complex landscapes can be challenging due to substantial local variability in both temperature and precipitation (e.g., Ford et al. 2013, Silverman and Maneta 2016, Henn et al. 2018, Catalano et al. 2019), as well as natural climate variability (e.g., El Niño Southern Oscillation, Abatzoglou et al. 2021). While the observed rise in temperatures is relatively consistent with predictive models and agreement among models is relatively high with respect to future temperature projections, particularly to mid-century, models of future precipitation projections are much more variable resulting in a greater range of possible effects. Further, these estimates represent 30-year averages in climate and not annual, monthly, or daily variability in weather, thus do not account for potential effects of annual and seasonal time lags.

In some cases, ongoing and projected changes in temperature and precipitation may be a benefit to pronghorn; in others, they will be a detriment. Mild winters with reduced snow may increase overwinter survival by increasing access to quality winter forage or improving dispersal ability (O'Gara and Yoakum 2004). Because precipitation is a primary factor in plant productivity in arid grassland and shrubland systems (Anderson and Inouye 2001, Deguines et al. 2017), increases in spring precipitation, earlier spring green-up, and longer growing seasons may also benefit herd productivity due to greater available of high-quality forage (O'Gara and Yoakum 2004). Yet these trends (less snowfall, earlier spring green-up) may negatively affect movement behaviors, potentially changing the timing or distance of migration (Hoskinson and Tester 1980, Dalton 2009, Collins 2016), or increase vulnerability to predation (Barnowe-Meyer et al. 2010). In addition, warm spring and summer temperatures coupled with decreased precipitation may result in decreased survival or recruitment due to reduced forage (Brown et al. 2006, Gedir et al. 2015), decreased water availability and quality (Jacques et al. 2015, Mattson and Holton 2022), or increased incidence of disease or parasites (e.g., Aleuy and Kutz 2020, Buttke et al. 2021, Rivera et al. 2021). In arid landscapes or during drought years, access to surface water may be especially important for pronghorn, depending on location, season, and forage quality (O'Gara and Yoakum 2004, Mattson and Holton 2022). Given projected increases in drought conditions, access to water may become more of an issue for some herds in portions of the state. These changes likely compound other stressors to pronghorn, such as invasive plants, wildfire, disease, and interspecific interactions.

Table 4. Baseline (1981–2010, B) and projected (2040–2069, P) mean temperature (° C) and precipitation (cm) of the wettest (generally spring) and warmest (generally summer) quarters, and precipitation as snow (PAS, cm) averaged across pronghorn summer and winter distributions.

Summer and Winter Range Distributions	Elevation range (m)	Temperature				Precipitation				PAS	
		Wettest[d]		Warmest		Wettest		Warmest			
		B[a]	P[b]	B	P	B	P	B	P	B[c]	P[c]
Antelope Flat WRD	1,519–2,952	14.1	17.7	15.3	18.8	132.5	140.7	125.4	135.7	167.5	108.8
Atomic SRD	1,454–2,298	18.1	21.7	18.9	22.4	82.2	87.8	73.9	81.9	73.5	42.1
Bannock SRD	1,280–2,262	17.8	21.6	19.1	22.5	128.2	136.4	125.6	135.0	95.0	37.0
Bear Lake SRD	1,804–2,394	15.0	20.1	16.8	20.2	134.0	146.1	133.3	146.1	168.5	96.2
Big Desert SRD/WRD	1,260–1,724	19.1	22.7	19.4	22.8	87.1	94.2	85.7	93.9	62.1	25.9
Big Lost WRD	1,746–2,799	14.1	17.3	15.1	18.6	101.6	107.0	86.7	94.3	107.0	68.4
Birch Creek SRD	1,465–3,716	14.4	18.1	15.0	18.4	153.7	164.0	140.6	154.9	177.0	110.2
Birch Creek Sinks WRD	1,454–2,747	17.7	21.3	18.4	21.8	97.9	104.0	84.0	92.9	83.3	49.1
Camas SRD	690–3,153	9.7	13.8	19.6	23.1	130.5	137.9	105.5	113.8	105.8	52.3
Island Park SRD	1,450–2,520	14.1	17.9	16.5	19.8	160.1	171.0	145.6	161.3	188.6	133.4
Jarbidge SRD/WRD	747–2,389	15.6	19.6	19.8	23.3	102.8	109.0	98.1	105.8	39.2	14.5
Lemhi-Tower SRD/WRD	1,101–3,152	15.0	18.6	16.1	19.5	133.1	140.0	113.9	124.1	117.2	72.1
Little Lost WRD	1,558–2,636	16.2	19.7	16.6	20.1	90.1	95.7	78.2	86.4	97.0	61.6
Lost-Pahsimeroi SRD	1,336–3,858	14.1	17.7	15.4	18.8	153.4	164.0	141.4	154.9	205.4	141.6
Medicine Lodge SRD	1,491–3,474	15.2	19.3	16.3	19.7	168.8	179.2	150.1	165.7	156.2	93.6
Morgan WRD	1,409–2,402	15.1	18.5	17.1	20.6	91.4	96.5	78.4	85.1	76.7	47.2
Morgan-Moyer SRD	1,144–3,021	13.8	17.3	16.3	19.8	133.4	141.4	121.5	131.4	144.8	96.0
Mountain Home WRD	690–1,813	11.8	16.3	21.3	24.8	105.9	112.2	91.6	99.2	43.9	17.2
Mud Lake SRD	1,450–1,695	18.1	21.6	18.9	22.3	88.6	94.9	76.1	84.8	64.8	37.5
Owinza WRD	1,125–1,548	12.9	17.4	19.8	23.3	88.4	94.3	82.0	89.4	55.9	19.4
Owyhee North SRD	671–2,260	17.0	20.3	19.8	23.3	135.3	145.3	131.1	140.6	71.3	27.0
Owyhee North WRD	671–1,863	21.1	24.5	21.3	24.8	87.1	93.9	87.1	93.7	29.6	10.2
Owyhee South SRD	717–2,346	15.7	19.5	18.7	22.2	120.7	129.0	116.9	125.1	63.7	24.9
Owyhee South WRD	717–2,045	17.7	21.7	19.5	23.0	115.3	124.2	114.6	123.6	47.0	17.8
Pioneer SRD	1,453–3,858	10.7	14.5	15.3	18.8	161.8	172.8	150.3	161.6	254.3	172.6
Raft River SRD/WRD	1,282–2,683	17.4	21.0	18.7	22.2	117.1	120.7	110.5	117.0	72.5	26.4
Sand Creek WRD	1,459–1,709	17.6	21.0	18.1	21.5	110.0	117.2	91.6	101.8	71.1	41.7
Sawtooth SRD	1,522–3,604	8.5	12.7	14.0	17.5	187.0	197.6	161.7	172.4	289.2	205.4
South Hills SRD/WRD	1,191–2,320	16.9	21.2	18.6	22.1	124.6	131.8	121.3	130.5	68.7	24.8
Weiser SRD/WRD	628–1,796	9.7	12.6	21.1	24.6	188.1	198.6	139.6	148.6	95.3	39.7

[a] Baseline temperature data represent mean values at 250 m spatial resolution (Holden et al. 2015).
[b] Projected mid-century values are based on an ensemble of 20 general circulation models (GCM) under a "business-as-usual" emission scenario (representative concentration pathway [RCP] 8.5) (Abatzoglou 2013) superimposed on baseline data.
[c] Baseline PAS data are modeled at 1 km spatial resolution with projected values from an ensemble of 10 GCMs under RCP 8.5 (Wang et al. 2016).
[d] Bioclimatic variables used include mean temperature of the wettest quarter (bio8), mean temperature of the warmest quarter (bio10), precipitation of the wettest quarter (bio16), and precipitation of the warmest quarter (bio18).

The ability of pronghorn to adapt to ongoing and projected changes is uncertain and, given the multitude of contributing factors, herds in different areas of the state are likely to respond differently to changing conditions. In general, pronghorn are thought to be moderately adaptable and exhibit several attributes typical of species with a moderate to high adaptive capacity (Nicotra et al. 2015, Thurman et al. 2020). These attributes, as defined by Thurman et al. (2020), include having a high dispersal capacity, living in well-dispersed populations across a wide range of environmental conditions, being moderately tolerant of semi-natural landscapes (e.g., agricultural fields), and displaying moderate behavioral flexibility. For example, individuals appear to alter both timing and distance of daily and seasonal movements depending on forage conditions and weather patterns (see Movement & Migration chapter), including traveling nearly double the average distance in years with colder temperatures and deeper snows (Collins 2016) or beginning spring migrations over one month earlier in mild years (Hoskinson and Tester 1980). Finally, pronghorn are physiologically well-adapted to arid environments and can tolerate extreme temperature and drought conditions, at least in the short term, by regulating brain temperature separate from body temperature and significantly conserving energy and water (Fuller et al. 2016, Strauss et al. 2017).

However, pronghorn also demonstrate characteristics indicative of species with lower adaptive capacity such as lower reproductive rates and recruitment, lower competitive ability, and somewhat limited climate niche breadth. Further, while sometimes considered a generalist forager given their ability to shift from a forb-based to shrub-based diet when necessary (a high adaptive capacity trait), doing so significantly decreases diet quality and can affect survival, recruitment, and population trends (indicative of low adaptive capacity). Needing to shift to shrubs during spring or summer (gestation and lactation periods) can be particularly detrimental (O'Gara and Yoakum 2004, Smyser 2005, Brown et al. 2006, Bender et al. 2013, Cain et al. 2017). These characteristics, in addition to significant migration barriers in some populations (see Movement & Migration chapter), may prevent rapid adaptation required to match the velocity of climate change.

Much is unknown regarding the long-term effects of changes in vegetation phenology (i.e., earlier spring green-up, longer growing season, variability in senescence) and changes in snow measures (i.e., depth, cover, condition) on the migratory behavior of pronghorn. Such changes may result in altered migration timing, duration, or destination, or even switching from migratory to resident (Collins 2016, Malpeli 2022). Thus, opposing effects of earlier spring green-up and longer growing seasons versus more extreme weather, may promote or hinder pronghorn response and resilience to climate change. A better understanding of the complex relationship between temperature, precipitation, and pronghorn population dynamics at local levels, including direct and indirect effects as well as individual- and population-level responses in Idaho SRDs and WRDs is needed to fully understand and appropriately manage herds under changing climatic conditions.

Climate Change Management Direction

Management Direction — Improve understanding of existing and potential effects of changing climates, specifically changes in growing seasons and snow conditions, on pronghorn recruitment, survival, distribution, and migratory behavior.

Strategy: Identify and support collaborative research, standardization of methods, and opportunities focused on identifying and understanding changes in climatic conditions that could affect pronghorn populations either positively or negatively.

Strategy: Work with researchers to develop climate projections at biologically meaningful scales for projecting future conditions and habitat trends in pronghorn SRD and WRDs.

Strategy: Engage partners in collaborative efforts to address challenges to pronghorn populations that may be compounded by effects of climate change.

SUMMER & WINTER RANGE DISTRIBUTIONS

Pronghorn are highly mobile and long-distance migrations between seasonal ranges make it difficult to manage populations based on GMUs. Recent research on Idaho pronghorn indicates management planning will likely be most effective if focused on subpopulations (Gese et al. *in review*). Thus, in this plan, groups (or herds) of pronghorn and the area they inhabit are divided into summer range distribution (SRD) and winter range distribution (WRD) areas approximating subpopulations (Figure 1). These biologically meaningful units are based on current knowledge of habitat, seasonal ranges, migration patterns, and connectivity among herds, including results from Kaufmann et al. (2022) and Bergen et al. (2022). In some instances, SRDs and WRDs are relatively well-defined and based on recent location data from pronghorn fitted with GPS collars, but in many cases the boundaries are delineated by best biological opinion when specific data on migrations and seasonal ranges are not available.

Movements among SRDs and WRDs are also not completely understood with little to no migration in some areas and extensive dispersal in others. Additional information on population structure, connectivity, and interactions among all SRDs and WRDs would be beneficial for management with direct implications for evaluation of population persistence or viability. Population boundaries will continue to be refined in the future as additional information becomes available that supports such changes. In addition, the extent of WRDs will likely change with winter severity and snow depth as pronghorn use is concentrated near food sources or areas with the least amount of snow. Each SRD, WRD, or SRD/WRD combination (for herds with little to no migration) is presented in the following pages with pertinent information regarding population status and objective, harvest, and current management considerations. Much of this section is intended for wildlife managers and is largely reference material for their benefit. In addition, Appendix F provides past pronghorn population surveys.

Summer Range Distributions

Atomic Summer Range Distribution

The Atomic SRD is found within GMUs 52A, 63, and 68 (Figure 13). This SRD includes Idaho National Laboratory (INL), Bureau of Land Management (BLM), and some private lands. Because most of the SRD is owned and managed by INL, access, hunting, and management opportunities are extremely limited. Little is known about movement, habitat use, and population estimates as access to INL is restricted.

The Atomic SRD consists of lower elevations with little annual precipitation, creating an arid habitat composed of mostly sagebrush steppe. Wildfire has affected this SRD for many years and as a result the sagebrush steppe component is in varying seral stages, with some areas in poor condition having been replaced by invasive annual grasses.

Pronghorn within this SRD are suspected to use both migratory and non-migratory strategies. While some pronghorn migrate north to Birch Creek Sinks WRD during winter, others may remain in the SRD. Additional data are needed to confirm movement patterns.

Population Status & Objective

No consistent population or herd composition surveys have been conducted in this SRD. The population objective for this SRD is to maintain or increase pronghorn numbers while considering depredation concerns and changing habitat conditions.

Harvest

There are limited amounts of hunting opportunities in this SRD due to access restrictions on INL as discussed above. There are some limited hunting opportunities on the outskirts of the SRD in GMUs 52A and 68 (see Big Desert SRD/WRD).

Current Management Considerations

- Habitat quality — Wildfire regime changes over the years have resulted in an altered ecosystem. Over 38% of the SRD has burned at least once since 1970. Invasive annual grasses are mapped as occurring at low to moderate abundance on >95% of the area.
- Water availability — Pronghorn are generally found within several miles of water sources. Most of the areas in the Atomic SRD lack available water, and given projected increases in drought conditions, access to water may become more of an issue in this area.
- Movement and migration — Portions of the Atomic SRD fall within the Big Desert-Mountain Valley Complex Priority Area for addressing big game migrations in Idaho (IDFG 2022b). Fences may impede pronghorn movements in some areas.
- Pronghorn data — Existing data regarding population size, composition population growth rates, and movement are limited.

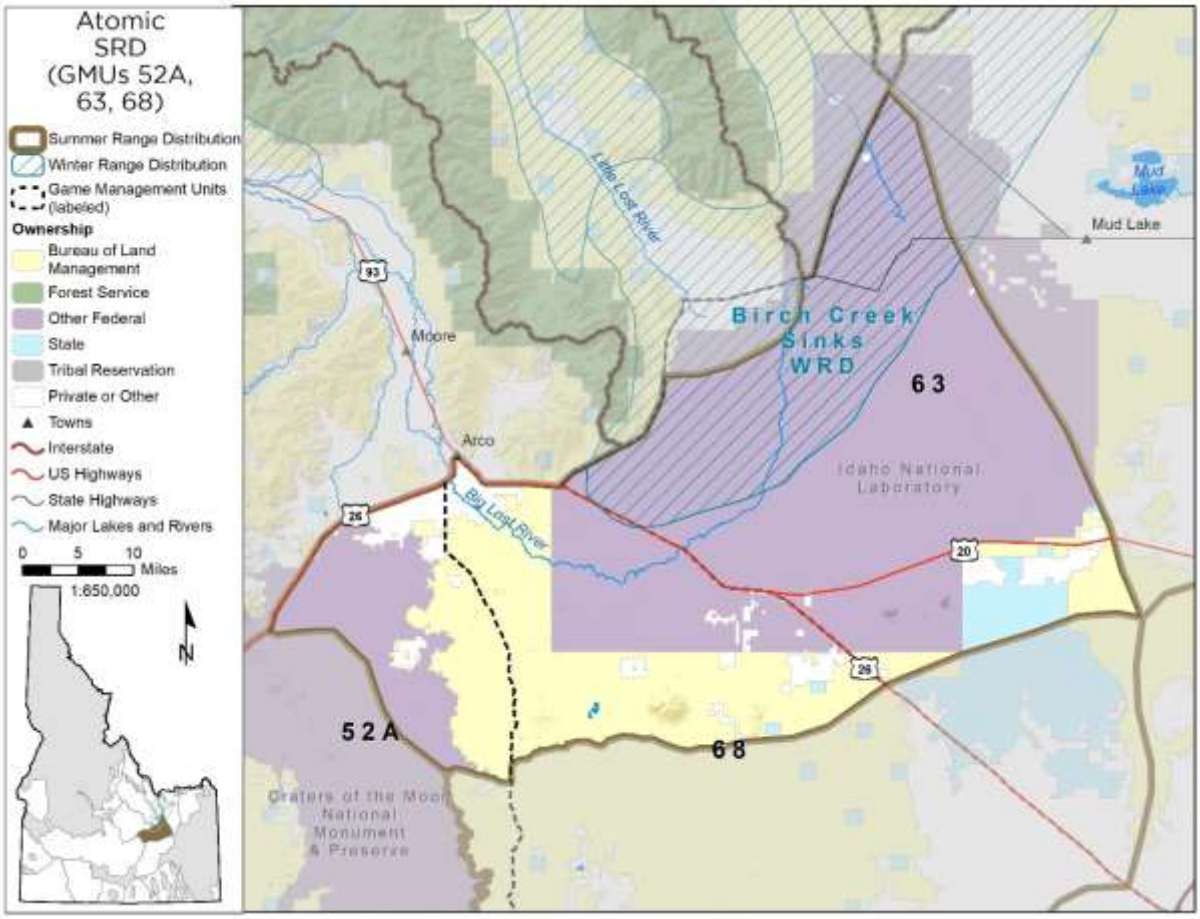


Figure 13. Atomic pronghorn summer range distribution, Idaho.

Bear Lake Summer Range Distribution

The Bear Lake SRD is found in the southern-most portion of GMU 76 (Figure 14 top). The area occupied by pronghorn includes a mix of private, state, and federal lands. Habitat is comprised of mostly of sagebrush steppe with riparian habitat along the Bear River and irrigated agriculture in valley bottoms.

Pronghorn data in this area are limited, but during the winter months pronghorn from this area likely move to adjacent Wyoming or Utah.

Population Status & Objective

No consistent population surveys or herd composition data have been collected for this SRD. Ground composition surveys have been attempted once, in 2015, when 33 individuals were observed. Anecdotal information and observations indicate that this area likely hosts fewer than 50 individuals during the summer and autumn seasons. Pronghorn in this area occur at low densities and are scattered making population data collection logistically challenging. Pronghorn within this SRD likely move among Wyoming, Utah, and Idaho.

For this SRD, IDFG's goal is to better understand population abundance, seasonal use, and movement within the SRD as well as how these pronghorn integrate with adjacent Wyoming and Utah. Furthermore, an evaluation of habitat suitability will help IDFG determine the potential for this population to persist or increase in the future.

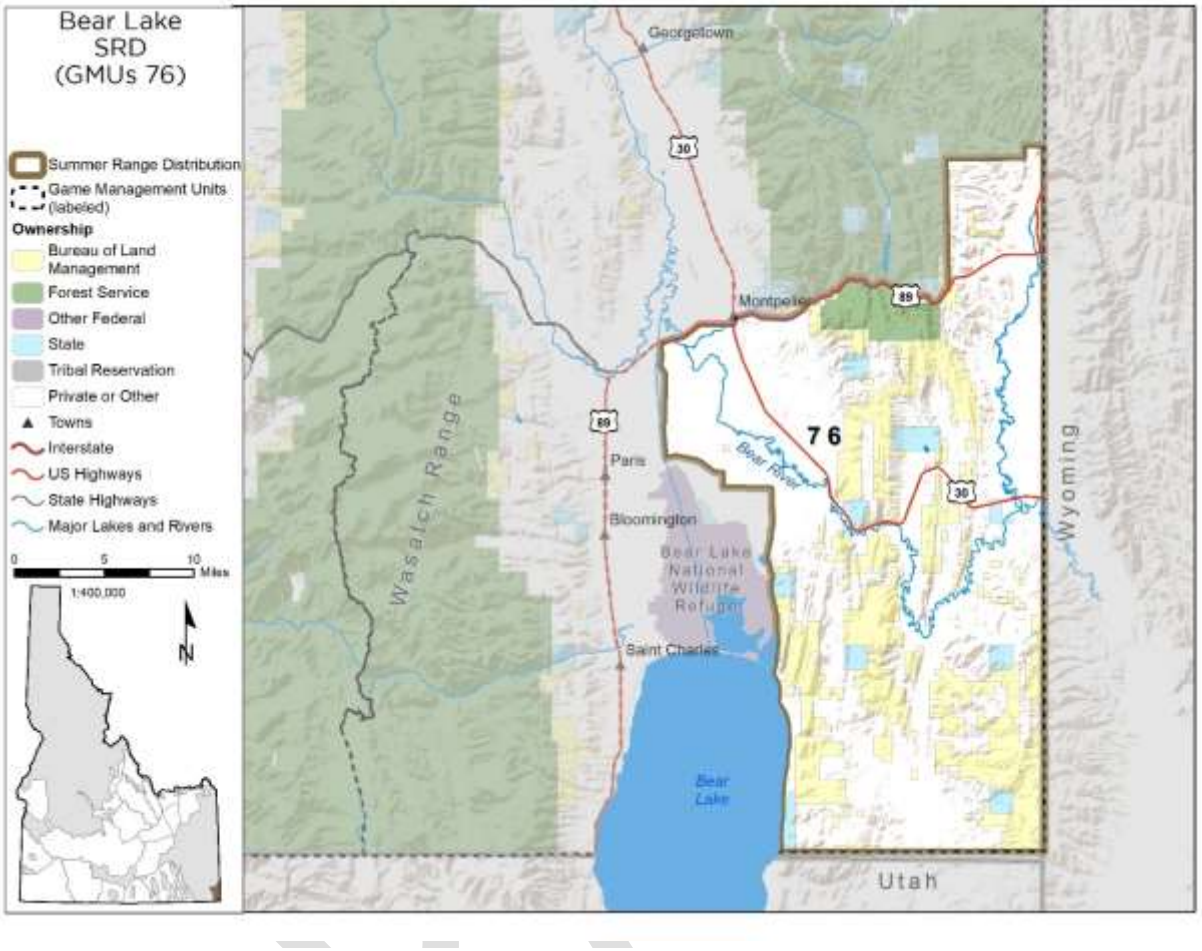
Harvest

A 5-tag, either-sex, any-weapon hunt was implemented in 2011 (Figure 14 bottom). Although pronghorn abundance is low, this group of pronghorn concentrate on irrigated agricultural fields during the summer months. This limited hunt provides opportunity to hunters while addressing potential damage to crops caused by pronghorn.

Hunter success rates average 84%, and recent information suggests pronghorn in this area have not increased or decreased in recent years.

Current Management Considerations

- Pronghorn data — Data on population movement, survival, and suitability for range and population expansion for this area are lacking. Understanding parameters that limit pronghorn in this SRD would be beneficial as well as how this population interacts with adjacent pronghorn in Wyoming and Utah.
- Depredation — Evaluate degree of current, and potential future, conflicts with farming and livestock practices.
- Habitat — This SRD has potential for significant residential development along the eastern shores of Bear Lake. Similarly, energy production such as hydropower or wind energy could reduce and compromise existing pronghorn habitat. Data on the extent and seasonality of habitat in this SRD are needed.
- Movement and migration — Portions of the Bear Lake SRD fall within the Rocky Point Priority Area for addressing big game migrations in Idaho (IDFG 2022b). Fences may impede pronghorn movement in this SRD.



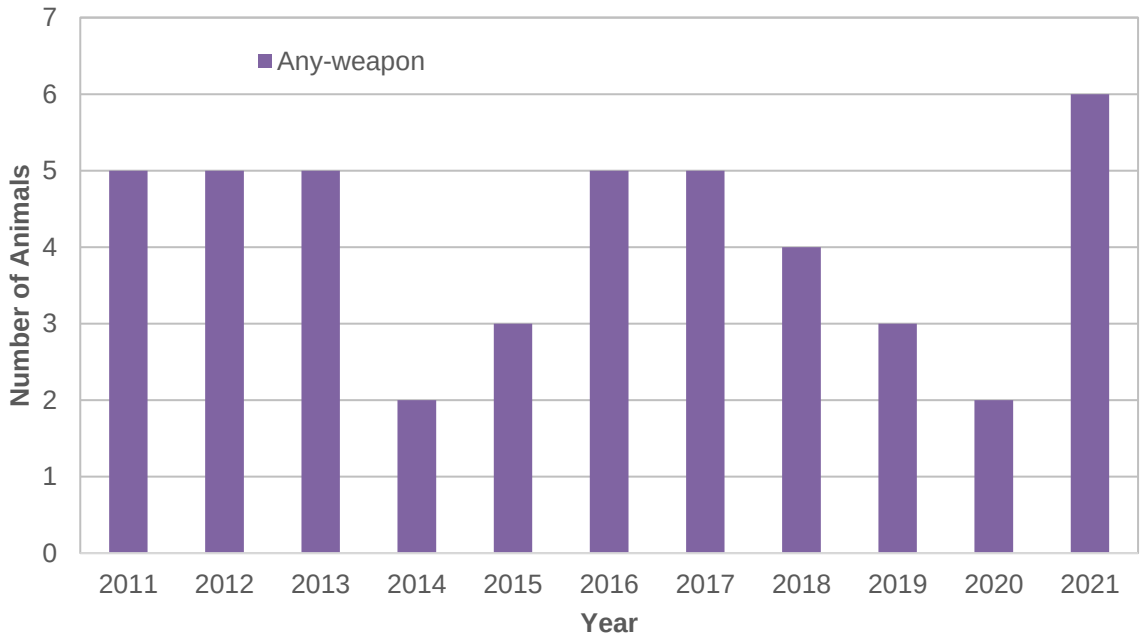


Figure 14. Bear Lake pronghorn summer range distribution (top) and harvest (bottom), Idaho.

Birch Creek Summer Range Distribution

The Birch Creek SRD includes GMUs 30A and 58 (Figure 15 top). It is mostly made up of public land (BLM, Forest Service [FS], Idaho Department of Lands [IDL]) but does contain private land near riparian corridors. It consists of broad mountain valleys that span between the Beaverhead and Lemhi Mountain Ranges and includes the Birch Creek and upper Lemhi River drainages. Most of the habitat in this SRD is higher elevation habitat with increased annual precipitation resulting in higher forage quality. The Birch Creek SRD contains some agricultural fields throughout and some lower precipitation arid areas towards the southeastern end of the SRD.

Pronghorn that summer in the Birch Creek SRD migrate down the valley in late autumn to winter in the Birch Creek Sinks WRD (Figure 25).

Population Status & Objective

Population or herd composition surveys were conducted in this SRD from 1973 to 2004 (Appendix F); however, methods, survey timing, and seasonal conditions have varied enough to make comparisons and inferences on population trends difficult. In 2004, translocation of 89 animals occurred in this area (see Translocation chapter), but follow-up population surveys to document changes in status have been limited.

The population objective for this SRD is to maintain or increase pronghorn numbers while considering depredation concerns and changing habitat conditions.

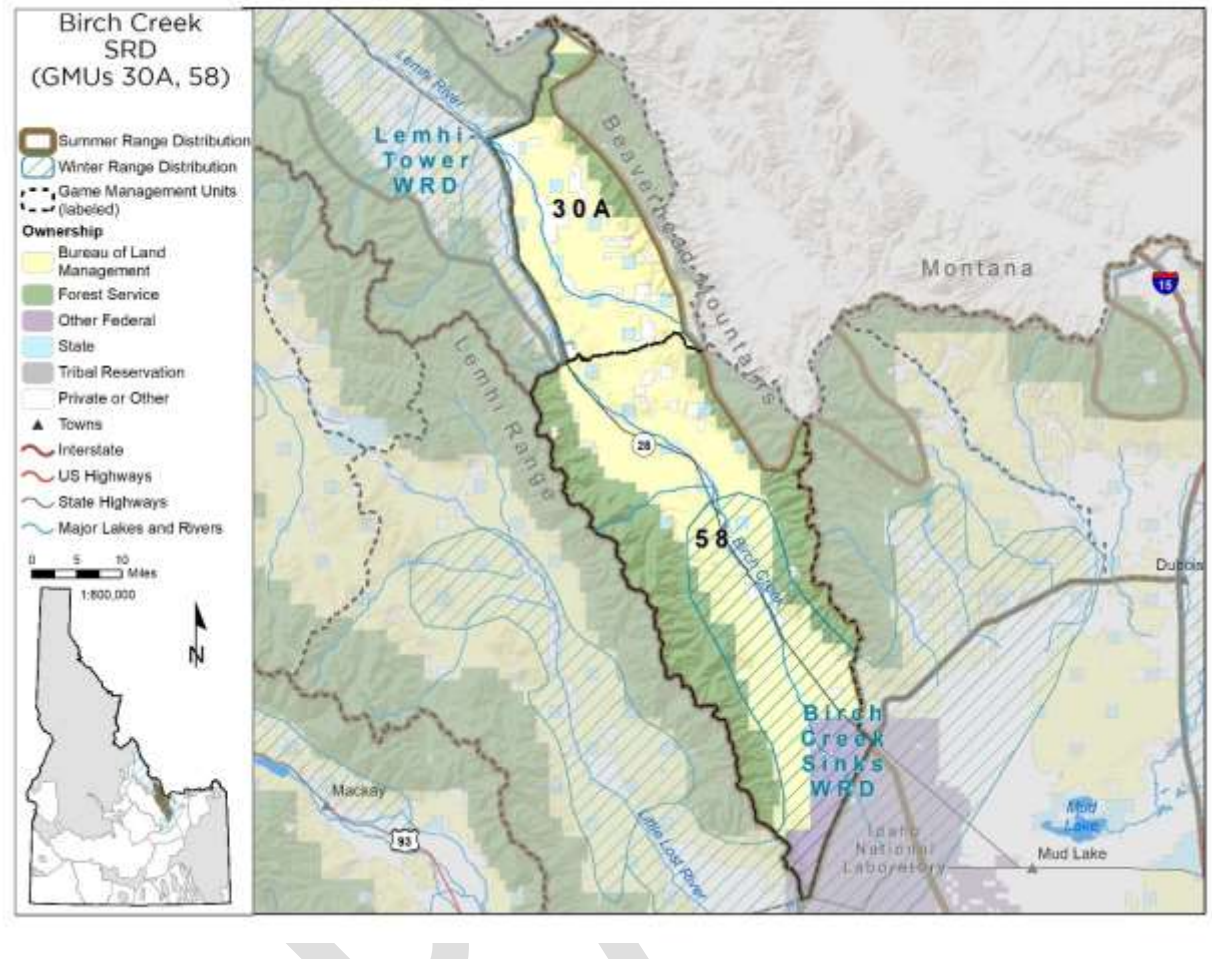
Harvest

Current any-weapon hunting opportunity is limited across this SRD with 50 tags available in GMU 58 in 2021. Muzzleloader-only opportunity is available with 40 tags in GMU 30A. This SRD was part of the 21A-1 unlimited archery-only hunt until 2021, when GMUs 30A and 58 were placed into their own unlimited archery-only hunt. Harvest success rates have remained consistent in the any-weapon hunt from 2010 to 2020 in GMU 30A (50–83%) and in GMU 58 (81–92%). In 2021, the large 21A-1 archery-only hunt unit was split into smaller groupings, two of which are in this SRD; one includes GMUs 30A and 29, and another includes GMUs 58, 59, and 59A. Archery-only harvest success rates in 2021 were 20% in GMU 30A and 24% in GMU 58. Since 2014, total archery-only harvest increased, any-weapon harvest remained relatively stable, and muzzleloader-only harvest declined (Figure 15 bottom).

Current Management Considerations

- Habitat quality — Invasive annual grasses are mapped as occurring at low abundance on 58% of the area. The increase of invasive annual grasses decreases the production and availability of high-quality forage available to pronghorn. Grazing pressure from other ungulates may be further affecting pronghorn in areas with low-quality forage.
- Water availability — Pronghorn are generally found within several miles of a water source, and given projected increases in drought conditions, access to water in this area may become more of an issue. The rerouting of the lower end of Birch Creek has left limited water in this SRD. Other areas of the SRD lack available water or have water sources that are in disrepair or need maintenance.

- Movement and migration — Portions of Birch Creek SRD fall within the Lemhi Valley Complex Priority Area for addressing big game migrations in Idaho (IDFG 2022b). Fences and roads may impede pronghorn movement in this SRD.
- Road density — Road density in this SRD is high. Increased number of OHVs (including ATVs, UTVs, and motorcycles) and use of those vehicles year round could have population-level effects by forcing pronghorn into substandard habitat, thereby reducing survival and productivity. Pronghorn as well as other wildlife are susceptible to disturbance, particularly during key time periods (e.g., fawning or winter). Increased road densities can be associated with lower pronghorn abundance (Christie et al. 2015) or survival (Eacker et al. 2023).



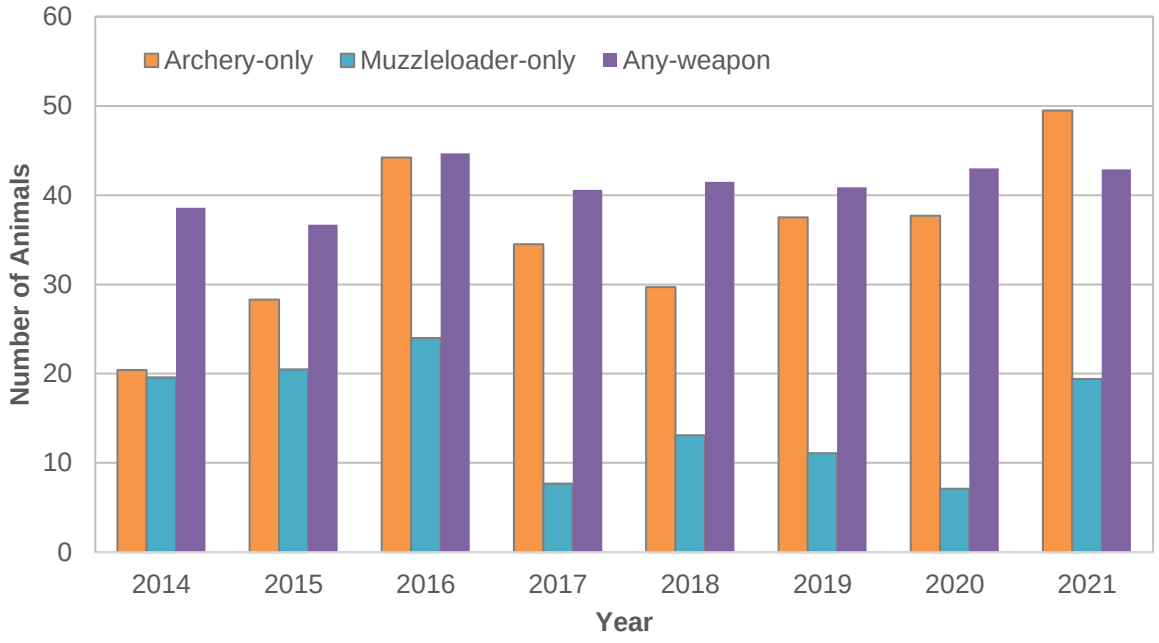


Figure 15. Birch Creek pronghorn summer range distribution (top) and harvest (bottom), Idaho.

Camas Summer Range Distribution

The Camas SRD includes all of GMUs 38, 39, 43, 44, 45, 48, 52, and 53 and portions of GMUs 49 and 52A (Figure 16 top). The core of this SRD includes the Camas Prairie, of which a large portion has been converted to agriculture. Farming is predominantly dryland, with alfalfa being the staple crop, but some small grains such as wheat and barley are also produced. The 3,100-acre Camas Prairie Centennial Marsh Wildlife Management Area is located within this SRD, which includes a portion of the Camas Creek riparian corridor, as well as native bunchgrass–sagebrush habitat. The eastern reaches of the Camas Prairie are dominated by private and BLM ground, which holds mature, intact sagebrush vegetation communities. The northern extent of this SRD includes the Soldier and Smoky Mountains, which host higher elevation sagebrush habitat, interspersed with broken timber and isolated aspen stands. Some pronghorn summer north of the South Fork of the Boise River in the southern end of GMU 39 and southwestern corner of GMU 43. Small groups of pronghorn summer throughout GMU 48, including at higher elevations in the Boulder Mountains. Summer range for pronghorn in GMU 49 is mostly restricted to sagebrush and agriculture habitat with some pronghorn occupying open meadows within broken timber. Most precipitation falls as snow between December and March, with little rain during the summer months.

The Camas SRD is a melting pot of pronghorn from various winter range distributions. Most pronghorn that summer in the Camas SRD migrate to winter range on the Mountain Home WRD between Mountain Home and Gooding (Figure 26). Most pronghorn that summer in GMU 48 and the southwestern portion of GMU 49 winter in the Owinza WRD (Figure 27), while pronghorn in the Little Wood and Fish Creek drainages of GMU 49 winter in the Birch Creek Sinks WRD (Figure 25). While small numbers of resident pronghorn are found in GMUs 52A and 53, these 2 GMUs are predominantly used during migration and winter and are discussed further in the Owinza WRD.

A relatively robust GPS collar dataset exists for this population, and migration and range maps have been developed. Anecdotal sightings and trail camera photos indicate some pronghorn summer in areas not represented within these maps due to the difficulty in capturing them in steep and broken timbered terrain. Additional GPS collaring on winter range may help fill in some of these known data gaps.

Population Status & Objective

Herd composition surveys have been conducted annually in several GMUs within this SRD since the 1970s (Appendix F); however, methods, survey timing, and seasonal conditions have varied enough to make comparisons and inferences on population trends difficult. Pronghorn numbers in this area have fluctuated over the last 3–4 decades, with population peaks in the late 1980s and again in 2015. Depredation claims in the 1970s on the Camas Prairie prompted an increase in hunting opportunity until severe winter conditions in 1992–1993 resulted in an estimated 30–50% decline in populations. Subsequently, hunting opportunity was reduced in 1994. Hard winters in 2001–2002, 2016–2017, and 2018–2019 led to a decline in pronghorn numbers in this SRD, and tag numbers were adjusted accordingly. The Camas Prairie and Little Wood River corridor continue to hold high densities of pronghorn, which is likely a result of

high-quality forage and strong recruitment. Population objectives for this SRD are to maintain or increase pronghorn numbers to maximize hunting opportunity while considering depredation concerns and changing habitat conditions.

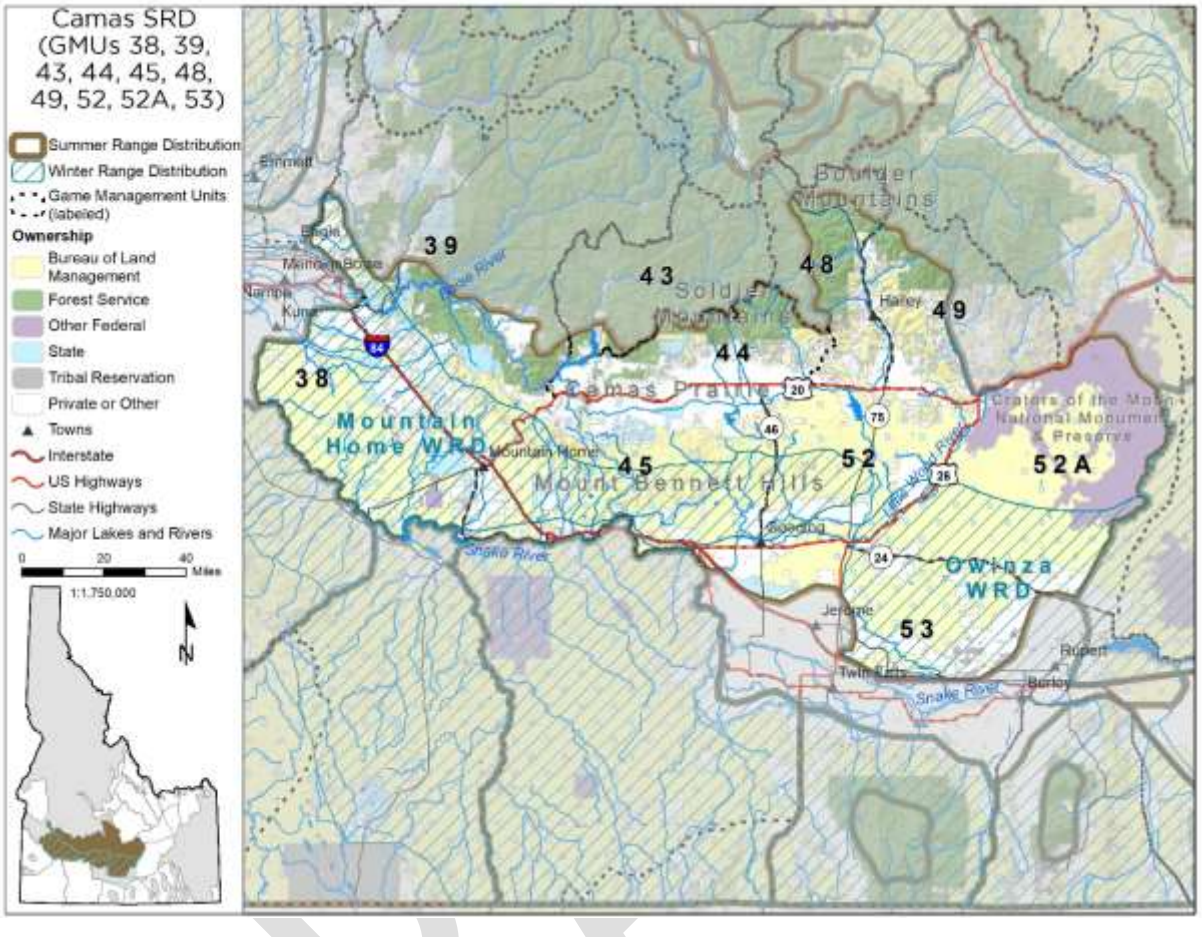
Harvest
Current hunting opportunity is limited across this SRD, with 215 either-sex any-weapon tags offered in GMUs 38, 39, 44, 45, 48, 52, and 52A in 2021. GMUs 45 and 53 were part of the 21A-1 unlimited archery-only hunt until 2021 when GMUs 44, 45, 48, and 52 were placed into their own unlimited archery-only hunt. The 52A-1 unlimited archery-only hunt, which includes GMUs 52A and 53, has been in place since 2015. Unit 39 offers a youth-only archery hunt with 5 permits, in addition to a doe/fawn hunt with 25 permits. This SRD also offers the most doe/fawn hunting opportunity with 100 permits offered in Units 44, 45, and 52, in addition to a Landowner Permission Hunt (LPH) with 25 permits in Unit 45. Harvest success rates have remained relatively consistent, with periodic declines following harsh winters (Figure 16 bottom).

Current Management Considerations

- Movement and migration — Portions of Camas SRD fall within the Smoky-Boise Complex Priority Area for addressing big game migrations in Idaho (IDFG 2022b). A large percentage of this population is migratory and encounters numerous barriers at least twice a year. Linear barriers including highways (US Highway 20 has been identified as an area of concern for wildlife-vehicle collisions), fences, and railroads, as well as development (residential, commercial, and energy) all have the potential to impede pronghorn movements in this SRD either directly (e.g., wildlife-vehicle collisions and entanglements) or indirectly by excluding animals from high-quality habitat which could lead to lower survival or recruitment. Many private parcels and public land allotments are delineated by a variety of fence types. Of particular concern are woven wire fences, which are largely impassable by pronghorn, particularly fawns. The BLM has addressed many woven wire fences and replaced them with wildlife-friendly fence whenever possible; however, many fences still present barriers to pronghorn, and removing and retrofitting fences will continue to be a priority throughout the SRD. US Highway 20 runs primarily east–west and is the main route connecting the growing cities of Boise and Sun Valley. This highway separates the northern part of the Camas SRD from the Mountain Home and Owinza WRDs, forcing twice annual crossings by much of the pronghorn population. Because US Highway 20 bisects the Camas Prairie, pronghorn that summer on agricultural ground may cross the highway multiple times throughout the year. State Highway 75 runs north–south and connects Sun Valley and northern rural communities with Twin Falls. Pronghorn that summer west of Timmerman Junction and that winter on the Owinza WRD cross this major roadway twice a year. Sections of this highway have been or are currently being widened to four lanes to accommodate heavy commuter and tourist traffic, both of which are expected to increase.
- Habitat — Both public and private lands are shifting in use across this SRD. The area is rich in renewable energy resources (e.g., at the time of this plan development, multiple energy projects within the SRD, including what will be

the largest wind farm in the state, are at various stages of permitting). As Idaho continues to grow in attractiveness for people relocating from other parts of the country, agricultural land could be rezoned if landowners decide to sell or explore development opportunities.

- Habitat quality — Habitat quality is generally high throughout this SRD. Noxious weeds and invasive annual grasses have degraded habitat quality in southern portions of the SRD, particularly GMUs 45 and 53. This is discussed further in the Mountain Home WRD description.
- Population data — While ground herd composition surveys have been conducted in this SRD almost every year since 1974, and harvest data provides some metric for evaluating population trends, there is currently no standardized survey method for estimating total pronghorn numbers.



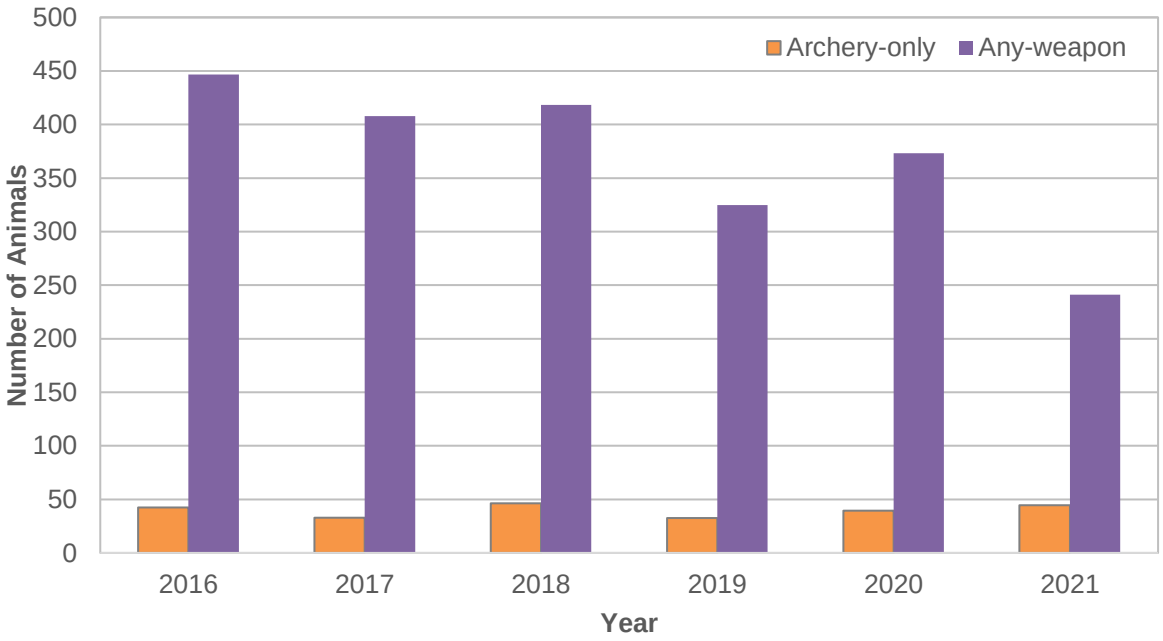


Figure 16. Camas pronghorn summer range distribution (top) and harvest in GMUs 38, 39, 44, 45, 48, 52, 52A, and 53 (bottom), Idaho. Harvest in GMU 49 is reported with Pioneer SRD.

Island Park Summer Range Distribution

The Island Park SRD includes GMUs 60, 60A, and 61 with typical pronghorn range in a mix of public (BLM, FS, IDL) and private lands (Figure 17 top). It consists of broad mountain valleys, such as Shotgun Valley and Henrys Lake Flats, and higher elevations portions of Sand Creek Desert. Generally, pronghorn use higher elevations within the SRD during the summer, which have higher forage quality as a result of higher precipitation, although some pronghorn do summer across the lower and drier portions of the Sand Creek Desert. The Island Park SRD consists of mostly native range lands across shrub steppe and conifer forest mosaic at higher elevations. Some agricultural fields, growing cereal grains and alfalfa, exist on private lands in the southwestern portion of the SRD.

Pronghorn in the Island Park SRD summer in 2 primary locations; those that summer along the foothills of the Centennial Mountains and those that summer in the Henrys Lake Flats and open shrub steppe around Chick Creek, east of Island Park Reservoir. Pronghorn that summer along the foothills of the Centennial Mountains, from Spencer to Shotgun Valley, migrate in the fall to the south and west toward Dubois and Hamer, ID (i.e., Sand Creek WRD) where they encounter I-15 and associated fencing that precludes further movement. Pronghorn that summer in the Henrys Lake Flats and Chick Creek area migrate in the fall across U.S. Highway 20 continuing north over Raynolds Pass into the Madison Valley of Montana for the winter (Millspaugh et al. 2021).

Population Status & Objective

No consistent population or herd composition surveys have been conducted in this SRD; however, this population consists of 2 large summering groups that winter in different locations in Sand Creek WRD and Madison Valley, Montana. Based on observations of pronghorn around Dubois there appear to be 150–200 pronghorn in the group that winters in Sand Creek WRD. This group has experienced multiple wildlife-train collisions during recent winters that have killed approximately 100 individuals (Table 2). The Madison Valley group is estimated at 75–125 individuals.

The population objective for this SRD is to maintain or increase pronghorn numbers while considering depredation concerns and changing habitat conditions.

Harvest

Current hunting opportunity is limited across this SRD with 15 any-weapon, 25 short-range-weapon-only, and 40 archery-only hunts available in 2021. Harvest success rates have remained consistent on the any-weapon hunt (75–94%) from 2016 to 2020, while they have been highly variable (0–73%) on the short-range-weapon-only hunt during the same period. Archery-only harvest was broken out from the large 21A-1 hunt area into smaller groupings in 2021. Archery harvest success rate in 2021 was 5% in hunt area 60A-1 (GMUs 60, 60A, and a portion of 61). Harvest in this SRD fluctuates, but a sizeable decline in harvest occurred after 2 large winter mortality train collisions in 2020 (Figure 17 bottom, Table 2).

Current Management Considerations

- Movement and migration — Portions of Island Park SRD fall within the Big Desert-Mountain Valley Complex Priority Area for addressing big game migrations in Idaho (IDFG 2022b). Much of the Island Park SRD has fence installed for domestic livestock which may limit or block pronghorn movements. Right-of-way fences along roadways and railways further bisect the landscape and limit pronghorn movements. Pronghorn with GPS collars curtailed their autumn migrations at the I-15 right-of-way fence near Dubois and Hamer. In some years, high concentrations of pronghorn cause depredation problems on nearby agricultural fields or haystacks, or end up on the railroad tracks as they seek shallower snows.
- Habitat quality — Grazing pressure from other ungulates, domestic and wild, can affect pronghorn when it leads to short-term overuse or long-term overgrazing, which can both lead to reductions in high-quality forage and transitions to lower-quality forage. Grazing strategies beneficial to all ungulates will maintain high-quality forage resources across the landscape.

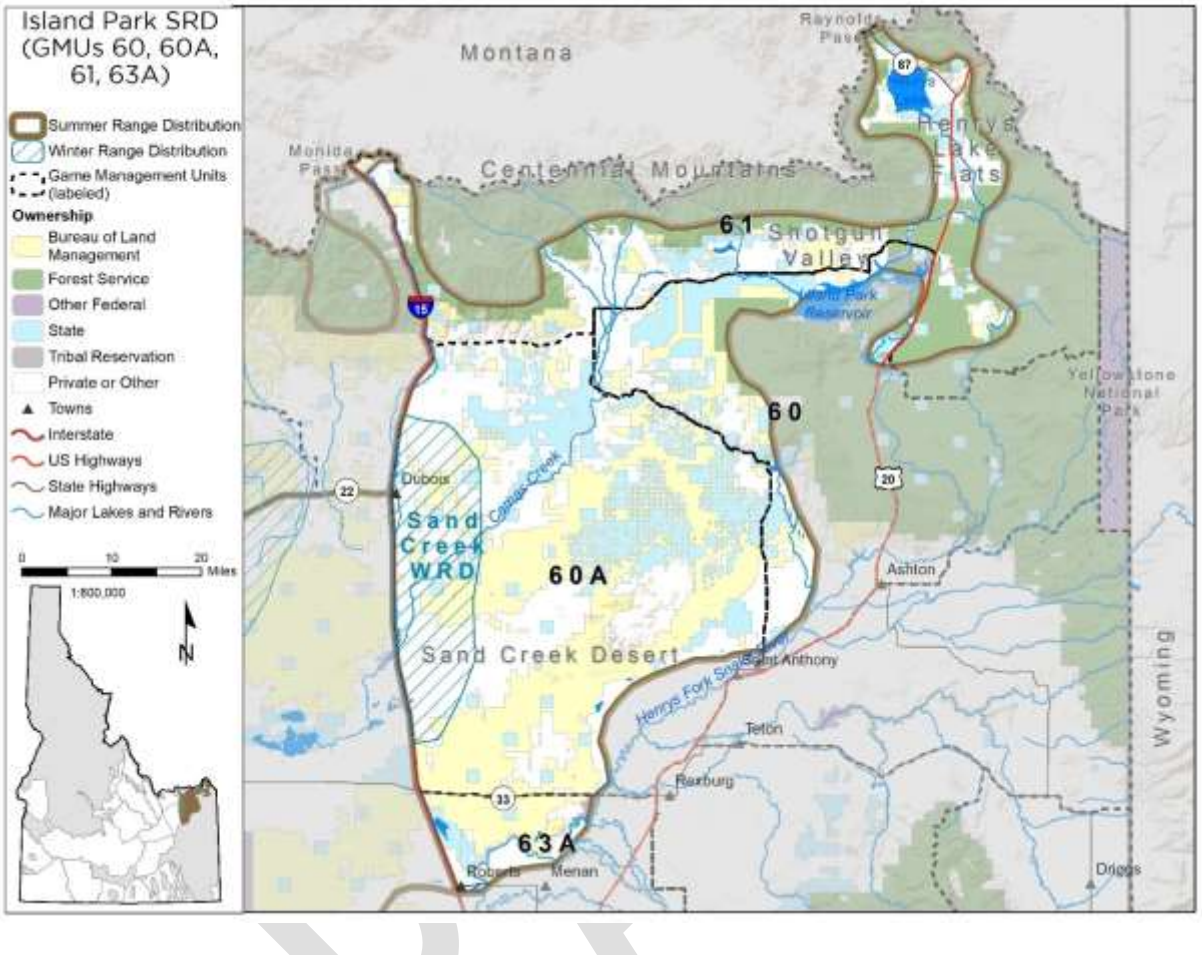


Figure 17. Island Park pronghorn summer range distribution (top) and harvest in GMUS 60, 60A, and 61 (bottom), Idaho.

Lost-Pahsimeroi Summer Range Distribution

The Lost-Pahsimeroi SRD includes GMUs 37, 37A, and 51 (Figure 18 top). It is mostly made up of public land (BLM, FS, IDL) but does contain private land near riparian corridors and valley bottoms. It consists of broad mountain valleys that span between the Lost River and Lemhi mountain ranges and includes the Little Lost and Pahsimeroi River drainages. Most of the habitat in this SRD is at higher elevations with increased annual precipitation, resulting in higher forage quality. The Lost-Pahsimeroi SRD contains some agricultural fields throughout and some lower precipitation arid areas in valley bottoms.

Pronghorn that summer in the Lost-Pahsimeroi SRD have a split migration to winter range. Pronghorn found in the Little Lost Valley migrate to the lower elevation valley bottom (Little Lost WRD) or to the Birch Creek Sinks WRD. Pronghorn found in the Pahsimeroi Valley are thought to migrate to the lower elevation valley bottom (Morgan WRD) or winter on the western end of the valley (Antelope Flat WRD).

Population Status & Objective

Population or herd composition surveys have been conducted in this SRD (Appendix F); however, methods, survey timing, and seasonal conditions have varied enough to make comparisons and inferences on population trends difficult.

The population objective for this SRD is to maintain or increase pronghorn numbers while considering depredation concerns and changing habitat conditions.

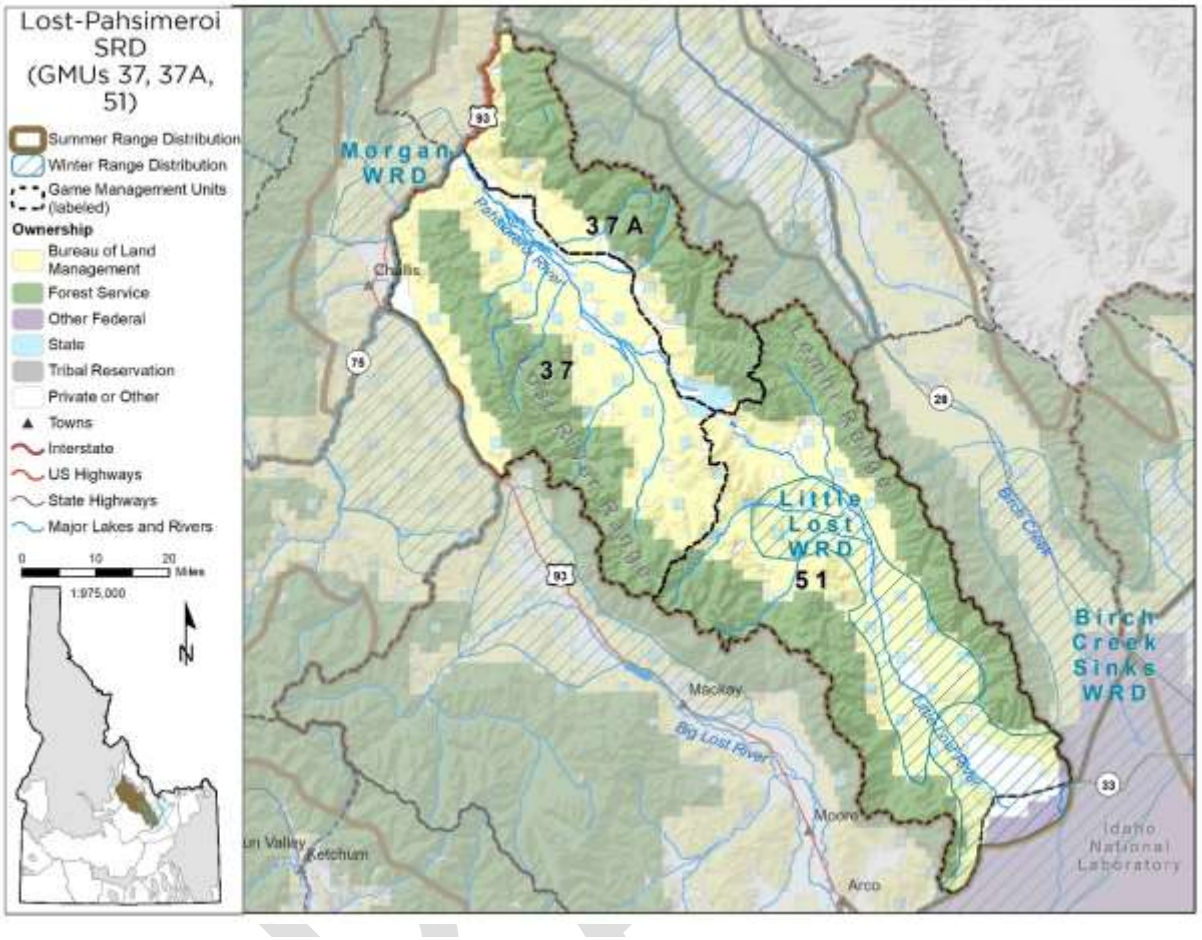
Harvest

Current hunting opportunity is limited across this SRD with 60 tags available in GMU 37 and 75 tags available in GMU 51 in 2021. Harvest success rates have remained consistent on the any-weapon hunt from 2010 to 2021 in GMU 37 (78–96%) and in GMU 51 (75–93%). Archery-only harvest was broken out from the large 21A-1 hunt area into smaller groupings in 2021. Currently, there are 2 archery-only hunts in this SRD; one that includes GMUs 37, 37A, 28, and 36B and a second that includes GMUs 51 and 63. Archery-only harvest success rates in 2021 were 31% in GMUs 37 and 37A and 13% in GMU 51. Total harvest across GMUs 37 and 51 has increased slightly for both weapon types from 2014 to 2021 (Figure 18 bottom).

Current Management Considerations

- Habitat Quality — Wildfire regime changes over the years have resulted in an altered ecosystem. This SRD has experienced several wildfire events in the past and invasive annual grasses have thrived in some areas. The increase of invasive annual grasses decreases the production and availability of high-quality forage (native forbs and grasses) available to pronghorn. Grazing pressure from other ungulates can further affect pronghorn in areas with low-quality forage.
- Water availability — Pronghorn are generally found within several miles of water sources. Some of the areas found in the Lost-Pahsimeroi SRD lack available water or have water sources that are not maintained.
- Movement and migration — Fences and roads may impede pronghorn movements across landscapes both seasonally and daily in this SRD.

- Road density — Road density in this SRD is relatively high. Increased amount of OHVs (including ATVs, UTVs, and motorcycles) and use of those vehicles year round has been increasing. Pronghorn as well as other wildlife are susceptible to disturbance during key time periods. High road densities can be associated with lower pronghorn abundance (Christie et al. 2015) or survival (Eacker et al. 2023).
- Depredations — Large numbers of pronghorn using agricultural fields can cause depredation concerns for local producers in this SRD.



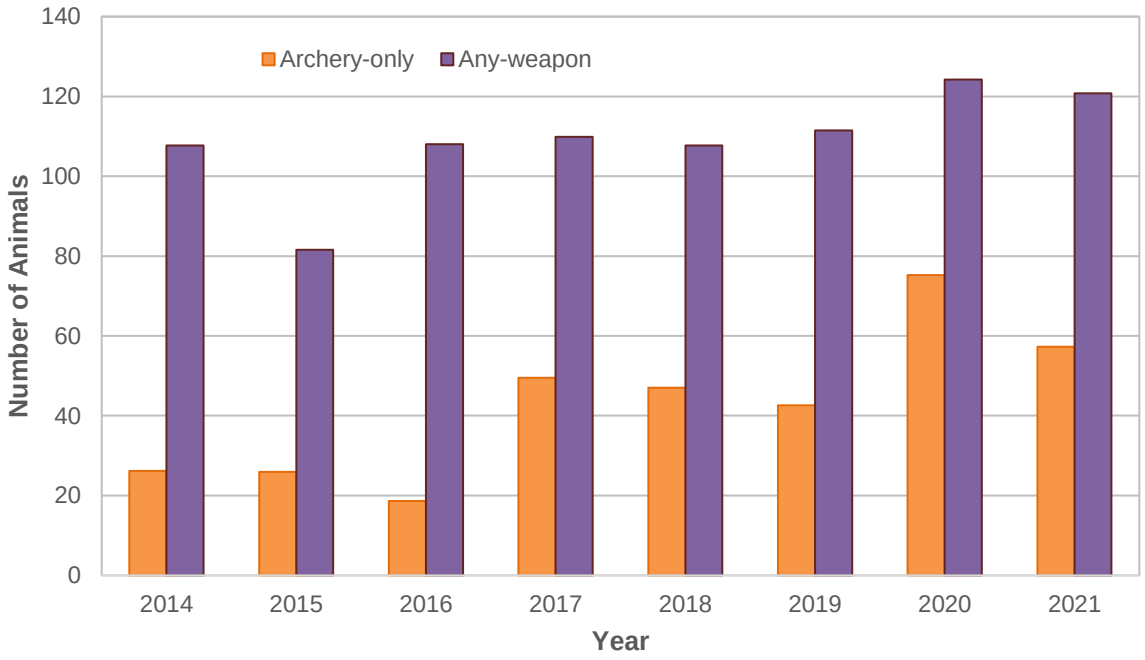


Figure 18. Lost-Pahsimeroi pronghorn summer range distribution (top) and harvest in GMUs 37 and 51 (bottom), Idaho.

Medicine Lodge Summer Range Distribution

The Medicine Lodge SRD includes GMUs 59 and 59A (Figure 19 top). It consists of large portion of public land (BLM, FS, IDL) but does contain private land throughout. It consists of Beaverhead Mountain ranges flattening out to the upper Snake River Plain. Most of the habitat in this SRD is higher elevation habitat with increased annual precipitation resulting in higher forage quality. The Medicine Lodge SRD contains some agricultural fields throughout and some lower precipitation arid areas towards the southern edges of the SRD.

Pronghorn that summer in the Medicine Lodge SRD migrate across the hills in late autumn to winter in the Birch Creek Sinks WRD (Figure 25). Some animals also migrate into Montana through Monida Pass or Bannack Pass (Figure 6).

Population Status & Objective

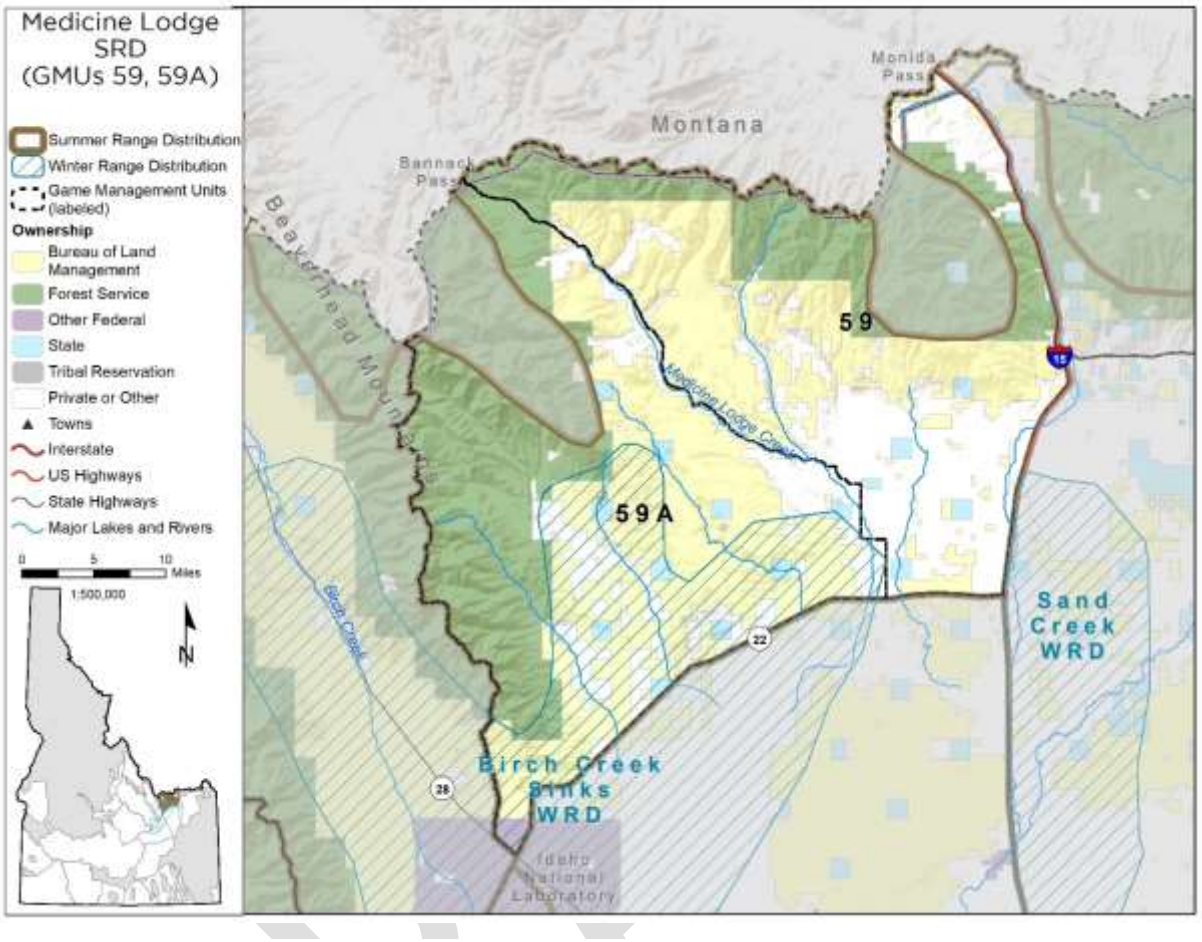
No consistent population or herd composition surveys have been conducted in this SRD in recent years (Appendix F). The population objective for this SRD is to maintain or increase pronghorn numbers while considering depredation concerns and changing habitat conditions.

Harvest

Current hunting opportunity is limited across this SRD with 50 any-weapon tags valid for the entire SRD in 2021. Harvest success rates have remained consistent from 2010 to 2021 (67–94%). This SRD was part of the large 21A-1 unlimited archery-only hunt area until 2021, when GMUs 58, 59, and 59A became a separate unlimited archery-only hunt area. Harvest rates in this SRD have remaining relatively consistent with a slight increase in archery success rates (Figure 19 bottom). Archery harvest success in 2021 was 24% in GMUs 59 and 59A.

Current Management Considerations

- Fire and invasive annual grasses — As invasive annual grasses continue to spread into higher and colder sites that were thought to be resilient, the risk of fire and subsequent impacts from fire become a larger concern. Sagebrush steppe can be difficult to rehabilitate after fire and may become unproductive for many species, including pronghorn, if invasive annual grasses are allowed to thrive. Over 15% of this SRD has burned since 1970 and >70% of the area is mapped as containing invasive annual grasses.
- Movement and migration — Portions of Medicine Lodge SRD fall within the Big Desert-Mountain Valley Complex Priority Area for addressing big game migrations in Idaho (IDFG 2022b). Fencing associated with livestock management operations or roadways can exclude pronghorn from certain areas or extend migration routes. Woven wire fences, often remnants of historical domestic sheep grazing, or barbed wire fences with an excessive number of strands or low bottom strands can be found across the SRD.
- Habitat quality — Grazing pressure from other ungulates, domestic and wild, can affect pronghorn when it leads to short-term overuse or long-term overgrazing, which can both lead to reductions in high-quality forage and transitions to lower-quality forage. Grazing strategies beneficial to all ungulates will maintain high-quality forage resources across the landscape.



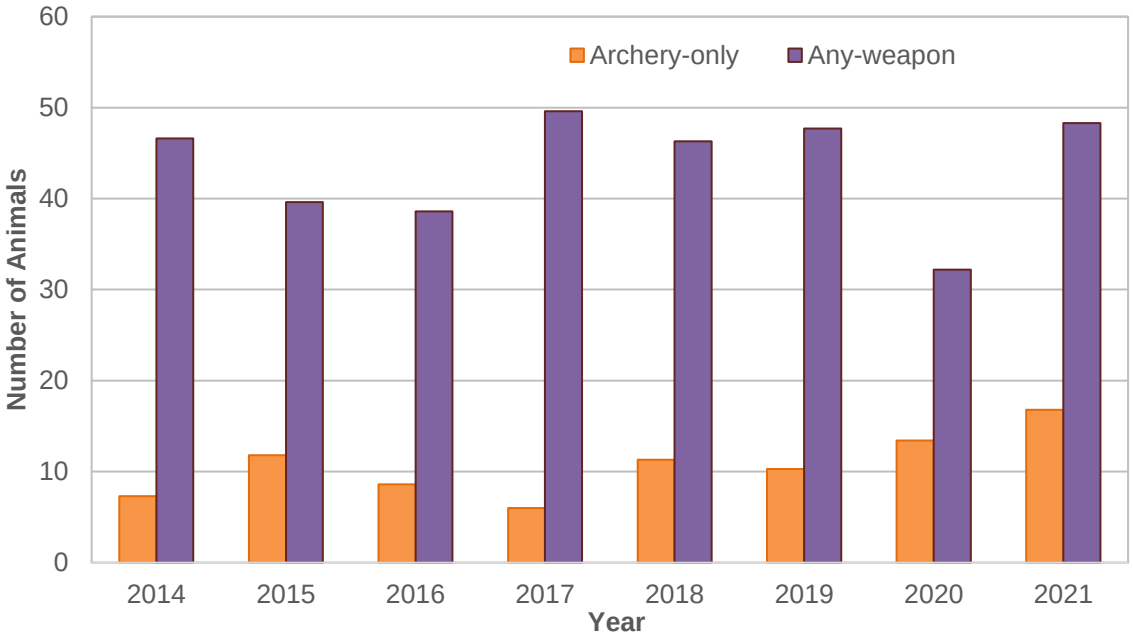


Figure 19. Medicine Lodge pronghorn summer range distribution (top) and harvest in GMUs 59 and 59A (bottom), Idaho.

Morgan-Moyer Summer Range Distribution

The Morgan-Moyer SRD includes portions of GMUs 28 and 36B (Figure 20 top). It is almost entirely public land (FS and BLM) with some small private inholdings used for summer cattle grazing. The lower portion around the mouth of Morgan Creek consists of steep, sagebrush covered hills with deeply incised gulches and draws scattered throughout. Some of these contain small riparian areas. The upper portion is in Moyer Basin. This is a high elevation sagebrush plateau with high-quality forage surrounded by dry lodgepole pine/Douglas fir forest.

Pronghorn that summer in this SRD use two different, but adjacent winter ranges (see Morgan WRD). Those that summer on the lower end of Morgan Creek move a short distance to the south side of the creek. Those that summer in Moyer Basin make their way in late autumn to the north side of Morgan Creek.

Population Status & Objective

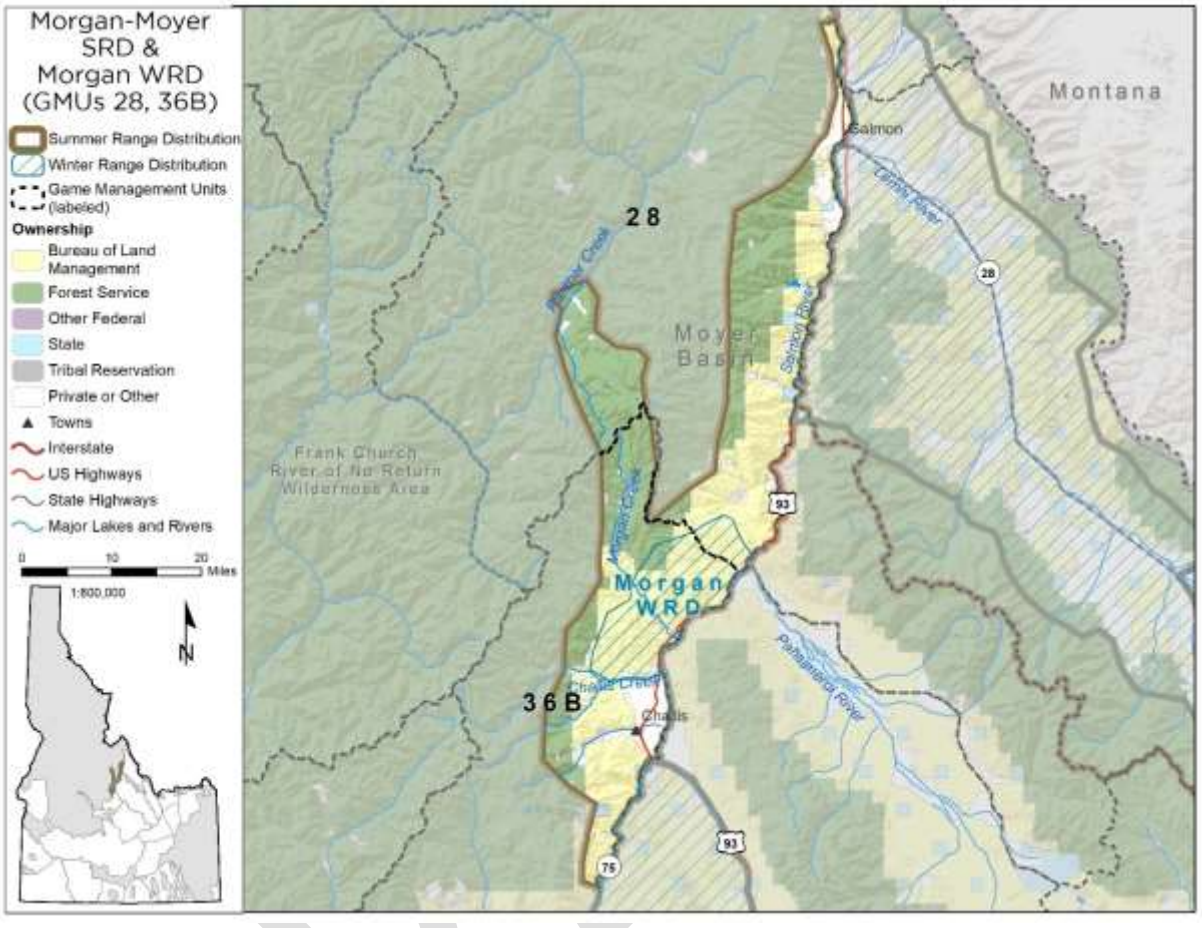
Historical composition data do not exist for this SRD and it is not part of an existing ground composition route. Some total counts from aerial surveys and observations incidental to other species surveys have occurred over the years and this population appears to be stable (Appendix F). The management objective is to increase the population to provide more opportunity while considering depredation concerns and habitat availability

Harvest

Currently, harvest in this SRD (both GMUs 28 and 36B) takes place by an unlimited archery-only season and an any-weapon controlled hunt. Harvest and success rate for the controlled any-weapon hunt in GMU 36B has been stable over the last several years, while harvest during the archery-only season has averaged only 1 or 2 animals with no harvest in 2015, 2017, and 2020 (Figure 20 bottom).

Current Management Considerations

- Habitat quality — Noxious weeds and invasive annual grasses (cheatgrass) are impacting habitat quality, particularly in Morgan Creek.
- Movement and migration — Old woven wire fence may be impacting pronghorn movement throughout the SRD and an emphasis on fence removal or reconstruction on both public and private land would benefit pronghorn populations.
- Livestock management — Improper livestock management on public allotments may be suppressing the forb component of the understory, which is important to pronghorn doe nutrition and lactation in the spring and early summer.
- Conifer encroachment — Conifer encroachment in Moyer Basin is impacting the extent of the sagebrush community.
- Population data — There are no standardized population or composition surveys, either ground or aerial, to monitor population performance in this SRD.



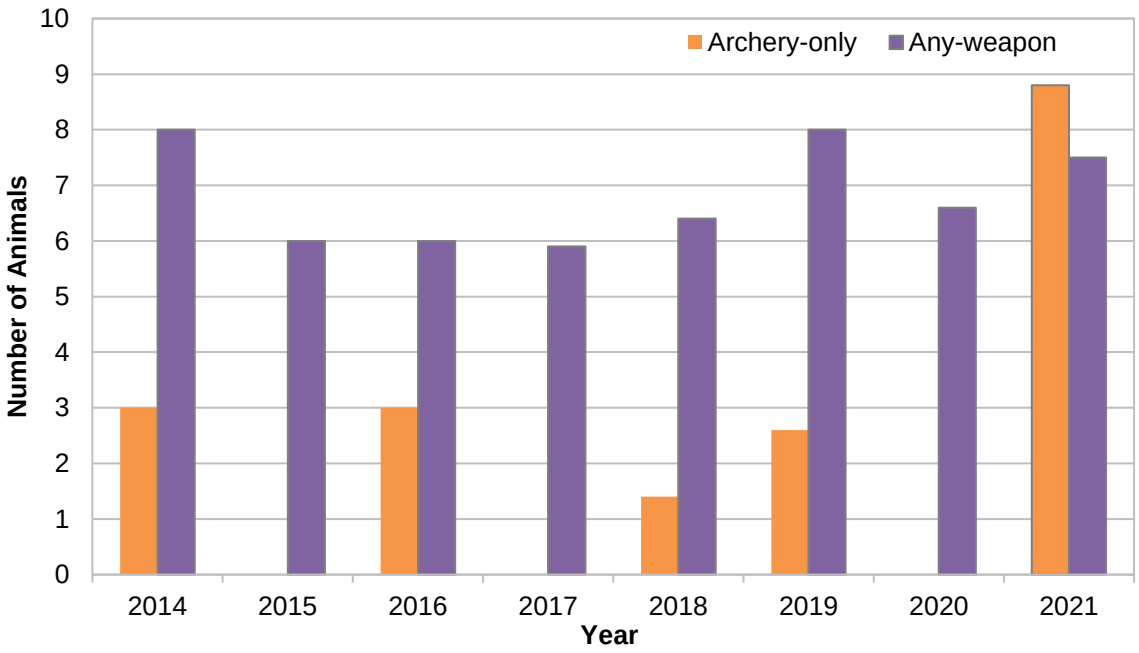


Figure 20. Morgan-Moyer pronghorn summer range distribution and Morgan pronghorn winter range distribution (top) and harvest in GMU 36B (bottom).

Mud Lake Summer Range Distribution

The Mud Lake SRD includes portions of GMU 63 (Figure 21 top). It is a mix of public land (BLM, FWS, INL, IDFG, IDL) and private land. It encompasses the upper portion of the Snake River Plain. Most of the habitat in this SRD is lower elevation habitat consisting of low precipitation native rangeland and agricultural fields.

Pronghorn that summer in the Mud Lake SRD are a combination of year-round residents and short-distance migrants to the Birch Creek Sinks WRD.

Population Status and Objective

No consistent population or herd composition surveys have been conducted in this SRD. Limited historical data are available (Appendix F) for various portions of the GMU (Compton 2005). The population objective for this SRD is to maintain or increase pronghorn numbers while considering depredation concerns and changing habitat conditions.

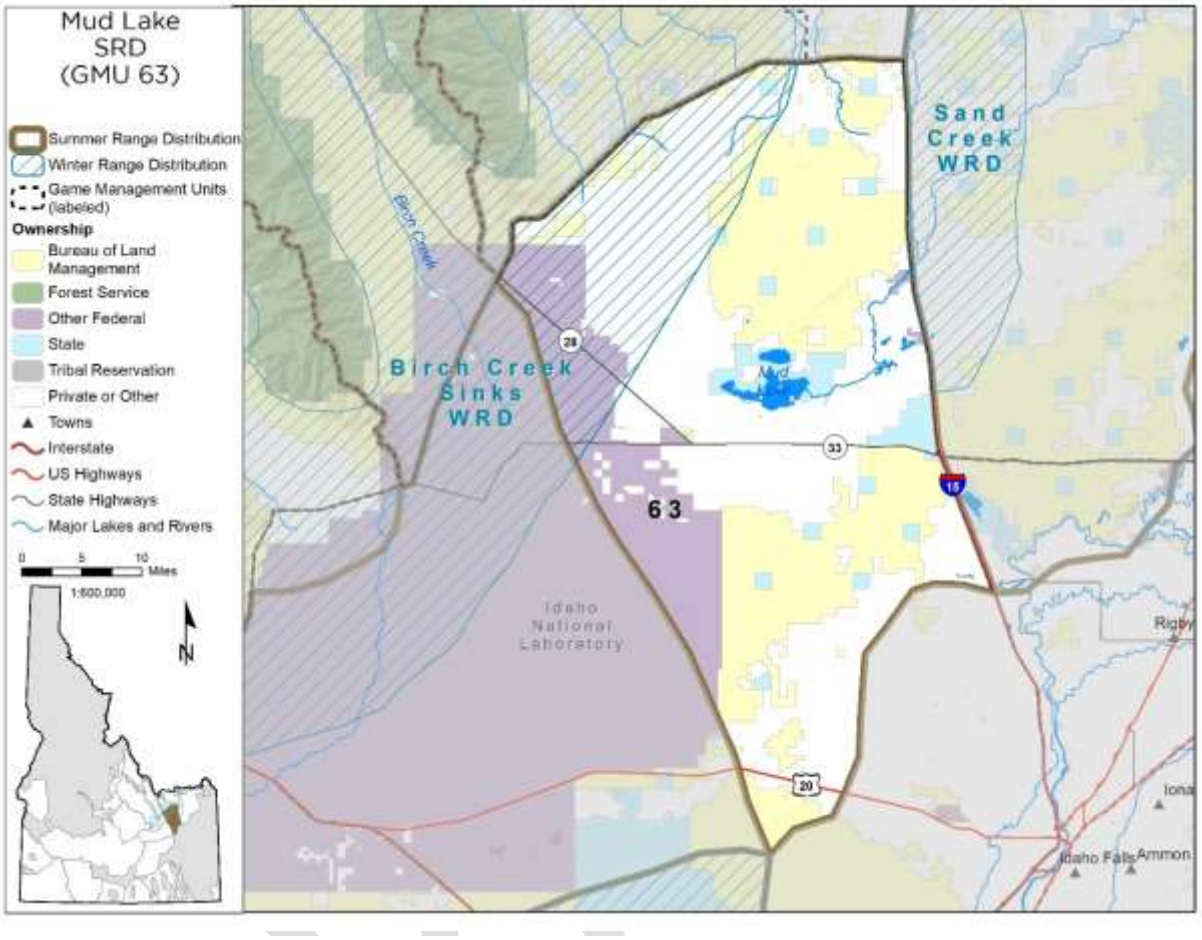
Harvest

Hunting in GMU 63 is split up into 3 pronghorn hunting areas 63-1, 63-2, and 63-3. Current any-weapon either-sex hunting opportunity is limited across this SRD with 50 tags available in 63-1. Success rates from the previous 10 years have ranged from 81% to 98%. Antlerless any-weapon opportunity is offered in 63-2 and 63-3 and during the previous 10 years has a large range of success from 18% to 85%. The muzzleloader-only opportunity is found in 3 different hunts in 63-2 (with one being a youth hunt) and the success rate ranges from 11% to 70%. Hunt area 63-1 was part of the 21A-1 unlimited archery-only hunt until 2021, when GMUs 51 and 63 were placed into their own unlimited archery-only hunt. Harvest success rate in 2021 for the archery-only hunt in GMUs 51 and 63 was 13%. Harvest rates have fluctuated modestly in this SRD but remain relatively stable with a slight decline in archery-only harvest the last 3 years (Figure 21 bottom).

Current Management Considerations

- Habitat Quality — Wildfire regime changes over the years have resulted in an altered ecosystem. Over 14% of this SRD has burned at least once since 1970 and >55% of the area is mapped as containing invasive annual grasses. The increase of invasive annual grasses decreases the production and availability of high-quality forage available to pronghorn. Grazing pressure from other ungulates can further affect pronghorn in areas with low-quality forage.
- Movement and migration — Portions of Mud Lake SRD fall within the Big Desert-Mountain Valley Complex Priority Area for addressing big game migrations in Idaho (IDFG 2022b). Fencing associated with grazing operations or roadways can exclude pronghorn from certain areas or extend migration routes. Woven-wire fences, often remnants of historical domestic sheep grazing, or barbed-wire fences with an excessive number of strands or low-bottom strands can be found regularly across the SRD.
- Depredation — Significant numbers of pronghorn are known to use agricultural fields in the Mud Lake SRD, causing depredation concerns for local agricultural producers in this SRD.

- Water availability and distribution — Pronghorn are generally found within several miles of water sources. Some of the areas found in the Mud Lake SRD are lacking in available water, including parts of Table Butte and the southern tip of the SRD. Addressing those water source needs could possibly address pronghorn depredations as pronghorn could be moving into agricultural fields to find water, especially later in the summer.
- Population data — More research on population estimates, limiting population factors, and movements (seasonal and daily) would be beneficial for pronghorn management in this SRD.



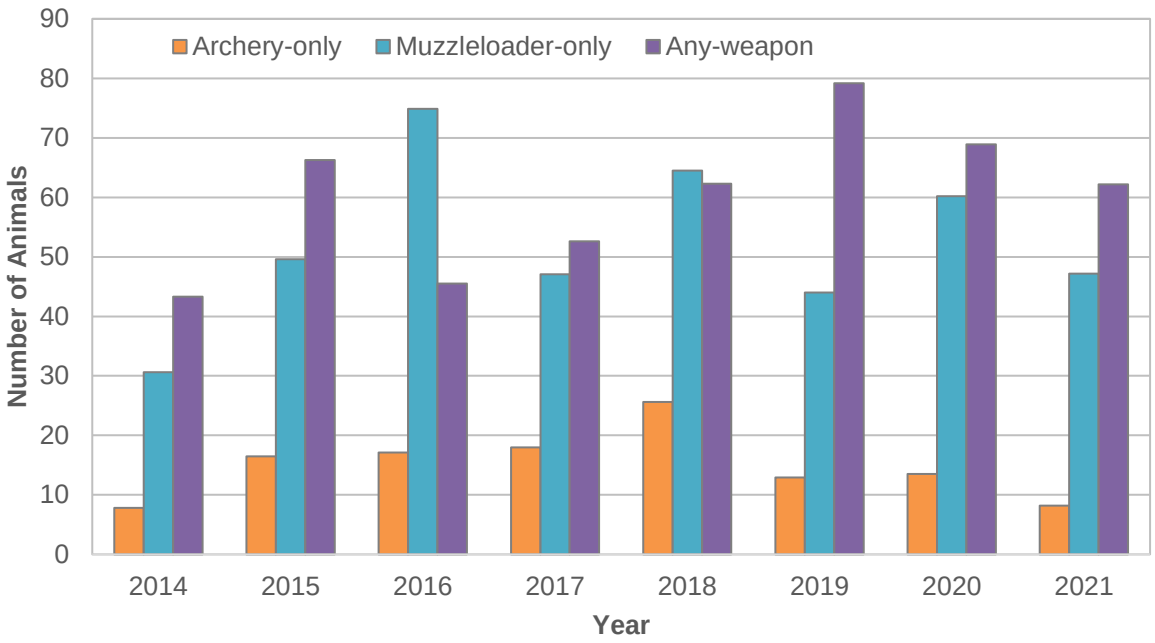


Figure 21. Mud Lake pronghorn summer range distribution (top) and harvest in GMU 63 (bottom), Idaho.

Pioneer Summer Range Distribution

The Pioneer SRD includes a portion of GMU 49 and all of GMU 50 (Figure 22 top). Typical pronghorn range across the Pioneer SRD is a mix of federal, state, and private lands. It consists of broad mountain valleys, such as Copper Basin and the Little Wood River Valley, which descend into the Big Desert. Pronghorn use higher elevations within the SRD that experience greater amounts of precipitation resulting in higher forage quality, and migrate into lower elevation areas during the winter. The Pioneer SRD consists of mostly native bunchgrass and sagebrush steppe, with agricultural fields common along the river corridors.

There are 3 distinct groups of pronghorn that use this SRD: those that spend summers in Copper Basin, those that spend summers in the Big Lost River Valley and Arco Desert, and those that spend summers in the Little Wood River Valley. The Copper Basin group descends into the Big Lost River valley during winter (Big Lost WRD). The Arco Desert group and Little Wood River group migrate toward the Birch Creek Sinks WRD during winter. One GPS-collared pronghorn doe that spent part of the summer in the Little Wood River drainage migrated to winter range on the Owinza WRD.

Population Status & Objective

Herd composition surveys have been conducted in GMU 49 in the Little Wood and Fish Creek drainages since 1974 using a mix of aerial and ground survey methodologies (Appendix F). Helicopter surveys were conducted as part of a research project to compare results to ground counts from 2003–2005. Population objectives for this SRD are to maintain or increase pronghorn numbers to maximize hunting opportunity while considering depredation concerns and changing habitat conditions.

Harvest

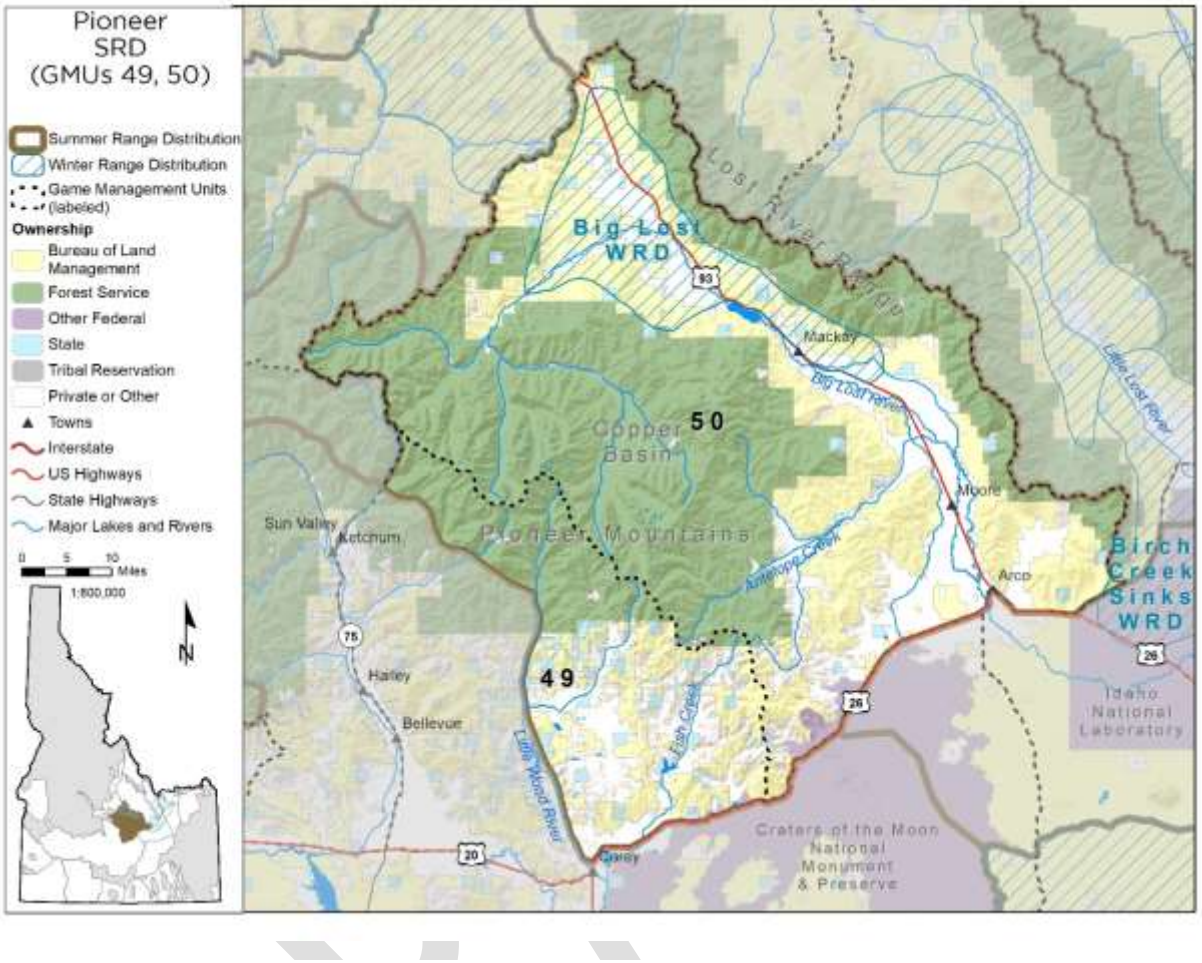
Current hunting opportunity is limited across this SRD with 25 any-weapon tags available in GMU 49 and 75 any-weapon tags available in GMU 50 in 2021. Harvest success rates have remained relatively consistent on the any-weapon hunt (61–100%) from 2014 to 2021. This SRD was part of the 21A-1 unlimited archery-only hunt until 2021, when GMUs 49 and 50 were placed into their own unlimited archery-only hunt. The harvest success rate in 2021 for GMUs 49 and 50 archery-only hunt was 19%. Harvest rates have fluctuated modestly in this SRD but remain relatively stable (Figure 22 bottom).

Current Management Considerations

- Habitat quality — While most of this SRD contains fairly high-quality habitat for pronghorn, it is susceptible to changes that will likely reduce its value for pronghorn. The Sharps Fire in 2018 burned nearly 65,000 acres, much of which was sagebrush steppe habitat used by pronghorn. While restoration efforts were quick and thorough, the inevitable establishment of invasive annual grasses still occurred in some areas. Livestock production is a primary land use in GMUs 49 and 50. Range conditions have been adversely affected by invasive annual grasses, fire, and drought. The cumulative impacts of wildfire, climate

change, and improper livestock management could negatively impact this population

- Movement and migration — A large percentage of this population is migratory and encounters numerous barriers at least twice a year. Domestic sheep grazing is prevalent on this SRD, and woven wire fence occurs in some areas, particularly around Campbell Flats and Muldoon Canyon. Pronghorn, particularly fawns, have been observed struggling to navigate these fences. Work is currently underway to rebuild some stretches of woven wire with wildlife-friendly fencing. Additionally, US Highway 20/26 has been identified as an area of concern for wildlife-vehicle collisions (IDFG 2022b), and likely impedes pronghorn that migrate south to the Owinza WRD, as well as narrowing an existing topographic bottleneck (Figure 7) for pronghorn migrating to Birch Creek Sinks WRD (Figure 25). Canals, railways and development (residential, industrial, and energy) are also possible barriers to pronghorn movements between this SRD and winter range.
- Depredation — Several groups of pronghorn cause depredation issues throughout the SRD, primarily on irrigated agricultural fields. These issues are generally minor but may be increasing due to changes in pronghorn distribution, phenology of habitat, or degraded native rangelands compromised by wildfire.
- Population data — In 2005, GPS-collared pronghorn revealed the migration path from the Pioneer Mountains to the Birch Creek Sinks WRD, but many information gaps remain for the Pioneer pronghorn population overall. Recent efforts to fill in some of these gaps have resulted in additional pronghorn being collared in the Little Wood drainage and on the Owinza WRD. Counting and obtaining accurate composition data for pronghorn remains challenging, particularly for populations with unidentified migration routes and seasonal ranges.



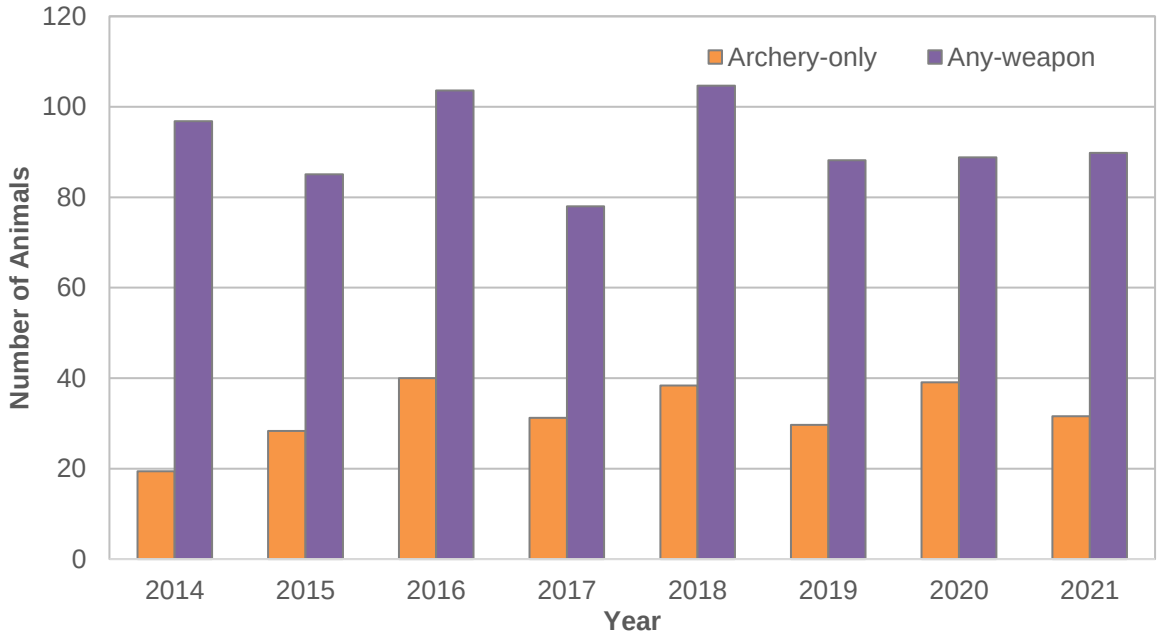


Figure 22. Pioneer pronghorn summer range distribution (top) and harvest in GMUs 49 and 50 (bottom), Idaho.

Sawtooth Summer Range Distribution

The Sawtooth SRD includes portions of GMU 36 and 36A (Figure 23 top). It is almost entirely public land (FS and BLM) with some small private land in the valley bottom used for summer cattle grazing and hay production. It is high elevation sagebrush steppe that has high-quality forage because of abundant precipitation. It is surrounded by lodgepole pine/Douglas fir forest types with some subalpine fir communities at the upper end of the valley.

The pronghorn in this SRD migrate in late autumn through substantial areas of forested habitat into the East Fork of the Salmon River and eventually into the Antelope Flat WRD south of Challis.

Population Status & Objective

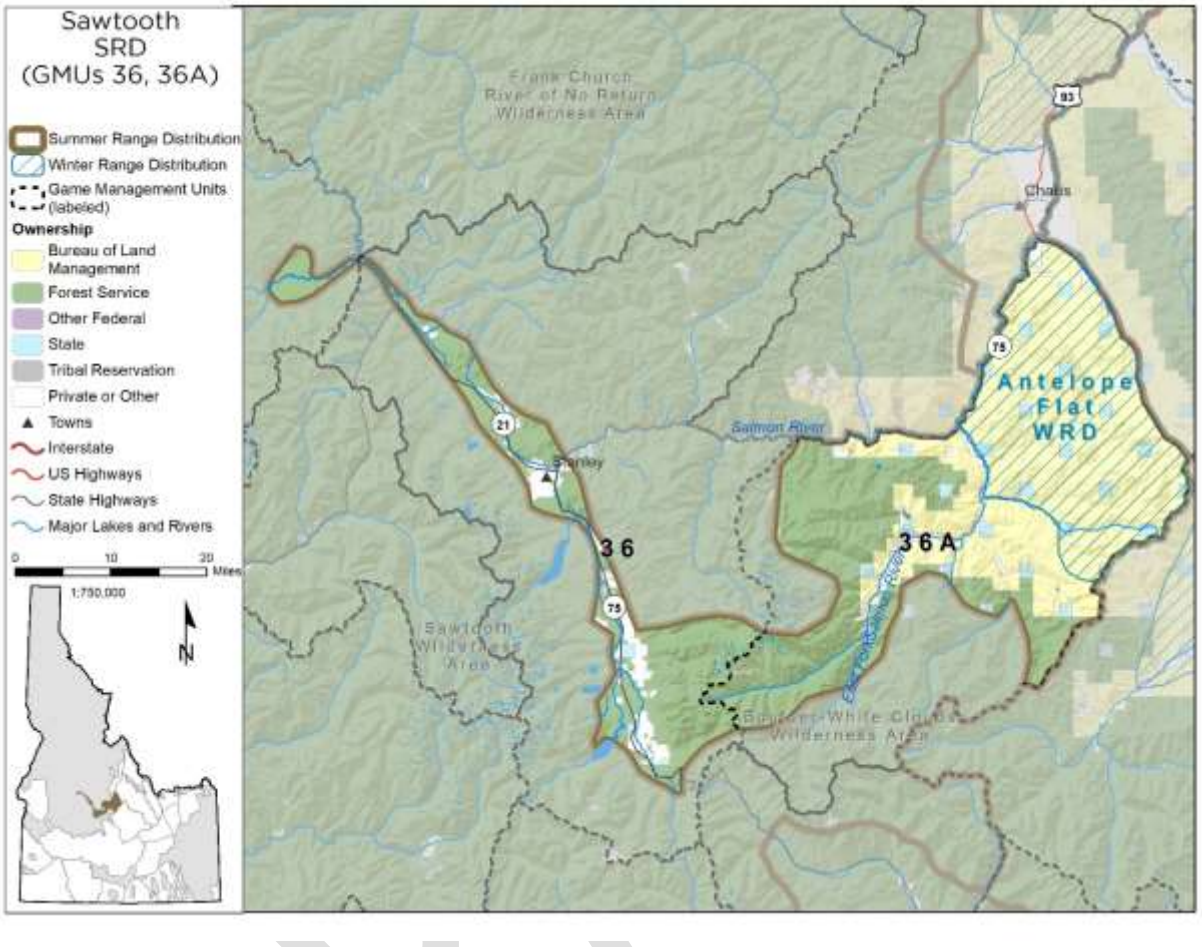
There are historical survey data for this SRD, and it is part of an existing ground composition route that has inconsistent data collection over the last decade (Appendix F). The composition trend between 2014 and 2017 appeared to be declining for both fawns and bucks. However, the composition survey in 2021 indicated these measures and the total population appear to be increasing. The management objective is to increase the population to provide more opportunity while considering depredation concerns and habitat availability.

Harvest

Currently, harvest in this SRD takes place by an unlimited archery-only season and controlled short-range-weapon-only hunt. Harvest during the archery-only season increased substantially the last 4 years compared to previous years while success has remained stable around 7% (Figure 23 bottom). Harvest and success for the short-range-weapon-only hunt has been stable over the last several years (Figure 23 bottom).

Current Management Considerations

- Habitat quality — Habitat quality is likely being affected by increased rural residential development.
- Movement and migration — Old woven wire fence and some jack-leg fencing on and between private and public land may be impacting pronghorn movement throughout the SRD.
- Recreational use — Recreational activity on the Sawtooth National Recreation Area is increasing and may impact pronghorn habitat use and movement.
- Population data — Population and composition data for this SRD are limited. There is an existing ground count route to estimate composition, but no standardized population survey method.
- Feral horse population — The Challis Herd Management Area (CHMA) often exceeds the population target and could be impacting pronghorn habitat use and population performance.



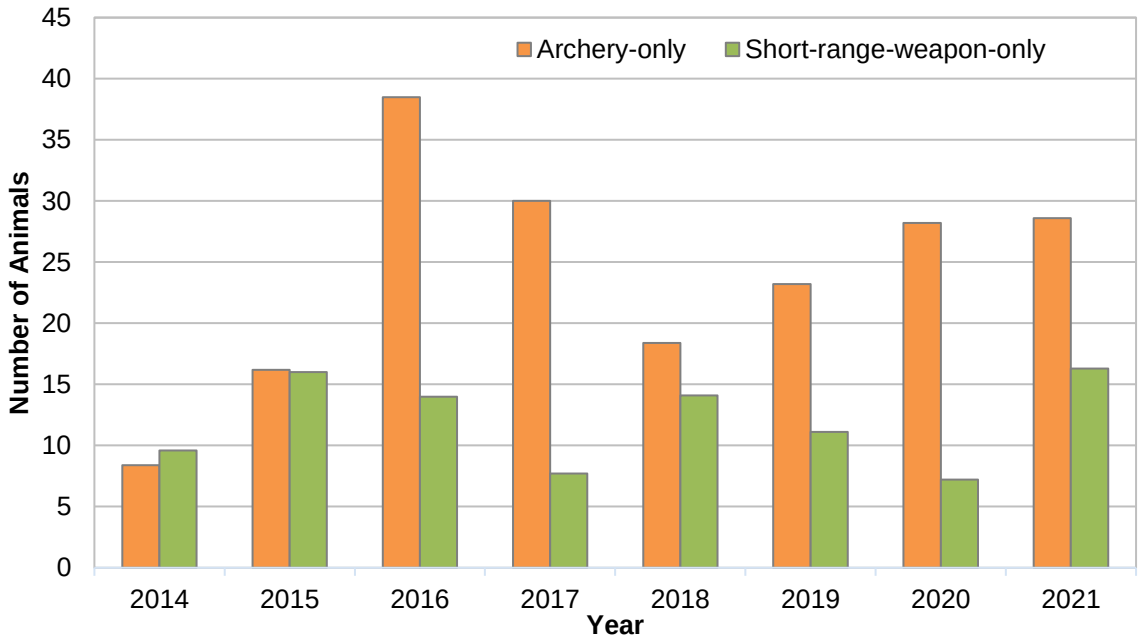


Figure 23. Sawtooth pronghorn summer range distribution (top) and harvest in GMUs 36 and 36A (bottom).

Winter Range Distributions

Antelope Flat Winter Range Distribution

The Antelope Flat WRD runs from Willow Creek Summit to Bradbury Flat and extends to the south to Road Creek in GMU 36A (Figure 24). It is characterized by broad, flat sagebrush steppe at lower elevations and rolling sagebrush-covered hills from Bradbury Flat to Road Creek. It is mostly public land (BLM) with some private land along US Highways 93 and 75. Pronghorn use is concentrated along US Highway 93 between Willow Creek and Bradbury Flat. Small groups can be found wintering throughout the rest of the WRD. Snow accumulation is light during most winters with occasional short periods of deeper snow. Pronghorn concentrations will vary depending on snow depth and winter severity.

Pronghorn that winter here come from two different summer ranges. Some are long distance migrants from the Sawtooth SRD. The other portion makes a short migration from the north end of the Lost River Range which is part of the Lost-Pahsimeroi SRD. There may be other unknown migration routes connecting other summering areas.

Population Status & Objectives

Please refer to the Sawtooth SRD.

Harvest

Please refer to the Sawtooth SRD.

Current Management Considerations

- Habitat quality — Noxious weeds and invasive annual grasses (cheatgrass) are impacting habitat quality, particularly in Spar Canyon, with >75% of the WRD mapped as containing invasive annual grasses.
- Movement and migration — Old woven wire fence on and between private and public land may be impacting pronghorn movement throughout the WRD.
- Livestock management — Improper livestock management on public allotments may be suppressing the forb component of the understory which is important to pronghorn doe condition.
- Depredation — Wintering pronghorn could cause damage to large cattle feeding operations.
- Feral horse population — The CHMA often exceeds the population target and could be impacting pronghorn habitat use and population performance.

Big Lost Winter Range Distribution

The Big Lost WRD includes valley bottom portions of the Big Lost River Valley in GMU 50 (Figure 24). It is a mix of public and private lands. Pronghorn use is concentrated around cattle feeding operations and other areas with little to no snow accumulation. Most of the public lands are native sagebrush rangelands dominated by low or black sagebrush, and the private lands are a mix of native rangelands and irrigated agriculture.

Pronghorn that winter in the Big Lost WRD migrate from higher elevation areas such as Copper Basin and upper portions of the Big Lost River Valley. Some Pronghorn that summer within the Pioneer SRD descend into the Big Lost WRD.

Population Status & Objective

Please refer to the Pioneer SRD.

Harvest

Please refer to the Pioneer SRD.

Current Management Considerations

- Depredation — High-quality forage resources, in the form of irrigated agriculture or haystacks on private lands, in a low-productivity area often lead to high concentrations of pronghorn, especially during winter months. While foraging pronghorn may not influence yields on crops such as winter wheat (Torbit et al. 1993), they can impact unprotected haystacks and lead to depredation complaints.
- Movement and migration — Fencing associated with grazing operations or roadways can exclude pronghorn from certain areas or extend migration routes. Woven wire fences, often remnants of historical domestic sheep grazing, or barbed wire fences with an excessive number of strands or low-bottom strands can be found regularly across the WRD. Movement barriers not only cause problems during seasonal or daily movements, but also during heavy snow events that may lead to extreme mortality events.

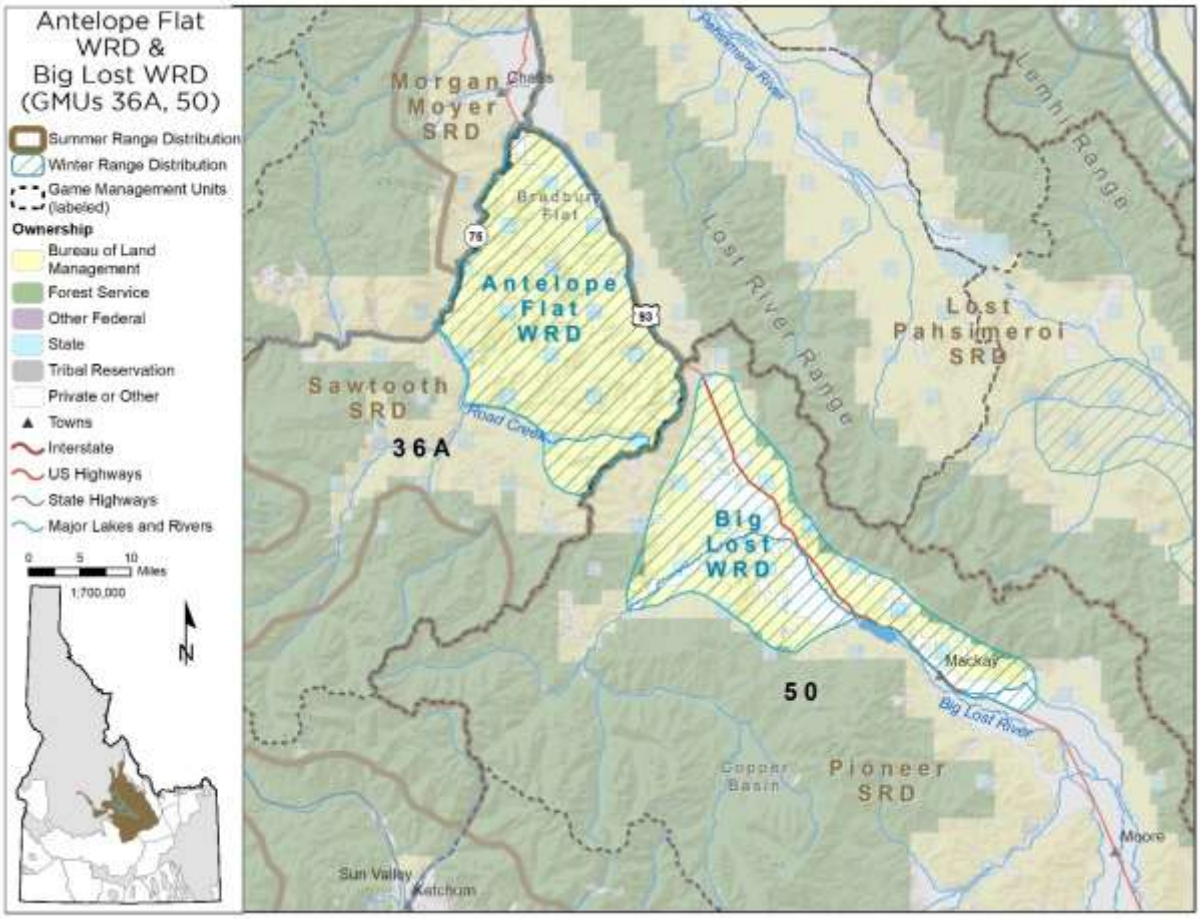


Figure 24. Antelope Flat and Big Lost pronghorn winter range distributions, Idaho.

Birch Creek Sinks Winter Range Distribution

The Birch Creek Sinks WRD includes lower elevation portions of Birch Creek, Little Lost River, and Medicine Lodge Creek primarily within GMUs 51, 58, 59A, and 63 (Figure 25). It is mostly made up of public land (BLM, INL, FS, and IDL) but does contain private land near riparian corridors and areas of heavy agricultural production. Pronghorn use is concentrated near food sources or areas with the least amount of snow, and the WRD extent will change with winter severity and snow depth. Most of the public lands are native sagebrush rangelands dominated by low and black sagebrush.

Pronghorn that winter in the Birch Creek Sinks WRD migrate from many areas creating one of the largest concentrations of pronghorn in Idaho. Known migration routes exist along Birch Creek, Little Lost River, Medicine Lodge Creek, Big Lost River, Little Wood River valley, Indian Creek, and Monida Pass. Pronghorn also shift across the desert from central portions of GMU 63 into the Birch Creek Sinks WRD. These migrations and shifts connect this WRD to the Medicine Lodge, Birch Creek, Lost-Pahsimeroi, Pioneer, Atomic, Mud Lake, and Big Desert SRDs. Timing and distance of both spring and autumn migrations for animals in Birch Creek Sinks WRD is known to vary among years due to snow and vegetation conditions (Hoskinson and Tester 1980).

Population Status & Objective

This WRD is known to winter pronghorn from the Atomic, Big Desert, Birch Creek, Lost-Pahsimeroi, Medicine Lodge, Mud Lake, and Pioneer SRDs. Please refer to the appropriate SRD for population information.

Harvest

Please refer to the appropriate SRD for harvest information.

Current Management Considerations

- Movement and migration — Portions of Birch Creek Sinks WRD fall within the Big Desert-Mountain Valley Complex Priority Area for addressing big game winter range and migrations in Idaho (IDFG 2022b). Woven wire fences, often remnants of historical sheep grazing, or barbed wire fences with an excessive number of strands or low-bottom strands can be found regularly across the WRD.
- Habitat quality — Low annual precipitation (typically <25 cm per year) results in landscapes with lower forage production, higher sensitivity to grazing pressure by domestic and wild ungulates, and lower resilience to disturbances such as fire and OHV travel.
- Fire and invasive annual grasses — As invasive annual grasses continue to spread into higher and colder sites that were thought to be resilient, the risk of fire and subsequent impacts from fire become a larger concern. Areas of lower productivity are harder to rehabilitate after fire and often become unproductive for many species including pronghorn.
- Depredation — High-quality forage resources, in the form of irrigated agriculture or haystacks on private lands, in a low-productivity area often lead

to high concentrations of pronghorn, especially during winter months. While foraging pronghorn may not influence yields on crops such as winter wheat (Torbit et al. 1993), they can impact unprotected haystacks and lead to depredation complaints.

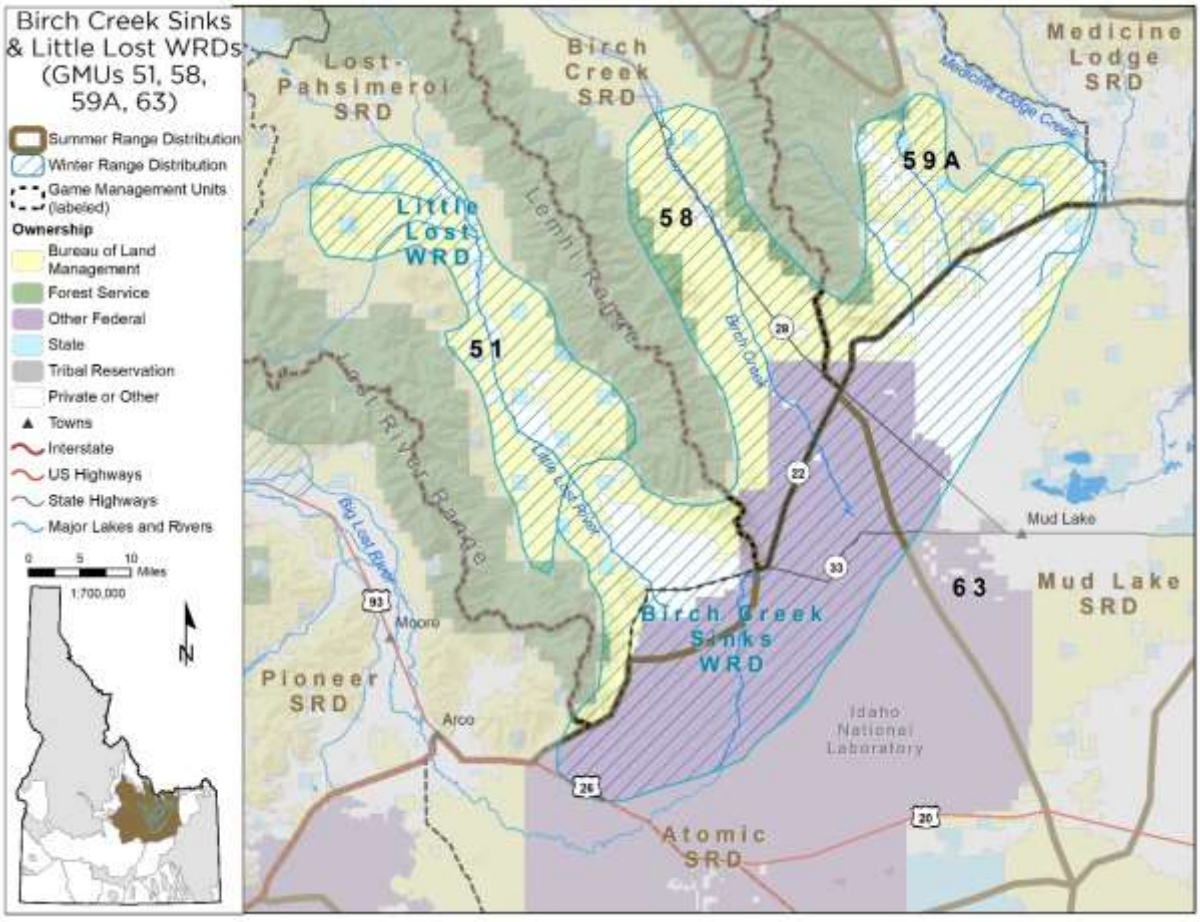


Figure 25. Birch Creek Sinks and Little Lost pronghorn winter range, Idaho.

Little Lost Winter Range Distribution

The Little Lost WRD includes lower elevation portions of the Little Lost River Valley in GMU 51 (Figure 25). It is mostly public land (BLM and IDL) interspersed with some private lands along the riparian corridors. Most of the public lands are native sagebrush rangelands dominated by low or black sagebrush, and the private lands are a mix of native rangelands and irrigated agriculture.

Pronghorn that winter in the Little Lost WRD are mostly residents that may migrate from higher elevations but stay within the Lost-Pahsimeroi SRD (GMU 51) throughout the year.

Population Status & Objective

Please refer to the Lost-Pahsimeroi SRD.

Harvest

Please refer to the Lost-Pahsimeroi SRD.

Current Management Considerations

- Habitat quality — Low annual precipitation (typically <25 cm per year) results in landscapes with lower forage production, higher sensitivity to grazing pressure by domestic and wild ungulates, and lower resilience to disturbances such as fire and OHV travel.
- Movement and migration — Fencing, associated with grazing operations or roadways, can exclude pronghorn from certain areas or extend migration routes. Woven wire fences, often remnants of historical domestic sheep grazing, or barbed wire fences with an excessive number of strands or low-bottom strands can be found regularly across the WRD. Movement barriers not only cause problems during seasonal or daily movements, but also during heavy snow events that may lead to extreme mortality events.
- Depredation — High-quality forage resources, in the form of irrigated agriculture or haystacks on private lands, in a low-productivity area often lead to high concentrations of pronghorn, especially during winter months. While foraging pronghorn may not influence yields on crops such as winter wheat (Torbit et al. 1993), they can impact unprotected haystacks and lead to depredation complaints.

Morgan Winter Range Distribution

The Morgan WRD is situated between Challis Creek on the south and Hat Creek on the north in GMUs 28 and 36B (Figure 20 top) and is characterized by steep sagebrush covered hills with deeply incised gulches and draws scattered throughout. Some of these contain small riparian areas. The lower portion includes private land used for winter cattle feeding operations. Winter conditions are dry and cold with little snow accumulation.

Pronghorn that winter here come from an adjacent summer range area along Morgan Creek and a more distant summering area in Moyer Basin. Both are part of the

Morgan-Moyer SRD. There may be other unknown migration routes connecting other summering areas.

Population Status & Objective
Please refer to Morgan-Moyer SRD.

Harvest
Please refer to Morgan-Moyer SRD.

Current Management Considerations

- Habitat quality — Noxious weeds and invasive annual grasses (cheatgrass) are impacting habitat quality, particularly in Morgan Creek
- Movement and migration — Old woven wire fence on and between private and public land may be impacting pronghorn movement throughout the SRD.
- Livestock management — Improper livestock management on public allotments may be suppressing the forb component of the understory which is important to pronghorn doe condition.
- Depredation — Wintering pronghorn could cause damage to large cattle feeding operations.

Mountain Home Winter Range Distribution

The Mountain Home WRD includes GMUs 38, 39, 45, and 52 (Figure 26 top). Most of the WRD used by pronghorn is public land, predominantly managed by the BLM, with private ground (mostly agriculture) found along the southern edges of all 4 GMUs. While challenges and management considerations are similar across these GMUs, GMU 38 is unique within the WRD. The eastern half of the GMU is the only available habitat for pronghorn, which were not frequently observed in the area until early 2000s. In recent years, the population has been increasing, and is highly dependent on agriculture. Pronghorn in GMU 38 are restricted from traveling north by I-84, and any movement by pronghorn into the area is thought to come from GMU 40.

Historically, the Mountain Home WRD had significantly more sagebrush habitat than it does currently and may have provided some of the best winter range on the Snake River Plain for ungulates. Large, repetitive wildfires have led to the establishment of nonnative annual grasses and noxious weeds, including cheatgrass, medusahead, and rush skeletonweed. Lava flows and boulder fields are prevalent throughout the WRD, particularly on the Snake River Plain, and a swath of rocky canyons run north–south through the middle of the Mount Bennett Hills. Perennial water sources are mostly confined to larger drainages and reservoirs, but some smaller livestock ponds and streams can hold water late into the year. On average, only 10 in (25 cm) of precipitation fall on this WRD annually, mostly as rain and snow between January and March.

A relatively robust GPS collar dataset exists for this population, although approximately half of the animals were collared on summer range, increasing the likelihood that some migration routes could be missing from the current migration and range maps. Preliminary data indicates that, like many pronghorn winter ranges, the Mountain Home WRD is a melting pot of pronghorn that summer within the Camas SRD on the Camas Prairie, in the Boise Foothills, and at higher elevations in the Soldier Mountains.

Population Status & Objective

Herd composition surveys are not conducted for the WRD. Please refer to Camas SRD.

Harvest

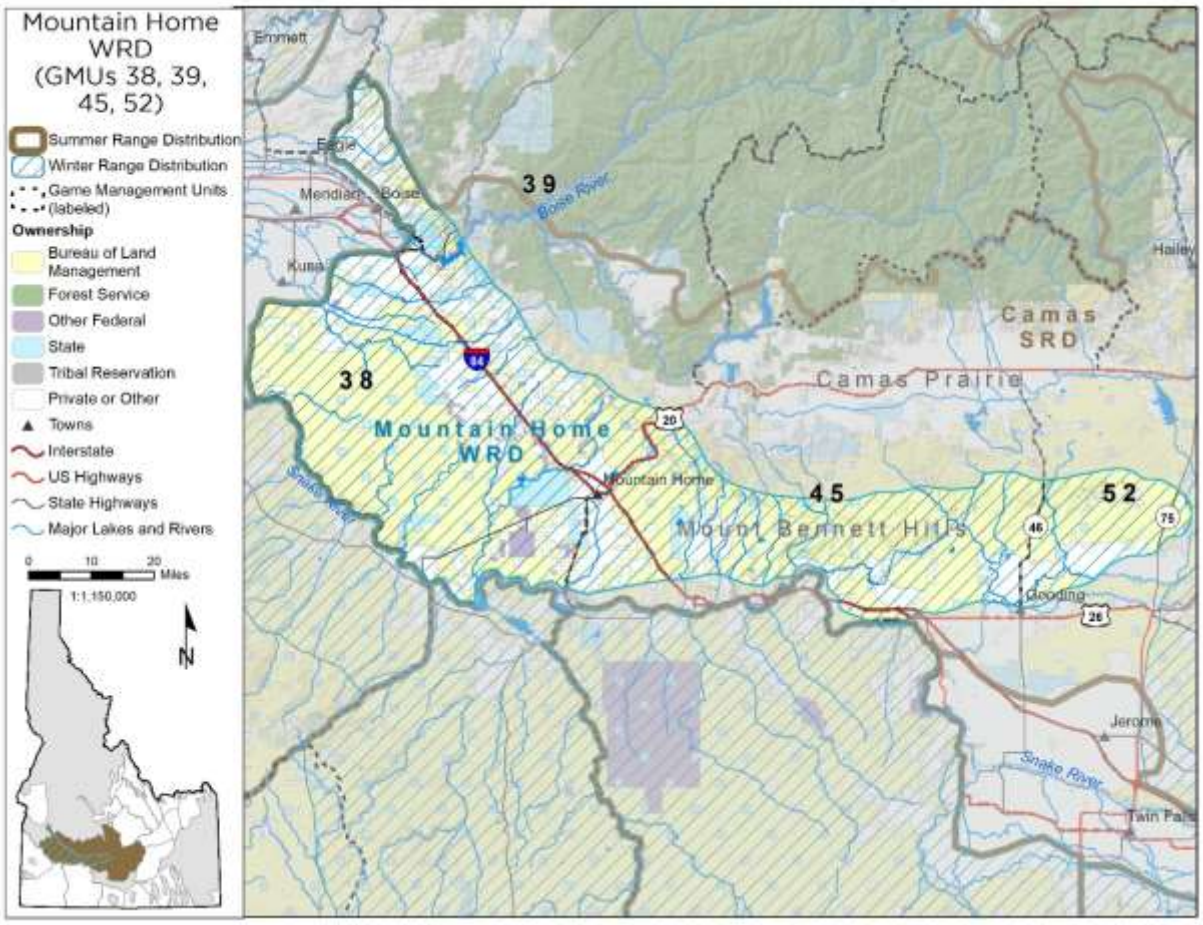
Due to a robust pronghorn population wintering adjacent to areas with a high percentage of agricultural land with stored or standing crops, several late season doe/fawn-only hunts are in place to help alleviate depredation complaints. One hundred doe/fawn-only tags are currently offered in GMUs 44, 45, and 52 (Oct 25—Nov 30), in addition to 25 Landowner Permission Hunt (LPH) doe/fawn-only tags for private land only in GMU 45 (November 1 – December 31) (Figure 26 bottom).

Current Management Considerations

- Habitat quality — Much of this winter range (50.4%) has burned at least once since 1970, leading to the subsequent establishment of invasive annual grasses and noxious weeds. This has substantially increased the frequency of fires, with part of the WRD burning nearly every year. The loss of quality forage due to

wildfire and the subsequent establishment of less nutritious and unpalatable invasive annual grasses will likely be compounded by long-term drought. Receiving on average just 10 in (25 cm) of precipitation annually, restoration efforts have proven to be extremely difficult. Improper livestock management on some portions of this WRD have also led to a decline in overall quality for pronghorn and other ungulates.

- Movement and migration — Portions of Mountain Home WRD fall within the Smoky-Boise Complex Priority Area for addressing big game winter range and migrations in Idaho (IDFG 2022b). Domestic sheep and cattle grazing occur on both public and private land throughout this WRD, and numerous allotment and private fences potentially limit pronghorn movements. Additionally, US Highway 20, State Highway 46, and I-84 traverse long stretches of the WRD. I-84 effectively shortstops pronghorn to the southwest and US Highway 20, identified as an area of concern for wildlife-vehicle collisions in the state, likely limits movements between GMUs 39 and 45 as well as 44 and 45. A large proportion of pronghorn using this WRD also cross State Highway 46 at least twice during their annual migration between summer and winter range. Both highways have seen increasing traffic volumes as resident and visitor populations rise in Idaho.
- Energy development — Wind energy does occur on this WRD, and additional renewable energy projects may be proposed in the future due to frequent wind and sun exposure in the area. The effects of such development on pronghorn specifically have not been widely studied, but it is likely that some level of direct or indirect effects may occur depending on the project type, size, and duration.
- Disturbance from recreational activities — This WRD lies near some of southern Idaho's largest cities, including Twin Falls, Mountain Home, and Boise, and as such, receives significant recreational pressures. The area is popular for OHV users, mountain biking, hiking, bird hunting, and shed hunting. Increasing interest in outdoor recreation has resulted in more year-round human activity, but particularly during late autumn to late spring. Enforcement of travel restrictions is difficult, particularly because of the natural topography of the area allowing user-created routes to be easily pioneered and almost impossible to close.
- Competition with livestock and other ungulates — Domestic sheep and cattle grazing occurs across much of the WRD, in addition to use by mule deer and elk. The degree to which any of these species compete with pronghorn is unknown; however, many animals depend upon this degraded winter range.
- Population data — While herd composition surveys are conducted for portions of this WRD in August, a lack of standardized methods for counting pronghorn makes it difficult to estimate and monitor overall population status.



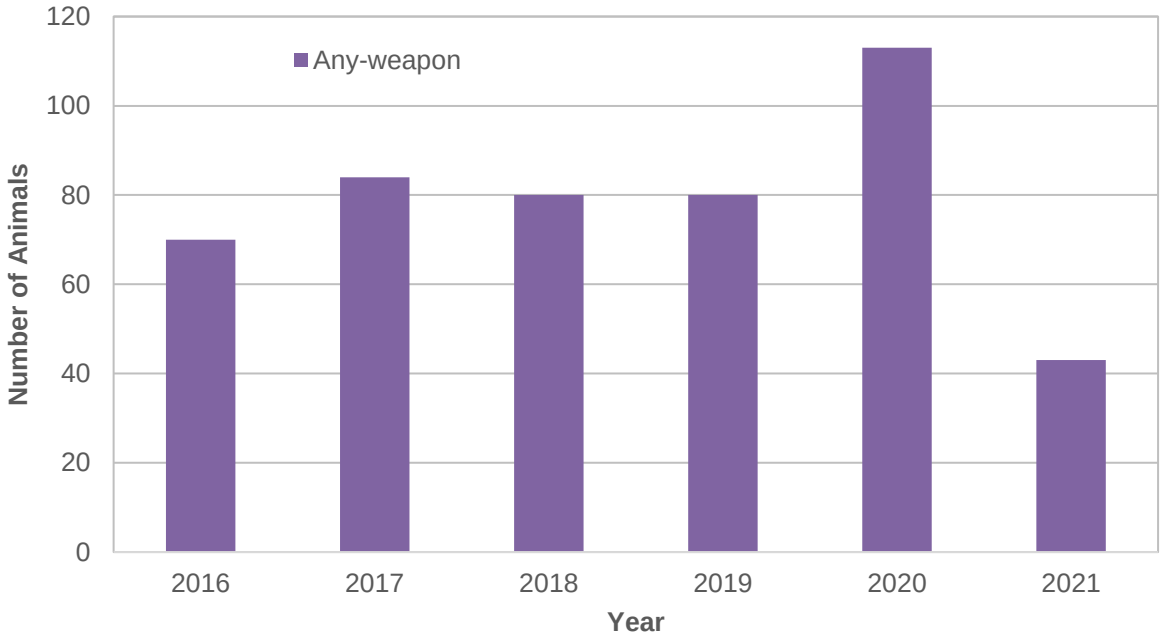


Figure 26. Mountain Home pronghorn winter range distribution (top) and doe/fawn-only harvest during late season hunts in GMUs 44, 45, and 52 (bottom), Idaho.

Owinza Winter Range Distribution

The Owinza WRD includes GMUs 52A and 53 (Figure 27). The northern portions of these GMUs serve mostly as transitional range for pronghorn between summer and winter range and are primarily managed by the BLM and NPS. Craters of the Moon National Monument and Preserve occupies nearly half of GMU 52A, characterized by expansive lava flows that offer little habitat for pronghorn. The southern portion of GMU 52A and the remaining available habitat in GMU 53 provide most of the critical winter range in this WRD. Unfortunately, a large percentage of the rangeland in these 2 GMUs has burned. Approximately 64% of GMU 53 is private, with much of that land in agricultural production. Cattle and domestic sheep grazing occur throughout the spring and summer, mostly on federal and state land within the WRD. On average, only 10 in (25 cm) of precipitation fall annually, mostly as rain and snow between January and March.

IDFG is currently building a GPS collar dataset for this population, with 18 pronghorn collared since 2019. Approximately half of the animals were collared on summer range, increasing the likelihood that some migration routes could be missing from the current migration and range maps. Preliminary data indicates that, like many pronghorn winter ranges, the Owinza WRD is a melting pot of summer populations. Pronghorn from GMUs 48 and 49, as well as some that make shorter migrations summering in 52 and 52A, and residents that remain in 53 year-round, all winter in this WRD.

Population Status & Objective

No recent or robust population or herd composition surveys have been conducted on this winter range. Based on anecdotal information, pronghorn numbers in this area have fluctuated over the last 3–4 decades, with relatively high numbers last observed in the late 1980s. A severe winter in 1992–1993 resulted in an estimated 30–50% decline in population. Numbers have remained lower in both GMUs than what was documented in the early 1990s, although more pronghorn are observed in GMU 53 during harsh winters. Hundreds of pronghorn were observed along I-84 between Jerome and Hazelton during the winters of 2016-17 and 2018-19. Additionally, in March 2022, a single herd of 300–400 pronghorn were observed near Wilson Butte.

Harvest

Please refer to Camas SRD.

Current Management Considerations

- Habitat quality — Historically, portions of this WRD probably supplied some of the best winter range for ungulates on the Snake River Plain. However, wildfires and frequent drought have led to the establishment of invasive annual grasses and noxious weed species, reducing forage quality for pronghorn. This has substantially increased the frequency of fires, with some part of the WRD burning nearly every year. Receiving on average just 10 in (25 cm) of precipitation annually, restoration efforts have proven to be extremely difficult. In areas with heavy grazing, sheep and cattle may be inhibiting the re-establishment of forbs and shrubs, both of which provide important seasonal forage for pronghorn.

- Movement and migration — During their migration from summer range, pronghorn in this WRD cross up to 5 highways (including US Highway 20 which has been identified as an area of concern for wildlife-vehicle collisions in the state [IDFG 2022b]; see Camas SRD for a more detailed description of this barrier), the Union Pacific railway, and numerous fences. Linear barriers such as roads, railroads, and fences are known to create challenges for pronghorn and can result in direct mortality or potentially diminished fitness due to the increased energy needed to navigate these barriers. A network of roads exists across the WRD of varying levels of seasonal use. GMU 53 is highly developed, with over half of the GMU in agriculture. Most of the roads within the interior of agriculture are paved, allowing for higher vehicle speeds. Roads on BLM ground are primarily unmaintained two-track roads, but occur at a fairly high density, which may displace pronghorn from preferred habitat due to disturbance. Additionally, the Milner-Gooding and North Side Main canals also present a likely barrier to pronghorn at certain locations, primarily where channel sides are concrete. Mitigating the impacts of infrastructure on pronghorn will continue to be a primary objective for managing this species.
- Energy development — Rich renewable energy resources, particularly wind, has made this area attractive for energy development. The Lava Ridge windfarm, as proposed at the time of this plan, would include up to 400 wind turbines and produce 1000 MW, making it the largest windfarm in Idaho. The effects of such development on pronghorn specifically have not been widely studied, but it is likely that some level of direct or indirect effects will occur depending on the project type, size, and duration. Additional research is needed to improve technical assistance, foster collaboration with project applicants and land management agencies, and to better inform management decisions.
- Population data — While adequate GPS collar data exists for the development of resource selection models and migration maps, a lack of standardized methods for counting pronghorn, particularly for low density populations such as this one, makes it difficult to estimate and monitor overall population status.

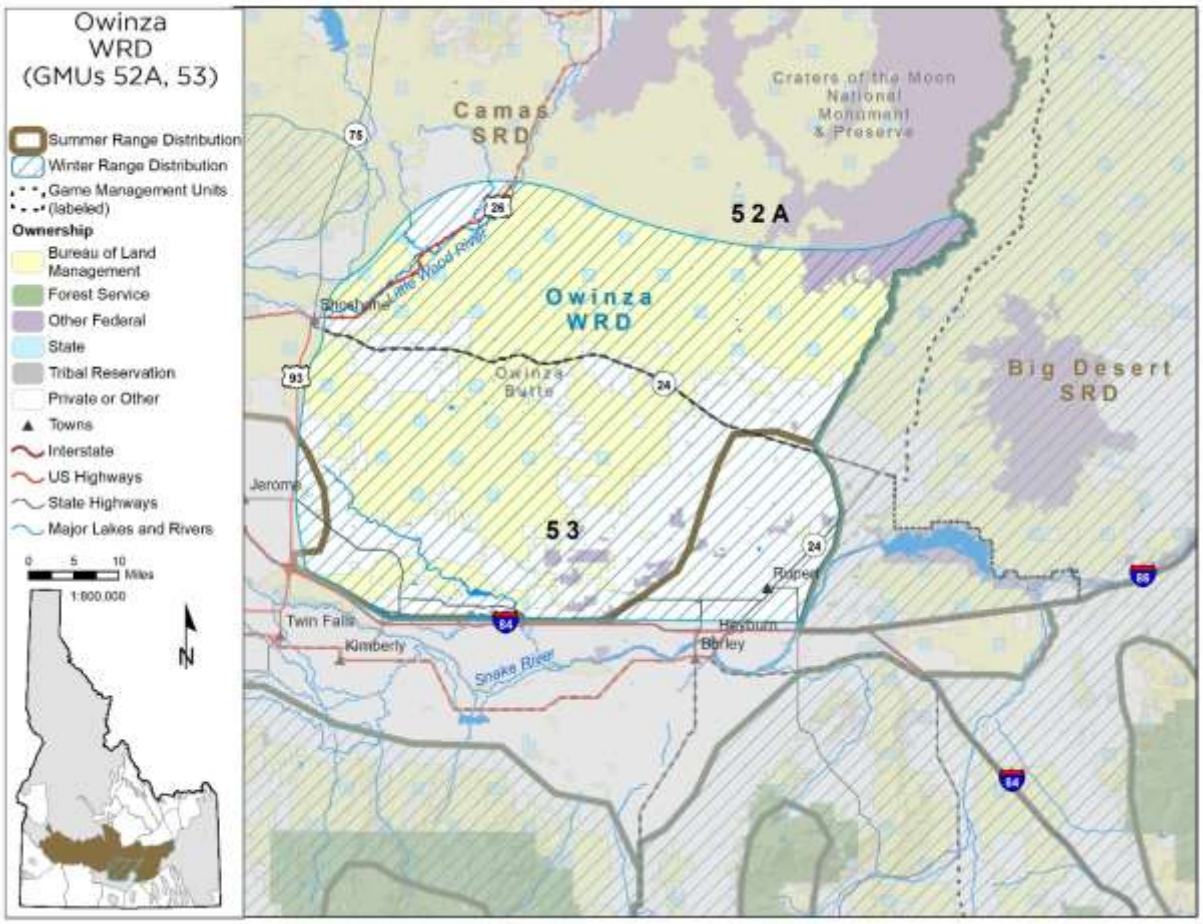


Figure 27. Owinza pronghorn winter range distribution, Idaho.

Sand Creek Winter Range Distribution

The Sand Creek WRD includes lower elevations of the Sand Creek Desert, primarily in western portions of GMU 60A near Dubois and Hamer, ID (Figure 28). It is a mix of public and private lands, including the US Sheep Experiment Station. Most of the public lands are native sagebrush rangelands dominated by low sagebrush, black sagebrush, or Wyoming big sagebrush, and the private lands are a mix of native rangelands and irrigated agriculture. Pronghorn that winter in the Sand Creek WRD migrate from higher elevation areas along the foothills of the Centennial Mountains from Spencer to Shotgun Valley (see Island Park SRD) where they encounter I-15 and associated fencing that precludes further movement.

Pronghorn use is concentrated along the I-15 corridor near forage resources or areas with the least amount of snow. Often, pronghorn are found on the railroad tracks east of I-15 as snow is removed by trains, which has led to large mortality events in the past (Table 2).

Population Status & Objective

Please refer to the Island Park SRD.

Harvest

Please refer to the Island Park SRD.

Current Management Considerations

- Movement and migration — Sand Creek WRD falls within the Big Desert-Mountain Valley Complex Priority Area for addressing big game winter range and migrations in Idaho (IDFG 2022b). Data indicate I-15 and nearby railroad tracks, and their associated right-of-way fences, act as a barrier to pronghorn movement and may be restricting further migrations to the Birch Creek Sinks WRD. Additional fences on the landscape (see Island Park SRD) alter pronghorn movements to the Sand Creek WRD.
- Depredations — With autumn migrations curtailed at the I-15 right-of-way fence near Dubois and Hamer, high concentrations of pronghorn can cause depredation problems on nearby agricultural fields or haystacks, or end up on the railroad tracks as they seek shallower snows. Pronghorn will spend significant amounts of time in winter on agricultural crops, but generally do not influence yields on crops like winter wheat (Torbit et al. 1993). Pronghorn also damage haystacks when allowed unimpeded access and spend a significant amount of time at a local hay processing plant.

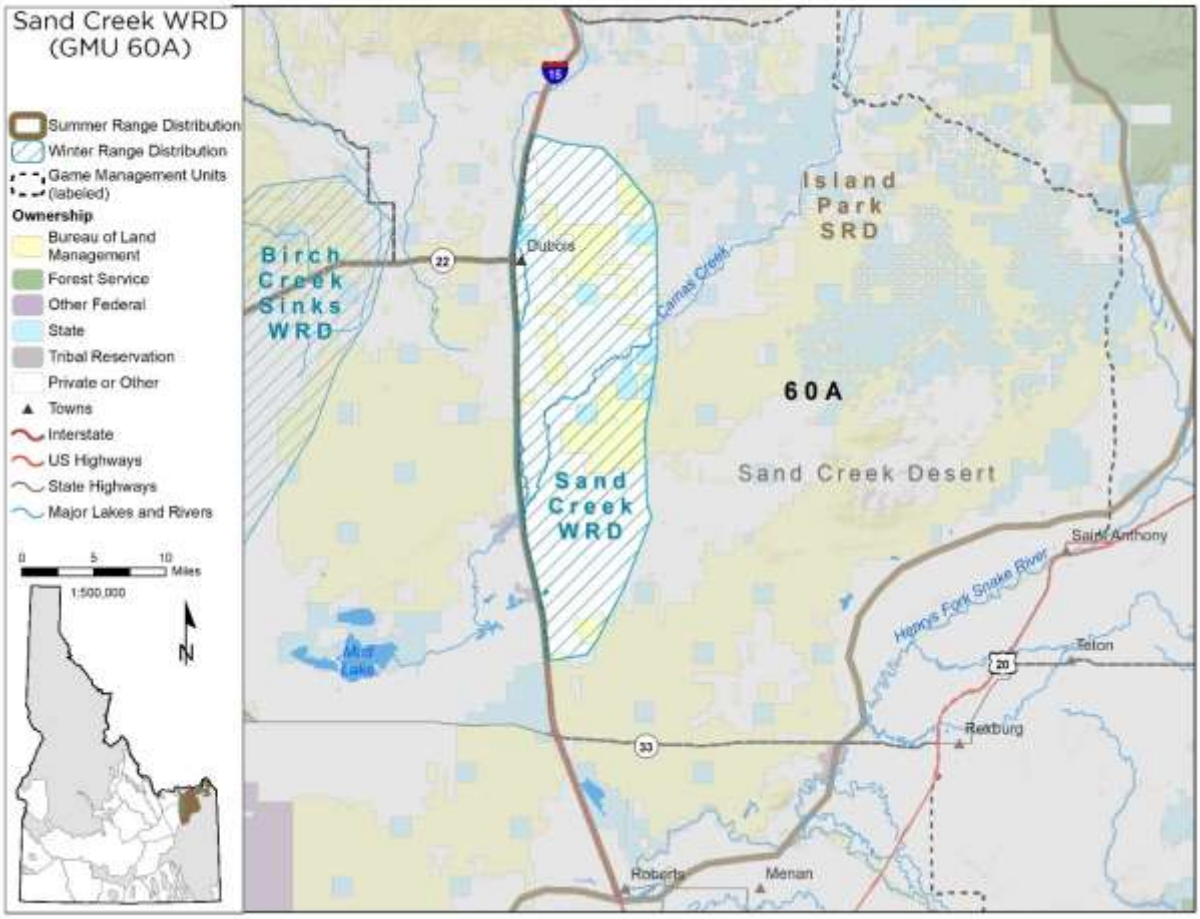


Figure 28. Sand Creek pronghorn winter range distribution, Idaho.

Summer/Winter Range Distributions

Bannock Summer/Winter Range Distribution

The Bannock SRD/WRD includes GMUs 56, 70, 73, and 73A (Figure 29 top). These GMUs are characterized by small north–south mountain ranges and broad valleys with mixed sagebrush steppe and agriculture. Historically, pronghorn could have seasonally occupied some of these mountain valleys and GMUs 73 and 56 were both recipients of early translocations in the 1940s (see Translocation chapter). However, since the 1960s, interstate highways likely have limited pronghorn from moving organically into these GMUs as the area is bordered by I-86 to the north, I-84 to the west, and I-15 to the east, the latter two of which converge roughly 20 mi (32 km) south of the Utah border. Currently, pronghorn are not known to permanently reside in much of this SRD/WRD. Infrequent observations have been made of small groups that likely moved from adjacent areas where pronghorn currently reside.

Population Status & Objective

Herd composition and trend surveys were flown in the 1960s in GMU 56 (Appendix F). Pronghorn were observed in low to moderate numbers north of Sublett Road and on either side of I-84 near Juniper. Based on predicted habitat (Figure 2) and some past observational data, the Bannock SRD/WRD could become an area with more robust pronghorn populations in the future and could be considered for potential translocation site if deemed appropriate. Additional pronghorn population surveys have not been conducted within this area due to lack of presence on the landscape.

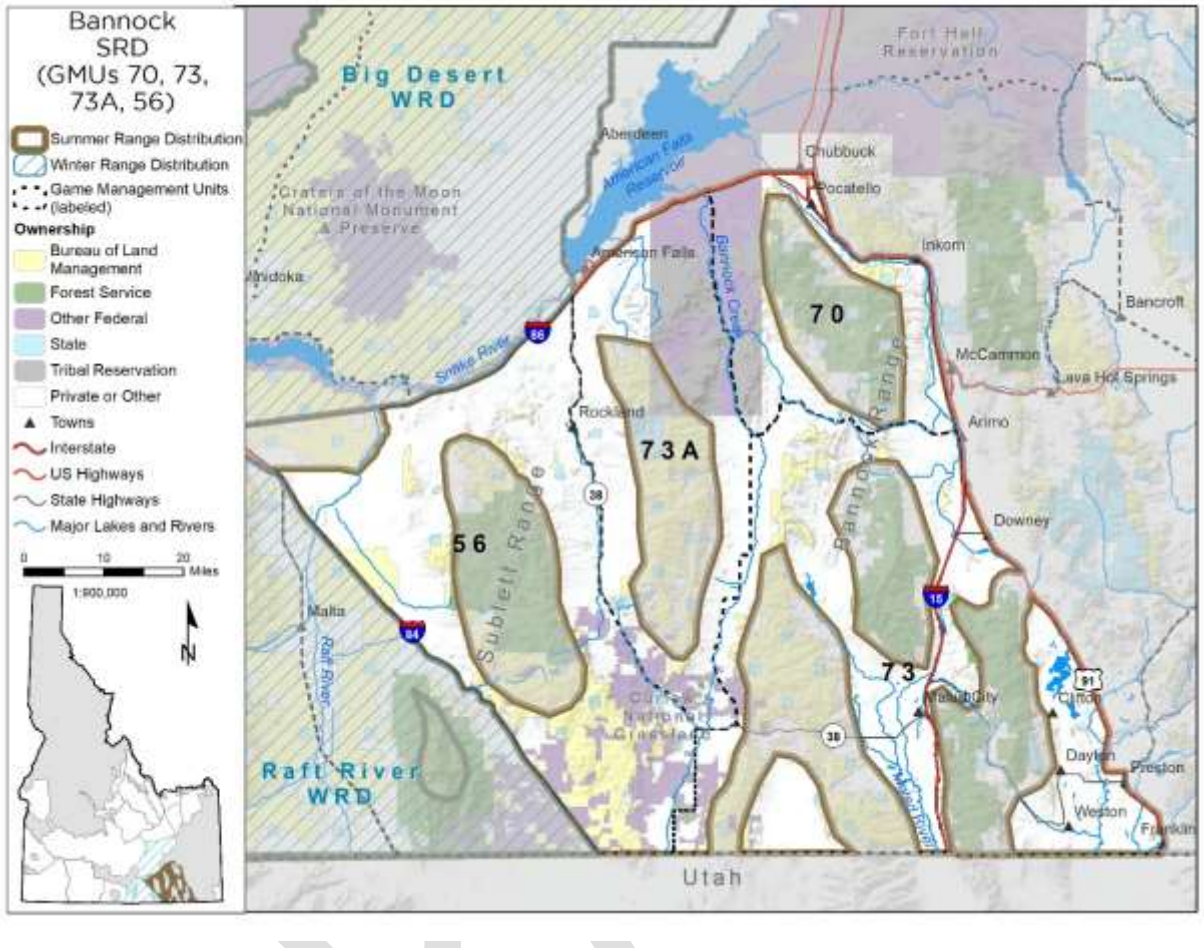
Goals for the Bannock SRD/WRD are to determine suitability of this area to sustain a more robust population of pronghorn.

Harvest

Limited hunting opportunity exists in GMU 56 and it is included as a part of the 55-1 controlled hunt area with GMUs 55 and 57. Ten any-weapon and 10 archery-only tags were offered in 2021, but no animals were harvested. Although a few individuals may get harvested in GMU 56 (Figure 29 bottom), most are harvested in GMUs 55 and 57. Misreporting by hunters could result in elevated harvest estimates for GMU 56. No pronghorn hunting opportunities are available in GMUs 70, 73, or 73A.

Current Management Considerations

- Habitat Suitability — The capacity for this SRD/WRD to support pronghorn, and factors that have prevented pronghorn from occupying this area in the past, are largely unknown.
- Depredation — Much of the potential habitat within this SRD/WRD is found on private agricultural lands. Conflicts with agricultural producers will need to be evaluated.
- Movement and migration — The Bannock SRD/WRD is bound by interstates (I-84, I-86, I-15) which are likely prohibitive for pronghorn movement between seasons.



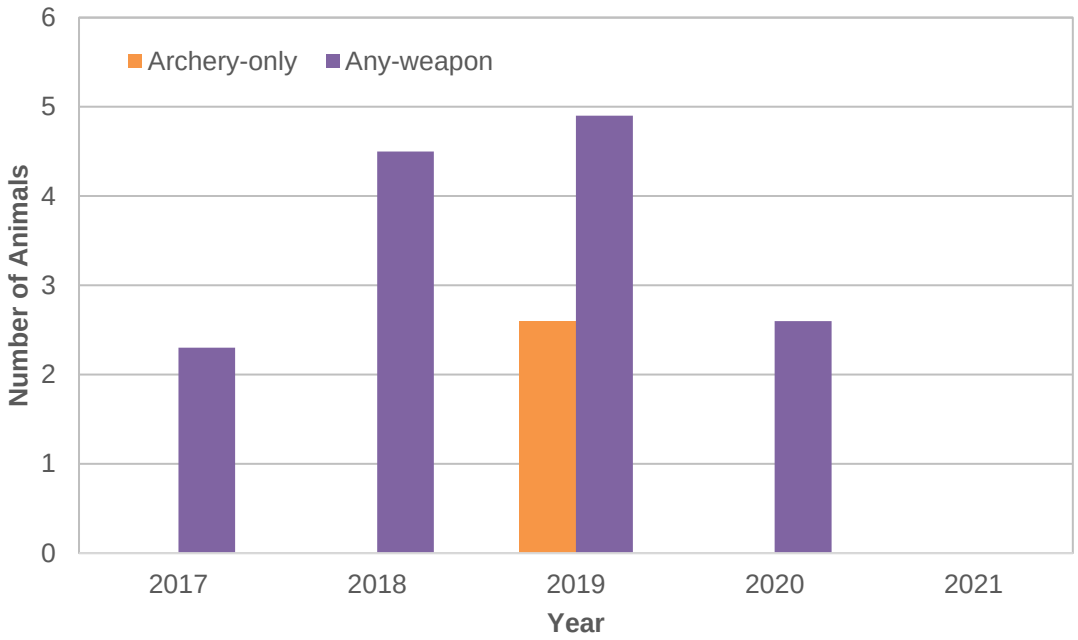


Figure 29. Bannock pronghorn summer and winter range distribution (top) and harvest in GMU 56 (bottom), Idaho. No animals were harvested in 2021.

Big Desert Summer/Winter Range Distribution

The Big Desert SRD/WRD is found mostly within GMU 68 but includes a small portion of GMUs 52A, 53, and 63 (Figure 30 top). The area occupied by pronghorn includes a mix of private, state, and federal lands with >50% of the land administered by BLM. Habitat is comprised of mostly sagebrush steppe; however, eastern and southern portions of the area are dominated by irrigated agriculture that is used by pronghorn throughout the year. Wildfire has affected this SRD/WRD for many years and as a result the sagebrush steppe component is in varying seral stages, some of which has been replaced by invasive annual grasses and remains in poor condition.

Pronghorn within this area can be described as primarily resident and do not display long distance migrations; however, pronghorn that winter in the Owinza WRD may move to the Big Desert during harsh winters. As a result, pronghorn winter and summer distributions largely overlap.

Population Status & Objective

Translocations occurred in the Big Desert SRD/WRD in 1950 and 2004 (see Translocation chapter), but follow-up population surveys to document changes in status have been sporadic. Past estimates of the pronghorn population within the Big Desert SRD/WRD were obtained through fixed-wing surveys using line- and strip-transect methodologies (Compton 2005). Estimates varied greatly with low confidence due to the low density of pronghorn in the area and their unpredictable distribution.

Beginning in 2014, staff initiated an August herd composition survey that consists of driving 9 different routes on the same day in GMU 68. IDFG staff feel this methodology has provided the first reliable trend data for pronghorn in the Big Desert (Appendix F). These data suggest a decreasing population in GMU 68, although sample sizes are relatively small and confidence intervals are not calculated.

Approximately 50 pronghorn crossed American Falls Reservoir on the ice during the 2001–2002 winter to the vicinity of the Pocatello Regional Airport (Toweill 2002). Similarly, in January 2017, approximately 300 pronghorn crossed the ice on American Falls Reservoir into GMU 68A between I-86 and the reservoir. Very few, if any, of these pronghorn are thought to have survived and returned to GMU 68 after these severe winter migration events. Composition data (Appendix F) supports this assumption as the number of observed pronghorn significantly declined during the August 2017 survey compared to previous years.

In December 2004, the Southeast Region assisted Utah Division of Wildlife Resources in capturing 56 pronghorn near Torrey, Utah (Appendix C). These animals were transported to GMU 68 in the Southeast Region for release. The 56 pronghorn transferred included 36 adults (16 male, 19 female), 6 yearlings (3 male, 3 female), and 14 fawns (6 male, 8 female). Ten of 56 pronghorn released were fitted with radio collars. Radio-tracking conducted within a month of the release found 3 mortalities and 7 live animals.

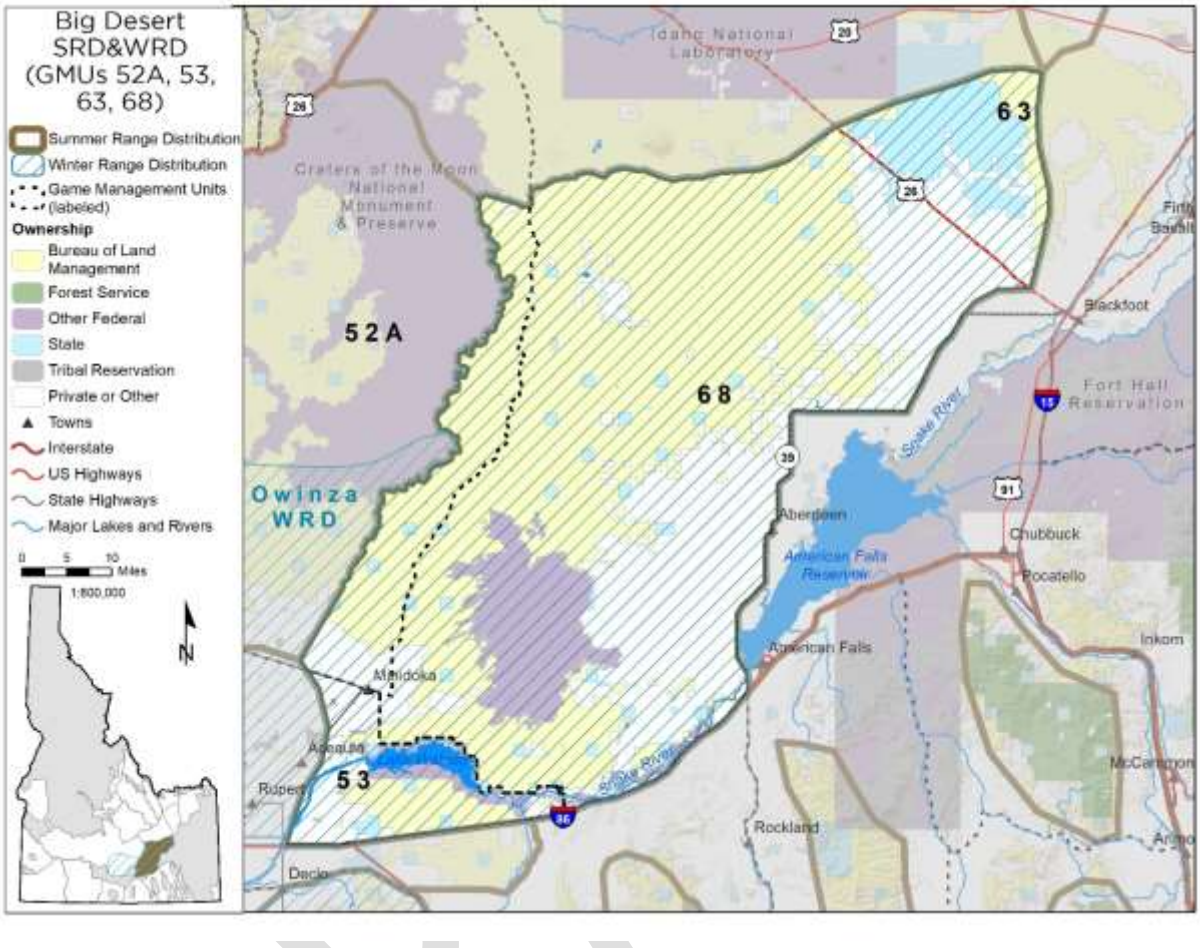
In March 2014, 15 adult females were captured in GMU 68 and fitted with GPS collars. In January 2016, another 7 adult females were captured in GMU 68 and fitted with GPS collars. Results from this effort indicated that adult mortality was high, mostly due to coyote predation. Additionally, most individuals do not show strong migratory behavior and remain close to agricultural fields throughout the year. The sample size was low and additional efforts or research with larger sample sizes is needed to better understand population trends.

IDFG's goal for this SRD/WRD is to increase pronghorn abundance and distribution. Despite many habitat restoration efforts and translocations this population has struggled to increase. Although severe winter events have had a significant impact, other factors are likely contributing to the slow or stagnant growth of this population. Continuing to understand these limiting factors will increase the capacity for managers to implement strategies that will bolster pronghorn abundance and survival.

Harvest
Since 2014, GMU 68 has had 3 either-sex controlled hunt opportunities, an archery-only hunt in August, an archery-only hunt in September, and an any-weapon hunt from September 25–October 24. Following the severe winter in 2016–2017, tag levels were reduced by 50% for all 3 hunt opportunities. The reduced total harvest is a result of reduced tag levels and reduced pronghorn abundance (Figure 30 bottom).

Current Management Considerations

- Habitat quality — Over half of this area has burned since 1970 and numerous efforts have taken place to improve or restore habitat impacted by fire. Additional information are needed on what types of range improvements would be most beneficial to pronghorn. Artificial water sources exist within this SRD/WRD, but how that water impacts pronghorn is largely unknown. Similarly, competition with other wildlife and domestic livestock for forage, water, and concealment may occur, but effects on pronghorn are generally unknown.
- Movement and migration — Portions of Big Desert SRD/WRD fall within the Big Desert-Mountain Valley Complex Priority Area for addressing big game winter range and migrations in Idaho (IDFG 2022b). Pronghorn in this SRD/WRD are thought to be largely resident but do move within the area seasonally. Many fences to distinguish grazing allotments or property ownership also exist, some of which are woven wire and could impede pronghorn movement.
- Pronghorn data — GPS collar data in this area are limited and dated. Additional monitoring efforts would improve understanding of how this herd uses the landscape, movement and migration behaviors, survival, limiting factors, and the potential capacity for this population to increase and expand.



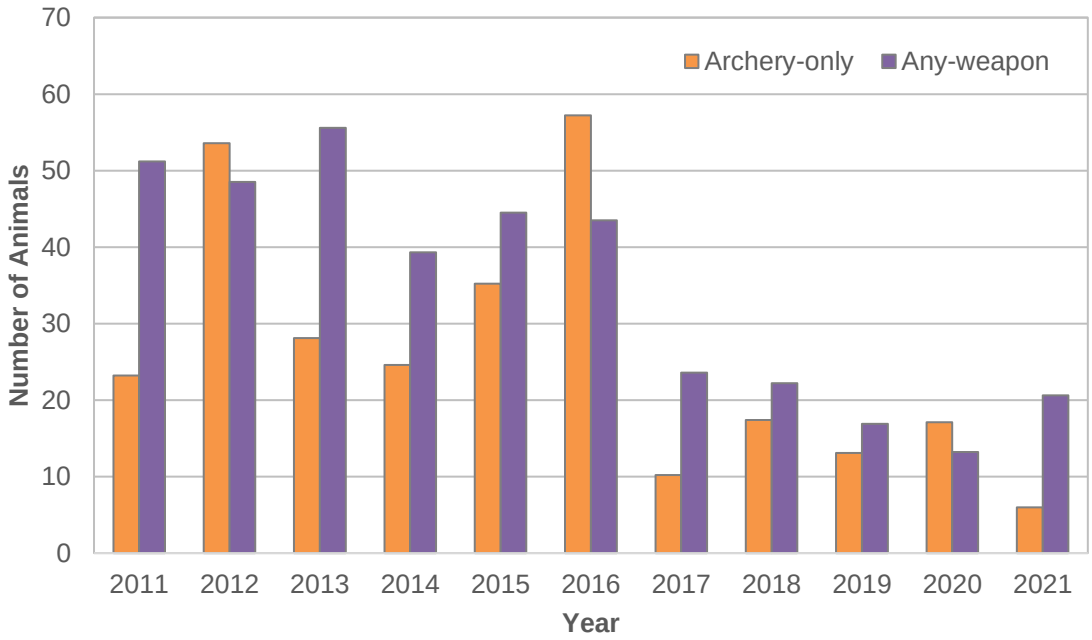


Figure 30. Big Desert pronghorn summer range distribution (top) and harvest in GMU 68 (bottom), Idaho.

Jarbidge Summer/Winter Range Distribution

The Jarbidge population includes GMUs 46 and 47, with BLM being the primary land management agency in both (Figure 31 top). GMU 46 has experienced large, recurring wildfires, which have converted much of the preexisting sagebrush to grassland (primarily crested wheatgrass seedings by BLM and IDL). The Murphy Complex Fire in 2007 burned 652,016 acres in Idaho and Nevada, with most of the fire footprint occurring in GMU 46. GMU 47 has higher elevation habitat, has retained much of its native vegetation communities, and provides good habitat for pronghorn. Portions of the Inside Desert and the area around Salmon Falls Reservoir were identified as critical habitat for pronghorn by BLM (Thomas and Rosentreter 1992), which remains true today based on anecdotal information and herd composition surveys.

Little GPS collar data has been gathered for this population, except for a few Nevada animals collared by NDOW that migrate into Idaho to winter. This SRD/WRD consists of a robust resident herd, but also provides winter range for pronghorn that summer in Nevada. Some of the movement that occurs between Nevada and Idaho is in response to water and forage availability in the summer and snow depth and condition in the winter. Limited GPS collar data has precluded this SRD/WRD from range and migration mapping analyses being applied to other pronghorn populations in the state.

Population Status & Objective

A lack of GPS data makes it difficult to delineate population boundaries for this SRD/WRD. Additionally, IDFG does not have a standardized method for counting pronghorn, and instead uses herd composition and harvest trend data to draw inferences regarding population status and productivity. Several translocations occurred in the Jarbidge area in the late 1940s–early 1950s (see Translocation chapter), and population surveys followed to document changes in status. Herd composition surveys have been conducted for the Jarbidge population since the 1960s (Appendix F). Fluctuations have occurred throughout that time, largely dependent on environmental conditions; however, based on number of pronghorn observed, the population appears to have remained stable over the years. Greater variation in fawn:doe ratios compared to overall numbers has been observed, with notable declines in fawn production in 2012 and 2018 following harsh winters. Buck:doe ratios are typically high in this area, although overall buck quality appears to have declined. Population objectives for this SRD are to maintain or increase pronghorn numbers to maximize hunting opportunity while considering depredation concerns and changes in habitat conditions.

Harvest

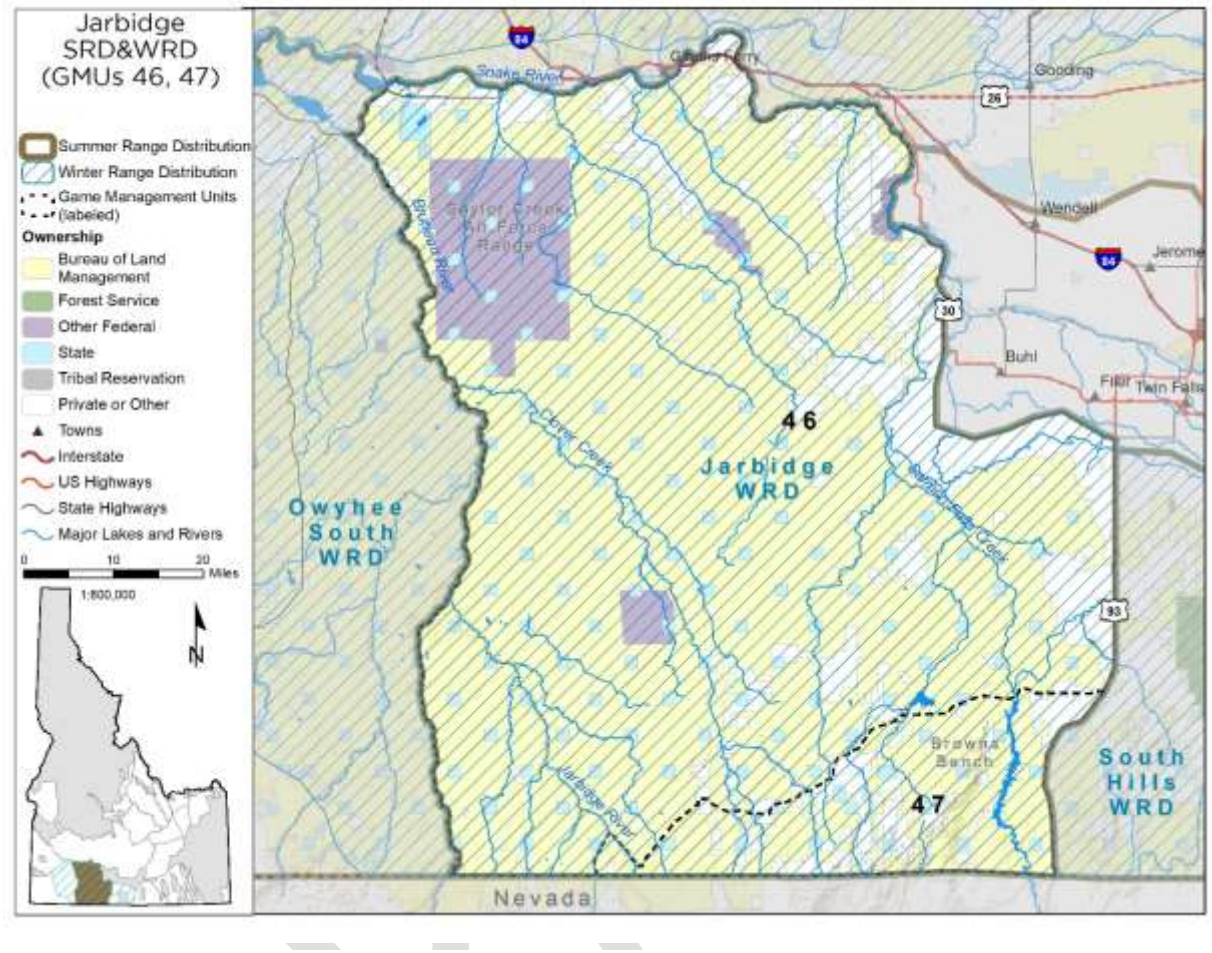
Current hunting opportunity is limited for this population with 60 any-weapon tags available in GMU 46. A muzzleloader-only hunt with 50 tags was offered in GMU 47 in 2021. Harvest success rates have remained consistent over the last decade (65–88%) (Figure 31 bottom).

Current Management Considerations

- Habitat quality — Habitat quality in a large portion of this SRD/WRD has been compromised by wildfire and the subsequent establishment of invasive annual

grasses, noxious weeds, and crested wheatgrass, which are not readily used by pronghorn. In areas with heavy grazing, cattle may be inhibiting the reestablishment of forbs and shrubs, both of which provide important seasonal forage for pronghorn.

- Movement and migration — Following the Murphy Complex fire in 2007, the BLM rebuilt damaged fences to meet wildlife-friendly specifications and has since continued to work on phasing out woven wire. Old fences likely still occur, particularly on private land that have not been addressed. No major highways occur within the area; however, US Highway 93 on the eastern border presents a barrier to pronghorn moving between the South Hills SRD/WRD.
- Road density — An extensive network of graveled and 2-track roads exists within the SRD/WRD; however, use of roads is relatively limited outside of the pronghorn archery-only season. Increased interest in OHV recreation should be considered in future travel management planning despite the relatively low levels of motorized recreation currently taking place in the area.
- Climate change and water availability — Changes in land use and climate can alter water sources available to pronghorn. Portions of this SRD/WRD (mainly in GMU 46) are susceptible to widespread drought conditions and, given projected increases in drought conditions, access to water may become more of an issue in this area which may affect pronghorn distribution and productivity. The degree to which water is limiting to this pronghorn population is unknown; however, much of the water available in GMU 46 is in stock tanks, and the natural water that does occur there originates in GMU 47. While water is trucked to some tanks, many of them are pumped, and when cattle are moved out of an allotment, the tank is turned off, potentially forcing pronghorn to move out of the area.
- Energy development — This area has received attention for its renewable resource potential. Currently there are several wind or solar energy projects at varying stages, ranging from preproposal to construction in this area. The effects of such development on pronghorn specifically have not been widely studied, but it is likely that some level of direct or indirect effects will occur depending on the project type, size, and duration. Additional research is needed to improve technical assistance, foster collaboration with project applicants and land management agencies, and to best inform management decisions.
- Population data — Currently, adequate population data to develop migration and range maps using methods being applied to other pronghorn populations are lacking. Additionally, a lack of standardized methods for counting pronghorn, particularly for low density populations such as this one, makes it difficult to estimate and monitor overall population status.



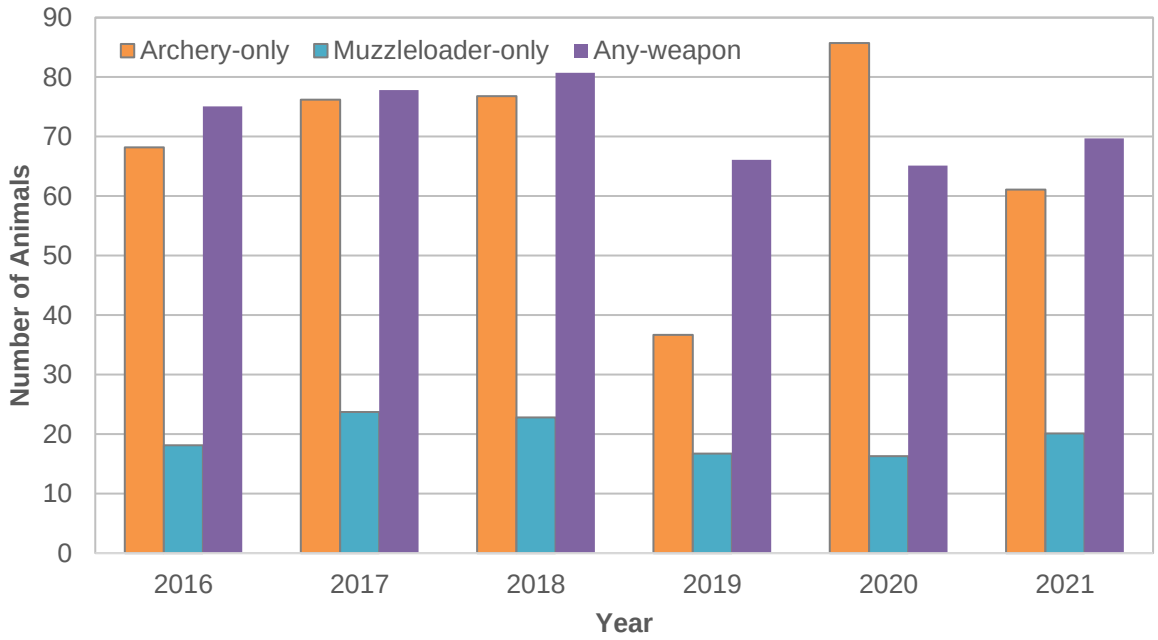


Figure 31. Jarbidge pronghorn summer and winter range distribution (top) and harvest in GMUs 46 and 47 (bottom), Idaho.

Lemhi-Tower Summer/Winter Range Distribution

The Lemhi-Tower SRD/WRD includes parts of GMUs 21A, 29, and 30 (Figure 32 top). This area is primarily public land (BLM, FS, IDL) with private land along the Lemhi River. It consists of sagebrush steppe foothills with some small conifer patches extending into parts of the area. Irrigated agricultural land is confined to the Lemhi valley bottom and along tributaries.

Pronghorn using this area appear to be largely resident, based on limited location data. Concentrations of animals seem to be in the following areas: Hayden Creek to McDevitt Creek; Pattee Creek to Pratt Creek; Carmen Creek to Tower Creek; Fourth of July Creek. Overall, road density is moderate with small areas with high road density. There are pockets of cheatgrass infestations that are impacting habitat quality.

Population Status & Objective

Some historical survey data are available for this area, while more recent data are total counts incidental to other surveys (Appendix F). Consequently, there are no recent composition data. Although the area is not part of an existing composition survey route, the population appears to be stable to increasing. The management objective is to increase the population to provide more hunting opportunity while considering depredation concerns and habitat availability.

Harvest

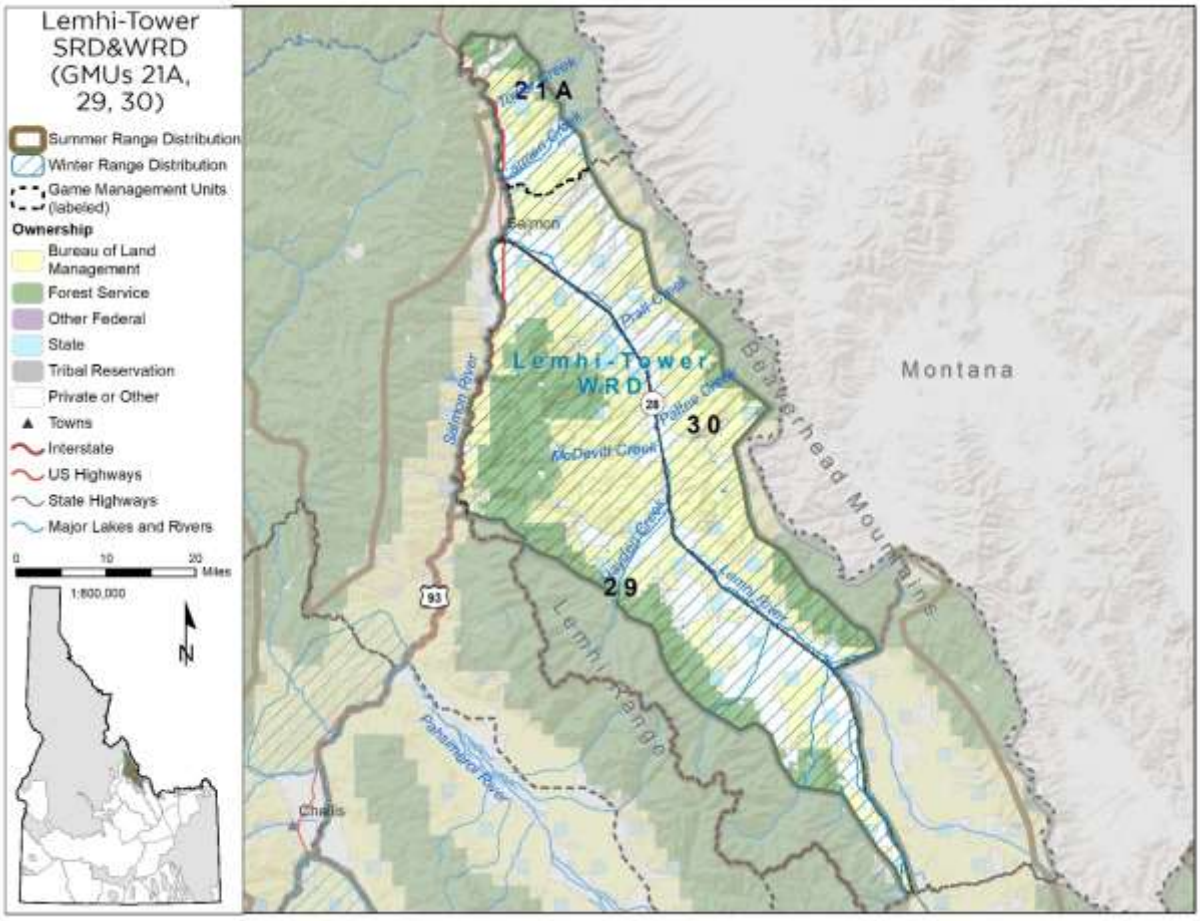
Currently, harvest in this SRD/WRD takes place by an unlimited archery-only season and controlled hunt any-weapon tags. All 3 GMUs are included in the archery-only hunt area, but only GMUs 29 and 30 are part of the controlled any-weapon hunt. Harvest during the archery-only season has been increasing the last several years while success has remained stable around 15%. Harvest and success for the controlled any-weapon hunt has been relatively stable over the last several years (Figure 32 bottom).

Current Management Considerations

- Habitat quality — Habitat quality in this area is most affected by noxious weeds and invasive annual grasses, particularly in GMU 21A. Efforts are underway to address cheatgrass infestations, but continued surveillance and treatment are necessary.
- Movement and migration — Lemhi-Tower SRD/WRD falls within the Lemhi Valley Complex Priority Area for addressing big game winter range and migrations in Idaho (IDFG 2022b). Fence barriers continue to impede pronghorn movement in this area, primarily old woven wire fences on and between public and private land.
- Livestock management — Improper livestock management on public allotments may be suppressing the forb component of the understory, especially during drought years. Changing grazing management to improve the forb component of the understory would benefit pronghorn doe nutrition and lactation in the spring and early summer.
- Road density — Road densities are high in some parts of the SRD/WRD and likely impact movements and habitat use of pronghorn, particularly in GMUs 21

and 29. Increased road density can be associated with lower pronghorn abundance (Christie et al. 2015) or survival (Eacker et al. 2023).

- Population data — There are no standardized population surveys, either ground or aerial, to monitor population performance in this area.



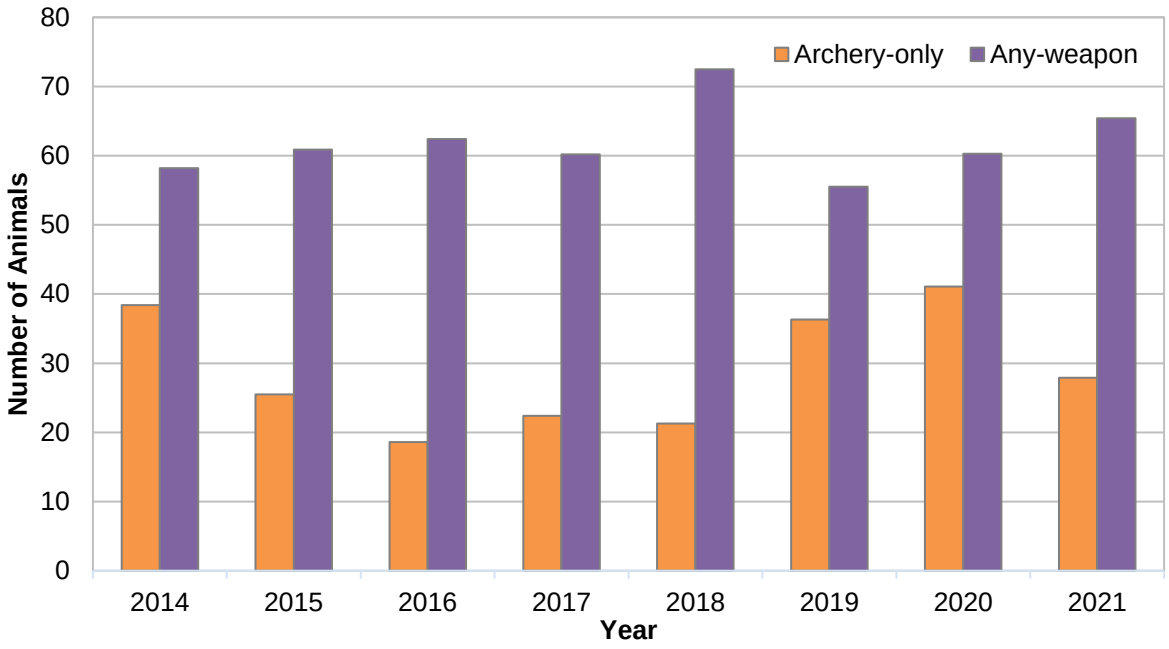


Figure 32. Lemhi-Tower pronghorn summer and winter range distribution (top) and harvest in GMUs 21A, 29, and 30 (bottom).

Owyhee North Summer/Winter Range Distribution

The Owyhee North SRD/WRD includes most of GMU 40 (Figure 33 top). Most of the area is federal land (BLM) with state and private land intermixed. Large scale and repetitive wildfires have led to the establishment of invasive annual grass and forb species in lower elevations. In 2015, the Soda Fire burned 283,000 acres in the northern portion of GMU 40. The lower elevations of this fire burned in predominately cheatgrass, medusahead, and crested wheatgrass with a history of frequent fires. Fire rehabilitation efforts were substantial, but pronghorn numbers could decline until the habitat has recovered. Broadscale juniper removal projects on federal, state, and private land in Owyhee County have the potential to improve habitat for pronghorn by increasing forage and water availability. Perennial water sources are mostly confined to larger drainages and reservoirs, but some smaller streams and livestock ponds can hold water late into the year.

The Owyhee North pronghorn are a combination of migratory and resident animals. Winter range is typically low elevation on the Snake River Plain and, in the summer, pronghorn either stay on winter range or migrate short distances to higher elevations with higher quality forage.

Population Status & Objective

The Owyhee North SRD/WRD has limited population monitoring data and historical data are for small portions of the area (Appendix F). Translocations occurred in the area 1949, 1950, and 2004 to bolster populations (Appendix C), but follow-up surveys to document changes in status did not occur. Populations have recently been monitored primarily using harvest metrics and anecdotal observations. In 2022, IDFG conducted a pilot project using helicopter-based quadrat surveys with a study site in the Owyhee North WRD. From 2019 to present, IDFG has GPS-collared and monitored pronghorn as part of a tristate migration study with Oregon and Nevada. Although the primary purpose of the study was to determine migration routes, the pronghorn collars have also provided data on cause-specific mortality, survival rates, and habitat use. Due to limited population data, numerical population objectives are unattainable. However, from cause-specific mortality data and hunter observations, it appears that the Owyhee North pronghorn population has been declining and the objective is to increase this population while considering depredation concerns and habitat availability.

Harvest

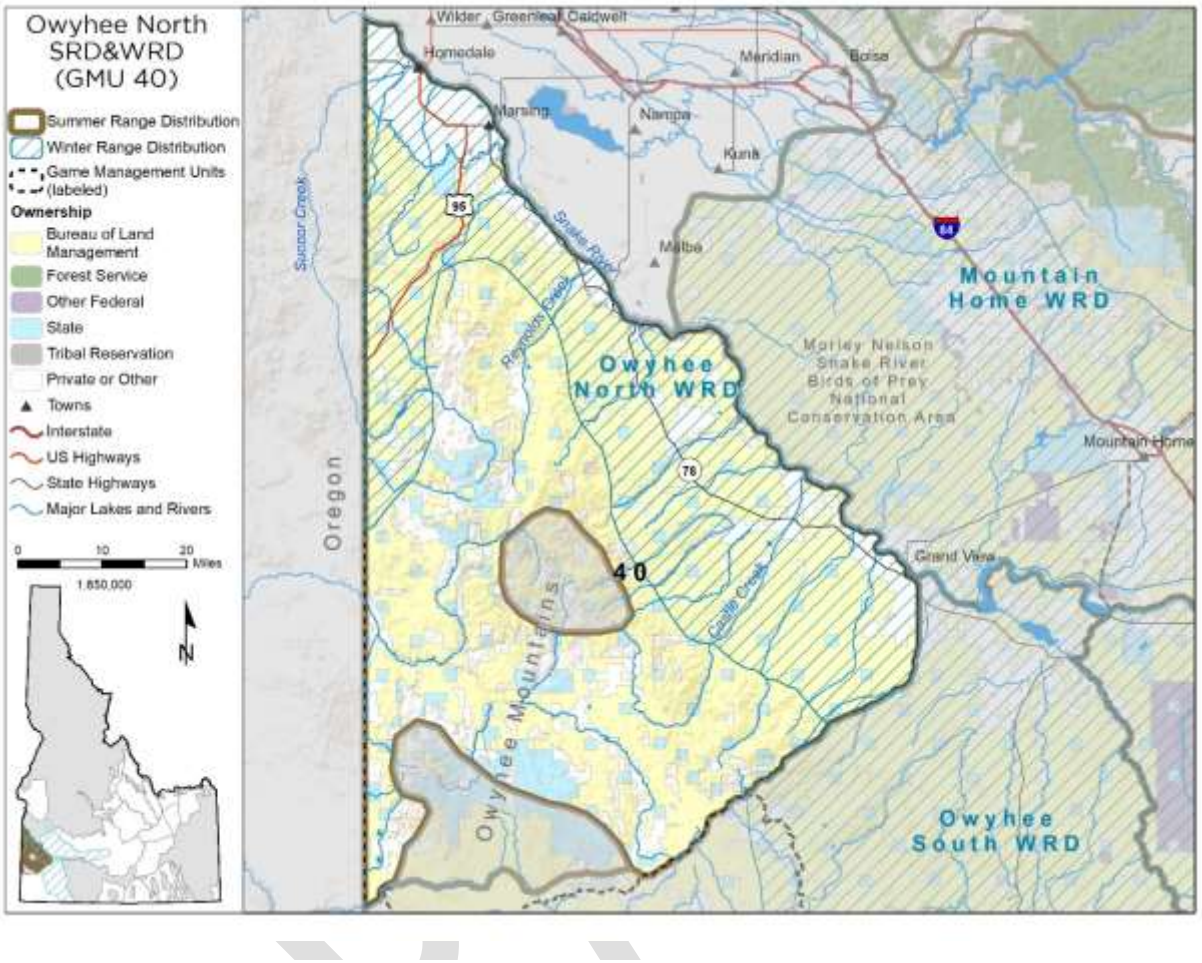
Hunting seasons in the SRD/WRD include an August archery-only season with 200 tags, an unlimited archery-only season in early September, and an any-weapon controlled hunt with 75 tags in late September to October. The hunt area (40-1) for the archery-only seasons is combined with the Owyhee South SRD/WRD west of State Highway 51. Harvests in the any-weapon and archery-only seasons have been variable but stable (Figure 33 bottom).

Current Management Considerations

- Habitat quality — The loss of quality forage due to wildfire and subsequent establishment of invasive annual grasses and forbs will continue to be compounded by drought. The Soda Fire in particular reduced pronghorn

habitat quality in the northwestern section of the SRD, but cheatgrass and medusahead have also spread throughout most of the WRD.

- Disturbance from recreational activities — OHV use has been a chronic problem across much of the area. Increasing interest in outdoor recreation (e.g., OHV, mountain biking, hiking, hunting, and shed hunting) has resulted in more human activity year round. Areas along the Owyhee Front particularly have seen increased use that may displace pronghorn, particularly from winter range.
- Movement and migration — Linear barriers such as highways and fences are known to create challenges for pronghorn and can result in direct mortality or limited movement. For example, current GPS-collar data from the Owyhee North SRD indicates that pronghorn have not crossed US Highway 95; however, in 2008, one collared animal did cross on rare occasions (Dalton 2009). Of particular concern are woven wire fences, which are impassable by pronghorn.
- Predation — Recent cause-specific mortality data from GPS-collared pronghorn show that predation may be high enough to affect the population. The study is ongoing, but preliminary results show an average annual survival rate of 81% for adult does with mountain lions being the primary predator (IDFG, unpublished data).
- Population data — There are no standardized population surveys, either ground or aerial, to monitor population performance in this area.



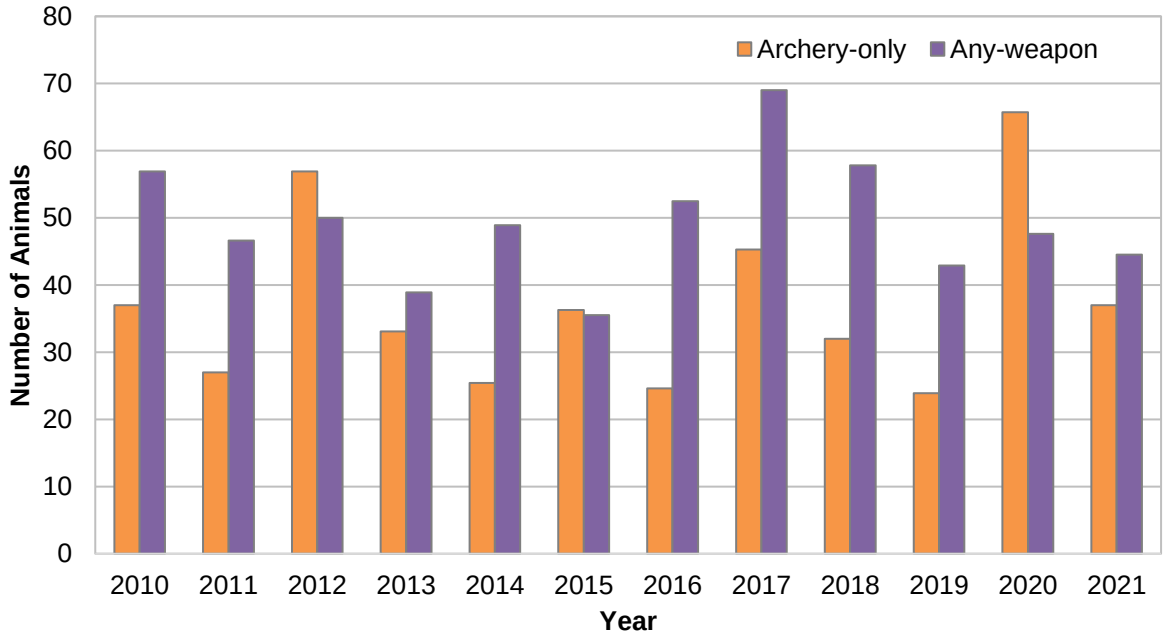


Figure 33. Owyhee North summer and winter range distribution (top) and harvest in GMU 40 (bottom), Idaho.

Owyhee South Summer/Winter Range Distribution

The Owyhee South SRD/WRD includes GMUs 41, 42, and the southern edge of 40 (Figure 34 top). Most of the area is federal land (BLM) with small parcels of state and private land intermixed. Pronghorn habitat in this area is characterized by sagebrush uplands bisected by deep canyons. Invasive annual grass and forb species including cheatgrass and medusahead have become established due to wildfires and natural spread particularly in lower elevations in the Snake River Plain. On the northern edge of the SRD, broadscale juniper removal projects on federal, state, and private land and controlled burns on public land have the potential to improve habitat for pronghorn by increasing forage and water availability. Perennial water sources are mostly confined to larger drainages and reservoirs, but some smaller livestock ponds and streams can hold water partway into the summer and autumn.

The Owyhee South pronghorn are primarily migratory animals, although some pronghorn inhabit winter range year round. Winter range is typically low elevation in the Snake River Plain and on the sagebrush flats and tables around Jacks Creek and Big Hill in GMU 41. In the summer most pronghorn migrate to areas of higher elevation in GMU 42. Owyhee South also shares migratory pronghorn with Oregon and Nevada. Recent GPS collar data have found pronghorn from all 3 states using summer range in GMU 42, and then separating to winter ranges in northern Nevada, southeastern Oregon, and GMU 41 (see Figure 6).

Population Status & Objective

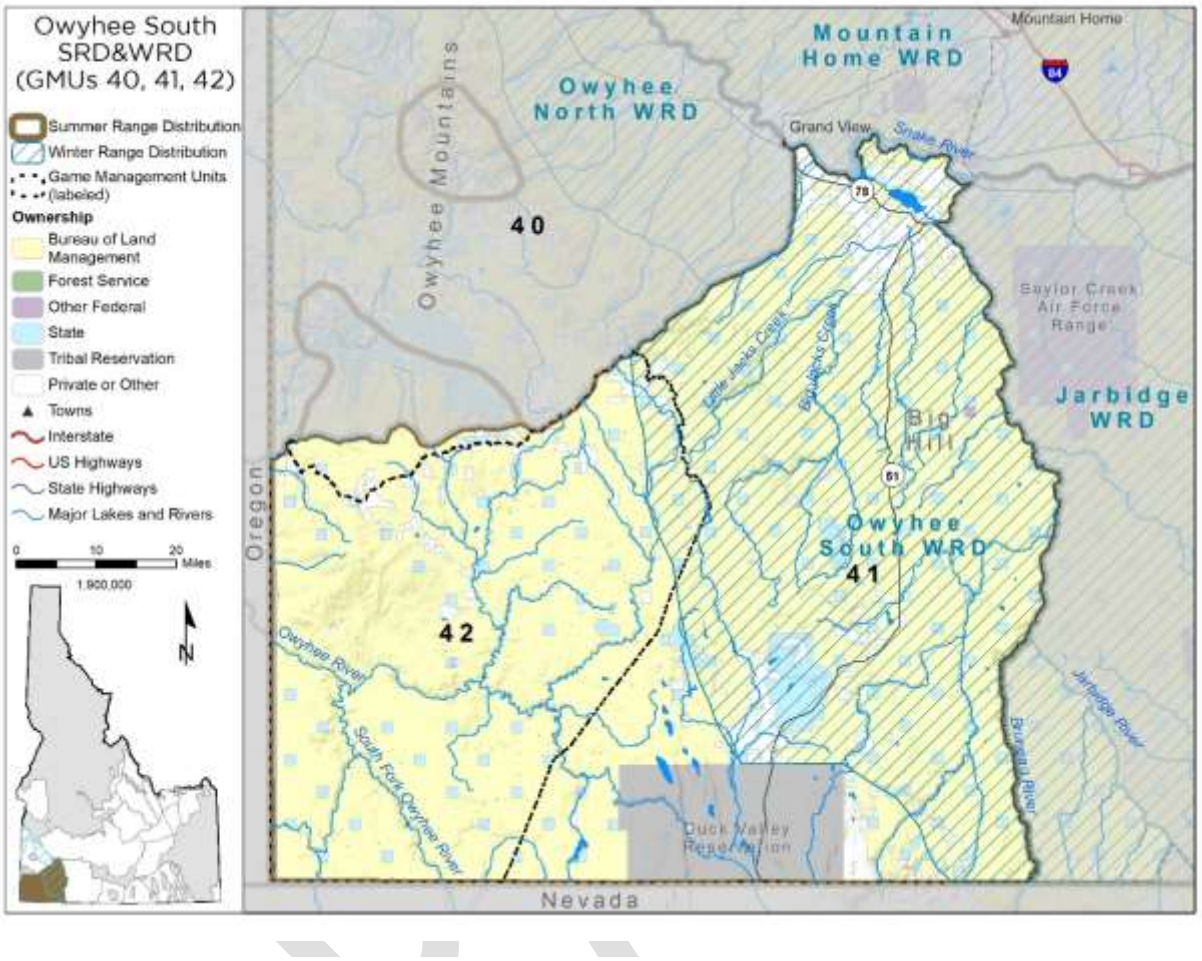
The Owyhee South SRD/WRD has mixed and limited population monitoring data (Appendix F). Populations have recently been monitored primarily using harvest metrics and anecdotal observations, but ground trend and composition surveys, hunter-observer ground mark-resight surveys, and line-transect aerial surveys have occurred in the past. In 2022, IDFG also conducted a pilot project using helicopter-based quadrat surveys with a study site in the Owyhee South SRD. No survey method besides harvest metrics have been used consistently due to funding and staffing limitations and data quality. From 2019 to present, IDFG has GPS-collared and monitored pronghorn as part of a tristate migration study with Oregon and Nevada. Although the primary purpose of the study was to determine migration routes, the pronghorn collars have also provided data on cause-specific mortality, survival rates, and habitat use. Due to limited population data, there is no numerical population objective. However, from cause-specific mortality data and hunter observations it appears that the Owyhee South pronghorn population has been declining, and the objective is to increase this population while considering depredation concerns and habitat availability.

Harvest

Hunting seasons in the SRD/WRD include an August archery-only season with 200 tags, an unlimited archery-only season in early September, an any-weapon controlled hunt with 200 tags in late September to October, and a muzzleloader-only hunt east of State Highway 51 with 40 tags from late September to October. The hunt area for the archery-only seasons is combined with the Owyhee North SRD/WRD. Harvest in all seasons has been variable but stable (Figure 34 bottom).

Current Management Considerations

- Predation — Recent cause-specific mortality data from GPS-collared pronghorn show high levels of predation. The study is ongoing, but preliminary results show an average annual survival rate of 66% for adult does. Mountain lions have been the primary predator, although coyotes have killed collared pronghorn as well (IDFG, unpublished data).
- Habitat quality — The loss of quality forage due to wildfire and the subsequent establishment of invasive species will continue to be compounded by drought. Small wildfires caused by lightning strikes have removed some summer range habitat, but winter range has been particularly affected by wildfire. Past fires between Big and Little Jacks Creeks and from Big Hill north toward the town of Bruneau have had poor shrub recovery and are almost entirely perennial grasses or invasive annual grasses and forbs. Low elevations in the Snake River Plain have established invasive annual grasses that have spread into winter range without the aid of wildfire. Expanding elk populations may also reduce forage available when overlapping pronghorn winter range in the Jacks Creek and Big Hill areas.
- Disturbance from recreational activities — Increasing outdoor recreational use (e.g., OHV riding, mountain biking, hiking, hunting, and shed hunting) has resulted in more human activity year round. Most of the summer range for this population has reduced recreational disturbance compared to an easily accessed SRD/WRD like Owyhee North, but hunters and shed hunters create some disturbance. On winter range there is disturbance from OHVs, hiking, and shed hunting, particularly in dry winters when road conditions allow recreationists more access.
- Movement and migration — Linear barriers such as highways and fences are known to create challenges for pronghorn and can result in direct mortality or limited movement. Of particular concern are woven wire fences, which are impassable by pronghorn. Collar data have shown that roads are less of a barrier to movement in the Owyhee South SRD/WRD than in more heavily traveled areas; however, pronghorn cross State Highway 51 to reach winter range in Big Hill and are at risk of collisions with vehicles.
- Population data — There are no standardized population surveys to monitor population performance in this area, although many methods have been tested in the past.



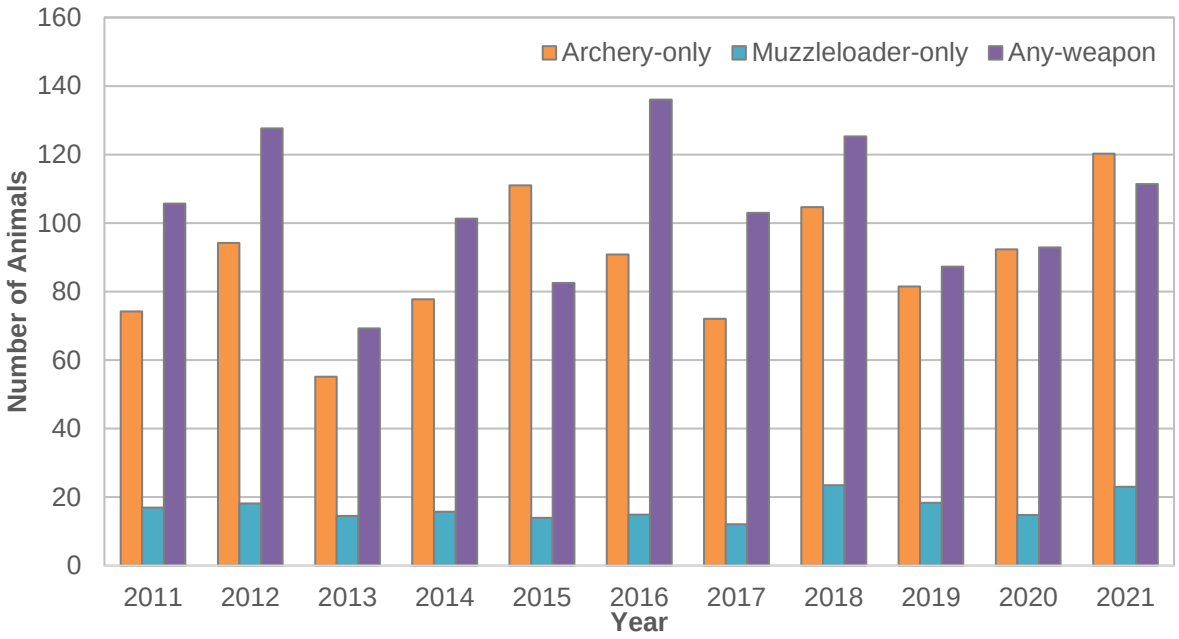


Figure 34. Owyhee South pronghorn summer and winter range distribution (top) and harvest in GMUs 41 and 42 (bottom), Idaho.

Raft River Summer/Winter Range Distribution

This population includes GMUs 55 and 57 and appears to be small in number, which is probably due in part to habitat loss and fragmentation (Figure 35 top). Historically, more movement between GMUs 55/57 and 56 likely occurred; however, I-84 and I-86 now present significant barriers and may partly explain why there are very few pronghorn in GMU 56. This population also has little available winter range, with most occurring in GMU 55 along the southern end of the Jim Sage mountains and the southern portions of GMU 57 along the base of Black Pine Mountain. During years of heavy snowfall, mule deer that typically winter in the southern part of GMU 57 migrate south into Utah, and pronghorn are believed to do the same, although they may also stay in the Raft River Valley. The Snake River Plain probably served as a primary winter range before human development.

Population Status & Objective

Translocations occurred in the Raft River SRD/WRD in 1949 and 1950 (see Translocation chapter) and population surveys followed to document changes in status. Aerial trend counts were used historically to determine population size; however, beginning in 1998, ground herd composition surveys have been the standard method of assessing pronghorn population productivity (Appendix F).

Harvest

Origin of the Raft River pronghorn herd is unknown, but it likely originated from a few remnant animals, supplemented with several translocations. This herd increased during the 1990s with a hunt established in 1996 with 5 permits. However, this hunt was discontinued in 2001, due to low numbers (Figure 35 bottom). In 2017, hunt area 55-1 was established, with 10 any-weapon and 10 archery-only permits available due to increasing pronghorn numbers and depredation concerns.

Current Management Considerations

- Population data — Currently, adequate data to develop migration and range maps using methods being applied to other pronghorn populations are lacking. Additionally, a lack of standardized methods for counting pronghorn, particularly for low density populations such as this one, makes it difficult to estimate and monitor overall population status.

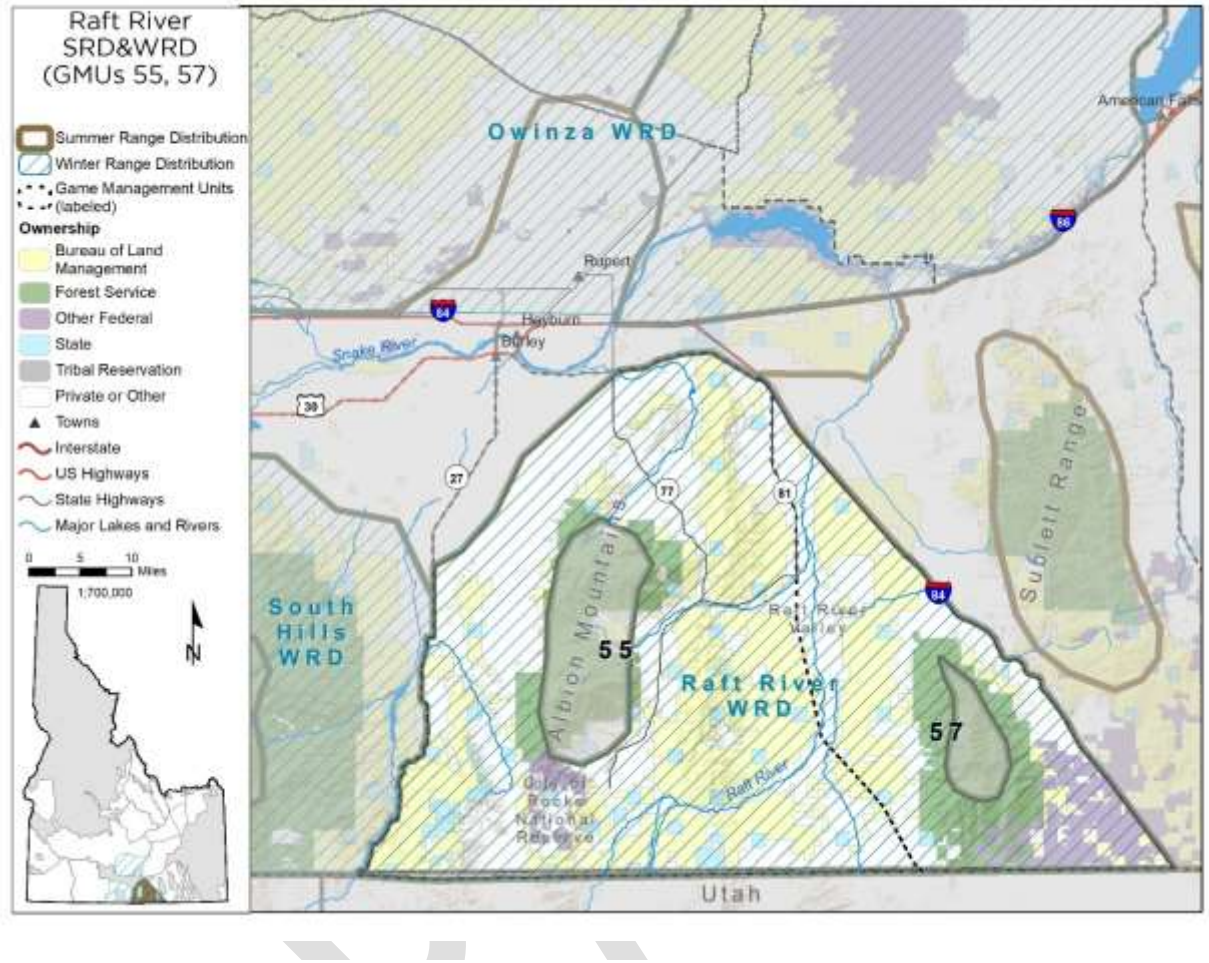


Figure 35. Raft River pronghorn summer and winter range distribution (top) and harvest in GMUs 55 and 57 (bottom), Idaho.

South Hills Summer/Winter Range Distribution

Pronghorn in the South Hills SRD/WRD are mostly found at middle to lower elevations within GMU 54, occupying sagebrush steppe habitat (Figure 36 top). In 1989, IDFG transplanted 29 pronghorn from GMU 63 to the Shoshone Basin area (Appendix C). Around this same time, the Nevada Division of Wildlife released pronghorn east of Jackpot, Nevada, and this population has continued to increase, providing hunting opportunity in both states. Pronghorn likely migrate to winter range in Nevada, particularly in severe weather years.

Population Status & Objective

Herd composition surveys have been conducted for this population since 2014 (Appendix F); however, methods, survey timing, and seasonal conditions have varied enough to make comparisons and inferences on population trends difficult. Additionally, IDFG does not have a standardized method for counting pronghorn, and instead uses herd composition and harvest trend data to draw inferences regarding population status and productivity. Based on composition and harvest trend data, this population appears to be declining over the last 3 years. Population objectives for this SRD are to increase pronghorn numbers to maximize hunting opportunity while considering depredation concerns and changing habitat conditions.

Harvest

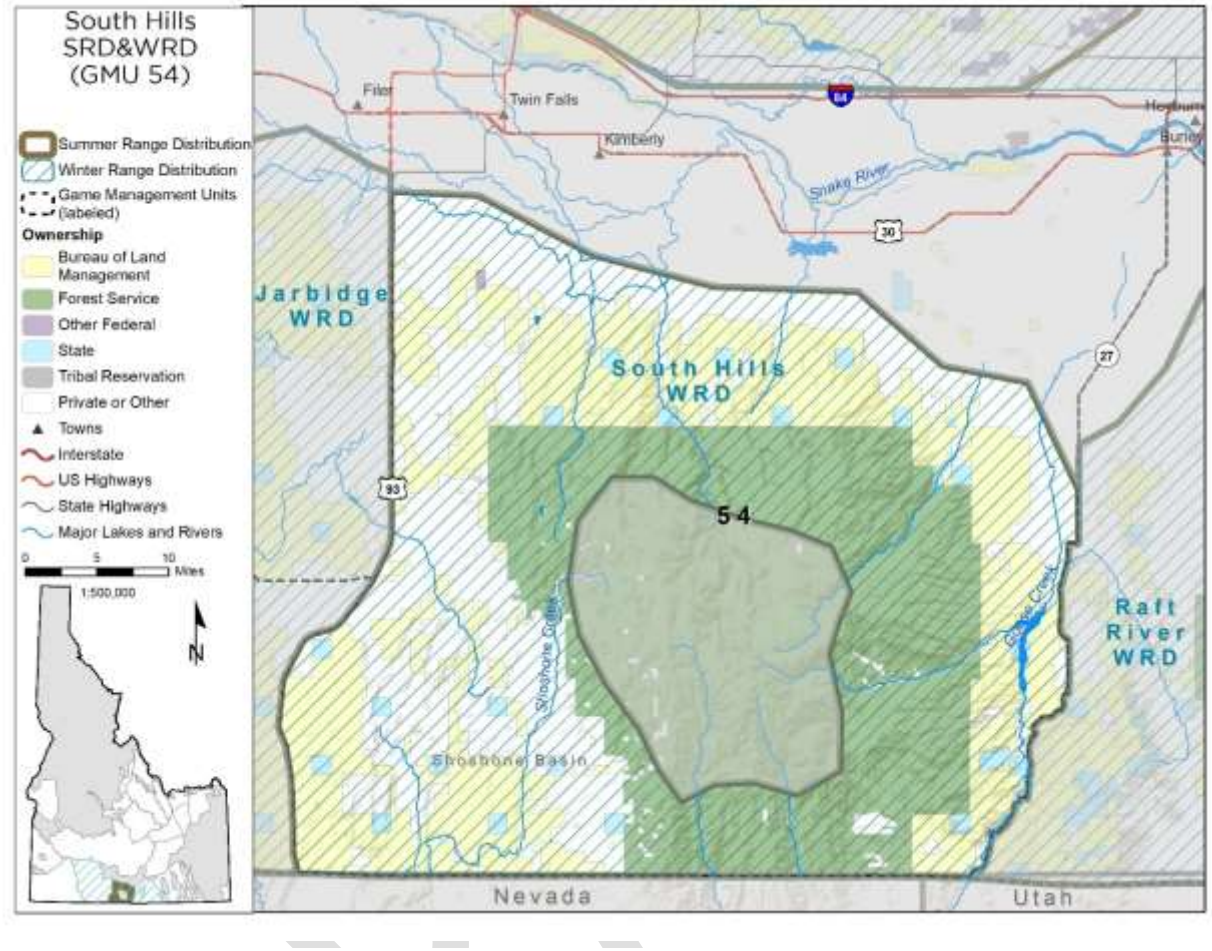
Current hunting opportunity is limited in GMU 54. Harvest success rates have remained consistent over the last decade (Figure 36 bottom).

Current Management Considerations

- Road density — The South Hills SRD/WRD is one of the most densely roaded areas in Idaho, with multiple user groups frequenting the area year round including OHV users, mountain bikers, hikers, rock climbers, hunters, skiers, and snowmobilers.
- Movement and migrations — Grazing allotment fences and private boundary fences occur throughout the SRD/WRD that present barriers for pronghorn movement. No major highways occur within the area; however, US Highway 93 on the western border presents a barrier to pronghorn moving to the Jarbidge SRD/WRD which is believed to occur more frequently during winter when pronghorn move out of Shoshone Basin and into the area around Salmon Falls Reservoir.
- Habitat quality — This SRD/WRD has only experienced a handful of large wildfires over the last decade, and some of the best pronghorn habitat has been spared. However, due in part to wildfire and compounded by recreational use and improper livestock management, invasive annual grasses and noxious weeds have become established in parts of the range resulting in reduced forage quality for pronghorn. Extensive juniper removal projects have been implemented in the southern portions of both GMUs for Greater Sage-grouse, but may also have a positive impact on pronghorn, although limited numbers of pronghorn currently reside in these areas.
- Population data — Adequate data to develop migration and range maps using methods being applied to other pronghorn populations are lacking.

Additionally, a lack of standardized methods for counting pronghorn, particularly for low density populations such as this one, makes it difficult to estimate and monitor overall population status.

- Depredation — Isolated incidents of pronghorn depredations occur periodically, and IDFG will continue to work with private landowners on this issue.
- Energy development — While not extensive, some renewable energy development already exists in this SRD/WRD. With the emphasis being placed on renewable energy development, it is possible the area will be identified in future project proposals. Additional research is needed to improve technical assistance, foster collaboration with project applicants and land management agencies, and to best inform management decisions.



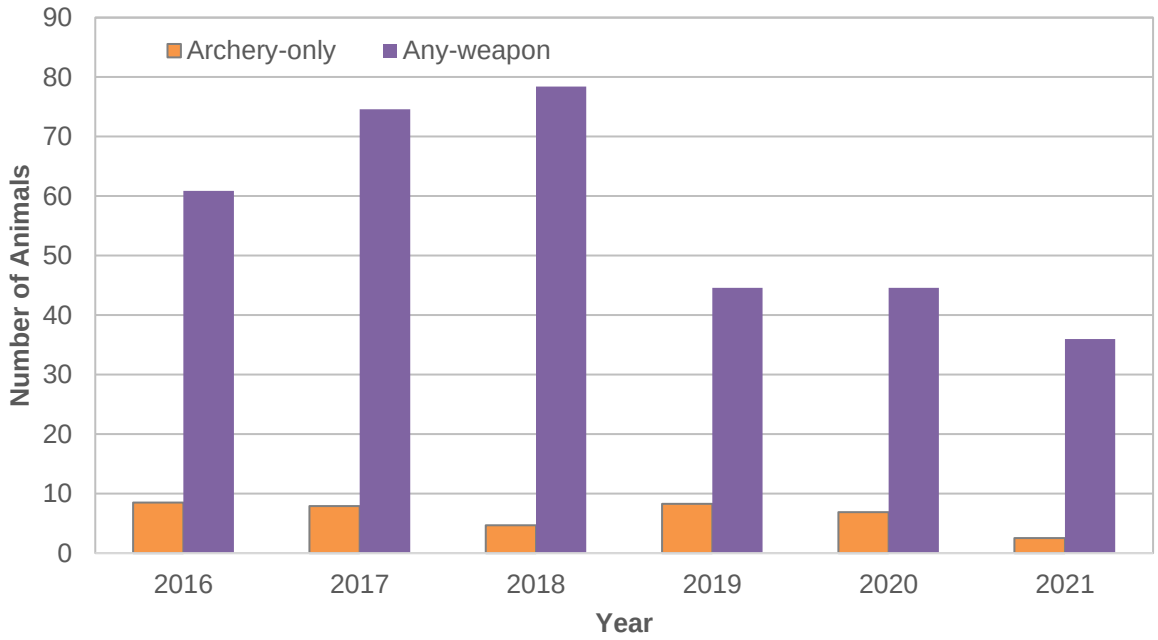


Figure 36. South Hills pronghorn summer and winter range distribution (top) and harvest in GMU 54 (bottom), Idaho.

Weiser Summer/Winter Range Distribution

Pronghorn distribution in the Weiser SRD/WRD includes all or portions of GMUs 22, 31, 32, and 32A (Figure 37 top). Land ownership in the region is a patchwork mix of public and private. The most contiguous and accessible public land is managed by BLM and occurs in the eastern half of GMU 32. Pronghorn habitat is primarily composed of sagebrush steppe ecosystems at elevations below 1,676 m (5,500 ft), and irrigated agriculture in the wider creek bottoms.

The Weiser pronghorn are believed to be a combination of migratory and resident animals. Summer range can be found in GMU 32 and portions of 22, 31, and 32A. Animals are sometimes observed in isolated high elevation valleys of GMUs 23 and 32A. During winters with significant snow accumulation, pronghorn in the Weiser SRD/WRD tend to congregate in the lowest elevations in and adjacent to Big Willow Creek, Sweet Valley, and the Emmett Bench in GMU 32, and the Snake River corridor in GMUs 31 and 32.

Population Status & Objective

In 1961, a small translocation of 6 animals occurred in this area (see Translocation chapter), but follow-up population surveys to document changes in status did not occur. No population or herd composition surveys have been conducted in this SRD/WRD due to low numbers and dispersed animals. Pronghorn counts and locations are recorded incidental to deer and elk surveys. Pronghorn appear to be expanding their range and increasing in number. The objective in this area is to maintain or increase pronghorn numbers and associated harvest opportunity.

Harvest

Current any-weapon hunting opportunity for this population is limited to a single, youth-only hunt with 15 tags in GMUs 32 and 32A. Hunter success has averaged around 50% over the past 5 years (Figure 37 bottom).

Current Management Considerations

- Habitat quality — Loss of quality forage due to wildfire and subsequent establishment of invasive annual grasses. Wildfires occur frequently and cheatgrass is well-established throughout much of this area.
- Disturbance from recreational activities — OHV use occurs year round but is especially high in the summer months. Road and trail densities in the Weiser SRD/WRD are high, with most trails used by OHVs.
- Movement and migration — Linear barriers such as highways and fences are known to create challenges for pronghorn and can result in direct mortality or limited movement. US Highway 95, the primary north-south route through Idaho, bisects this population and likely limits east-west movement within this area.

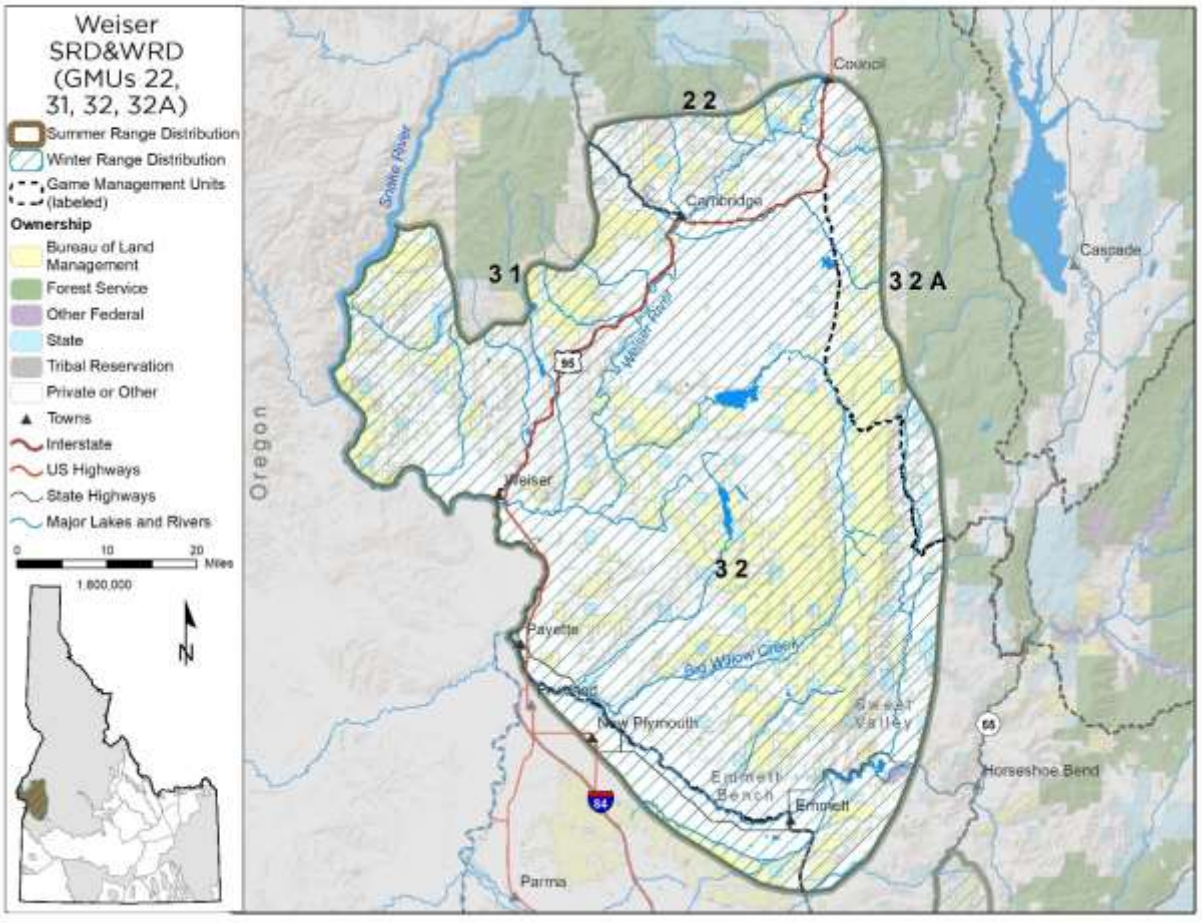


Figure 37. Weiser pronghorn summer and winter range distribution (top) and harvest in GMU 32 (bottom), Idaho.

LITERATURE CITED

Abatzoglou JT. 2013. Development of gridded surface meteorological data for ecological applications and modelling. International Journal of Climatology 33:121–131.

Abatzoglou JT, Marshall AM, Harley GL. 2021. Observed and Projected Changes in Idaho's Climate. Idaho Climate-Economy Impacts Assessment. James A. and Louise McClure Center for Public Policy Research. Boise (ID): University of Idaho.

Aikens EO, Mysterud A, Merkle JA, Cagnacci F, Rivrud IM, Hebblewhite M, Hurley MA, Peters W, Bergen S, De Groeve J, et al. 2020. Wave-like patterns of plant phenology determine ungulate movement tactics, Current Biology 30 (17): 3444–3449.

Aleuy OA, Kutz S. 2020. Adaptations, life-history traits and ecological mechanisms of parasites to survive extremes and environmental unpredictability in the face of climate change. International Journal for Parasitology: Parasites and Wildlife 12:308–317.

Aldridge C, Chalfoun A, Deibert PA, Espinosa SP, Holloran MJ, Withroder A. 2021. Mining and Energy. In Remington TE, Deibert PA, Hanser SE, Davis DM, Robb LA, Welty JL, editors. Sagebrush Conservation Strategy—Challenges to Sagebrush Conservation. US Geological Survey Open-File Report 2020–1125. p. 163–178.

Alldredge AW, Deblinger RD, Peterson J. 1991. Birth and fawn bed site selection by pronghorns in a sagebrush-steppe community. Journal of Wildlife Management 55:222–227.

Allred BW, Smith WK, Twidwell D, Haggerty JH, Running SW, Naugle DE, Fuhlendorf SD. 2015. Ecosystem services lost to oil and gas in North America. Science 348:401–402.

Ament R, Jacobson S, Callahan R, Brocki M. 2021. Highway crossing structures for wildlife: Opportunities for improving driver and animal safety. Albany (CA): US Department of Agriculture, Forest Service, Pacific Southwest Research Station. General Technical Report PSW-GTR-271.

Anderson JE, Inouye RS. 2001. Landscape-scale changes in plant species abundance and biodiversity of a sagebrush steppe over 45 years. Ecological Monographs 71(4):531–556.

Anonymous. 1951. Birch, Crooked Creek antelope trapping nets 262 pronghorns. Idaho Wildlife Review 3(3):7.

Balch JK, Bradley BA, D'Antonio CM, Gomez-Dans J. 2013. Introduced annual grass increases regional fire activity across the arid western USA (1980–2009). Global Change Biology 19:173–183.

Bansal S, James JJ, Sheley RL. 2014. The effects of precipitation and soil type on three invasive annual grasses in the western United States: Journal of Arid Environments 104:38–42. https://doi.org/10.1016/j.jaridenv.2014.01.010.

Barnowe-Meyer KK, White PJ, Davis TL, Smith DW, Crabtree RL, Byers JA. 2010. Influences of wolves and high-elevation dispersion on reproductive success of pronghorn (*Antilcapra americana*). Journal of Mammalogy 91(3):712–721.

Barnowe-Meyer KK, White PJ, Waits LP, Byers JA. 2013. Social and genetic structure associated with migration in pronghorn. Biological Conservation 168:108–115.

Barnowe-Meyer KK, White PJ, David TL, Treanor JJ, Byers JA. 2017. Seasonal foraging strategies of migrant and non-migrant pronghorn in Yellowstone National Park. Northwestern Naturalist 98(2):82–90.

Barrett MW. 1981. Environmental characteristics and functional significance of pronghorn fawn bedding sites in Alberta. Journal of Wildlife Management 45:120–131.

Barrett MW. 1982. Distribution, behavior, and mortality of pronghorns during a severe winter in Alberta. Journal of Wildlife Management 46(4):991–1002.

Beale DM, Smith AD. 1970. Forage use, water consumption, and productivity of pronghorn antelope in western Utah. Journal of Wildlife Management 34(3):570–582.

Beck JO. 1942. Nineteenth Biennial Report of the Fish and Game Department of the State of Idaho (1941–1942). Boise (ID): Idaho Department of Fish and Game.

Beckmann JP, Clevenger AP, Huijser MP, Hilty JA. 2010. Safe Passages: Highways, Wildlife, and Habitat Connectivity. Washington, DC: Island Press.

Beckmann JP, Olson SH, Seidler RG, Berger J. 2016. Sub-lethal effects of energy development on a migratory mammal—the enigma of North American pronghorn. Global Ecology and Conservation 6:36–47.

Bender LC, Boren JC, Halbritter H, Cox S. 2013. Factors influencing survival and productivity of pronghorn in a semiarid grass-woodland in east-central New Mexico. Human-Wildlife Interactions 7:313–324.

Bergen S, Berg J, Hurley MA, Roberts S. 2022. Deciphering Idaho's pronghorn antelope seasonal movements; modifying migration mapping methods for migration route estimation, seasonal range analysis and conservation. In 29th Biennial Pronghorn Workshop; August 22-25; Deadwood (SD).

Bever W. 1950. Parasites and diseases of South Dakota pronghorn. Pierre (SD): South Dakota Department of Game, Fish and Parks. PR Report 12-R-7.

Bleke C. 2022. Evaluation of noninvasive methods for determining pregnancy, diet, nutrition, and stress among pronghorn antelope: implications for population monitoring [master's thesis]. Logan (UT): Utah State University.

Bodie WL. 1979. Factors affecting pronghorn fawn mortality in central Idaho [master's thesis]. Missoula (MT): University of Montana.

Bowyer RT, Stewart KM, Kie JG, Gasaway WC. 2001. Fluctuating asymmetry in antlers of Alaskan moose: size matters. Journal of Mammalogy 82:814–824.

Boyd CS, Davis DM, Germino MJ, Garner L, Eiswerth ME, Boyte SP, Tekiela DR, Mayer KE, Pellant M, Pyke DA, Ielmini MR, Franklin S. 2021. Invasive Plant Species. In Remington TE, Deibert PA, Hanser SE, Davis DM, Robb LA, Welty JL, editors. Sagebrush Conservation Strategy—Challenges to Sagebrush Conservation. US Geological Survey Open-File Report 2020–1125. p. 99–120.

Bradley BA, Curtis CA, Chambers JC. 2016. Bromus response to climate and projected changes with climate change. In Germino MJ, Chambers JC, Brown CS, editors. Exotic brome-grasses in arid and semiarid ecosystems of the western US—Causes, consequences, and management implications. New York (NY): Springer, Springer Series on Environmental Management, p. 257–274.

Brooks ML, Matchett JR, Shinneman DJ, Coates PS. 2015. Fire patterns in the range of the Greater Sage-Grouse, 1984–2013—implications for conservation and management. Reston (VA): US Department of Interior, US Geological Survey Open-File Report 2015-1167.

Brown DE, Mitchell CD. 2006. A comparison of pronghorn horn size in relation to environmental factors. Managing Wildlife in the Southwest 2006:49–54.

Brown DE, Warnecke D, McKinney T. 2006. Effects of midsummer drought on mortality of doe pronghorn (Antilocapra americana). The Southwestern Naturalist 51(2):220–225.

Bruns EH. 1977. Winter behavior of pronghorns in relation to habitat. Journal of Wildlife Management 41(3):560–571.

Bukowski BE, Baker WL. 2013. Historical fire regimes, reconstructed from land-survey data, led to complexity and fluctuation in sagebrush landscapes. Ecological Applications 23(3):546–564.

Buttke D, Wild M, Monello R, Schuurman G, Hahn M, Jackson K. 2021. Managing wildlife disease under climate change. EcoHealth 18:406–410.

Byers JA., Byers AA, Dunn SJ. 2006. A dry summer diminishes mate search effort by pronghorn females: Evidence for a significant cost of mate search. Ethology 112(1):74–80.

Cain JW, Avery MM, Caldwell CA, Abbott LB, Holechek JL. 2017. Diet composition, quality and overlap of sympatric American pronghorn and gemsbok. Wildlife Biology 2017:wlb.00296. doi: 10.2981/wlb.00296.

Catalano AJ, Loikith PC, Aragon CM. 2019. Spatiotemporal variability of twenty-first-century changes in site-specific snowfall frequency over the northwest United States. Geophysical Research Letters 46:10122–10131.

Chambers JC, Bradley BA, Brown CS, D'Antonio C, Germino MJ, Grace JB, Hardegree SP, Miller RF, Pyke DA. 2014. Resilience to stress and disturbance, and resistance to *Bromus tectorum* L. invasion in cold desert shrublands of western North America. Ecosystems 17:360–375.

Chambers JC, Beck JL, Bradford JB, Bybee J, Campbell S, Carlson J, Christiansen TJ, Clause KJ, Collins G, Crist MR, et al. 2017a. Science framework for conservation and restoration of the sagebrush biome—Linking the Department of the Interior's integrated rangeland fire management strategy to long-term strategic conservation actions—Part 1, Science basis and applications. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, General Technical Report RMRS– GTR–360.

Chambers JC, Maestas JD, Pyke DA, Boyd CS, Pellant M, Wuenschel A. 2017b. Using resilience and resistance concepts to manage persistent threats to sagebrush ecosystems and greater sage-grouse: Rangeland Ecology and Management 70(2):149–164.

Christie KS, Jensen WR, Schmidt JH, Boyce MS. 2015. Long-term changes in pronghorn abundance index linked to climate and oil development in North Dakota. Biological Conservation 192:445–453.

Christie KS, Jensen WF, Boyce MS. 2017. Pronghorn resource selection and habitat fragmentation in North Dakota. Journal of Wildlife Management 81(1):154–162.

Clary WP, Beale DM. 1983. Pronghorn reactions to winter sheep grazing, plant communities, and topography in the Great Basin. Journal of Range Management 36:749–752.

Collins GH. 2016. Seasonal distribution and routes of pronghorn in the northern Great Basin. Western North American Naturalist 76(1):101–112.

Compton B. 2005. Pronghorn Antelope. Boise (ID): Idaho Department of Fish and Game. Progress Report Project W-170-R-29, 1 July 2004 to 30 June 2005.

Crenshaw JG. 1991. Pronghorn antelope management plan, 1991–1995. Boise (ID): Idaho Department of Fish and Game.

Crist MR, Belger R, Davies KW, Davis DM, Meldrum JR, Shinneman DJ, Mayer KE. 2021. Altered Fire Regimes. In Remington TE, Deibert PA, Hanser SE, Davis DM, Robb LA, Welty JL, editors. Sagebrush Conservation Strategy—Challenges to Sagebrush Conservation. US Geological Survey Open-File Report 2020–1125. p. 79–98.

Dalton KA. 2009. Pronghorn: migration triggers and resource selection in southeastern Oregon [master's thesis]. Pullman (WA): Washington State University.

Davis EB, Brakora KA, Lee AH. 2011. Evolution of ruminant headgear: a review. Proceedings of the Royal Society B 278:2857–2865.

Davis GG. 1946 April 2. Subject: Grassy Hill Antelope. Filer (ID): Personal letter from Davis GC, Conservation Officer, to Thoman PJ, Idaho Fish and Game Commissioner.

Deblinger RD, Alldredge AW. 1989. Management implications of variations in pronghorn social behavior. Wildlife Society Bulletin. 17(1):82–87.

Deguines N, Brashares JS, Prugh LR. 2017. Precipitation alters interactions in a grassland ecological community. Journal of Animal Ecology 86(2):262–272.

Duncan NP, Kahl SS, Gray SS, Salice CJ, Stevens RD. 2016. Pronghorn habitat suitability in the Texas Panhandle. Journal of Wildlife Management 80(8):1471–1478.

Eacker DR, Jakes AF, Jones PF. 2023. Spatiotemporal risk factors predict landscape-scale survivorship for a northern ungulate. Ecosphere 14:e4341.

Ellis JE. 1970. A computer analysis of fawn survival in the pronghorn antelope [dissertation]. Davis (CA): University of California.

Eliason SL. 2020. Poaching, social conflict, and the public trust: some critical observations on wildlife crime. Capitalism Nature Socialism 31(2):110–126.

Firchow KM. 1986. Ecology of pronghorn on the Pinon Canyon Maneuver Site, Colorado [master's thesis]. Blacksburg (VA): Virginia Polytech. Institute and St. University.

Ford KR, Ettinger AK, Lundquist JD, Raleigh MS, Lambers JHR. 2013. Spatial heterogeneity in ecologically important climate variables at coarse and fine scales in a high-snow mountain landscape. PLoS ONE 8(6): e65008.

Fuller A, Mitchell D, Maloney SK, Hetem RS. 2016. Towards a mechanistic understanding of the responses of large terrestrial mammals to heat and aridity associated with climate change. Climate Change Responses 3:10.

Gates CC, Jones P, Suitor M, Jakes A, Boyce MS, Kunkel K, Wilson K. 2012. The influence of land use and fences on habitat effectiveness, movements and distribution of pronghorn in the grasslands of North America. In Somers MJ, Hayward MW, editors. Fencing for conservation: restriction of evolutionary potential or a riposte to threatening processes? New York (NY): Springer. p. 277–294.

Gavin SD, Komers PE. 2006. Do pronghorn (Antilocapra americana) perceive roads as a predation risk? Canadian Journal of Zoology 84(12):1775–1780.

Gedir JV, Cain III JW, Harris G, Turnbull TT. 2015. Effects of climate change on long-term population growth of pronghorn in an arid environment. Ecosphere 6(10):189.

Gese EM, Bleke CA, Roberts SB, Atwood P, Terletzky PA. *In review*. Growth rates of pronghorn subpopulations in Idaho: influence of environmental factors, recruitment, and density dependence.

Gooch AMJ, Petersen SL, Collins GH, Smith TS, McMillan BR, Eggett DL. 2017. The impact of feral horses on pronghorn behavior at water sources. Journal of Arid Environments. 138:38–43.

Hailey TL. 1979. A handbook on pronghorn antelope management in Texas. Austin (TX): Texas Parks Wildlife Department, Federal Aid Wildlife Series 20.

Harrington JL, Conover MR. 2010. Characteristics of ungulate behavior and mortality associated with wire fences. Wildlife Society Bulletin 34(5):1295–1305.

Henn B, Newman AJ, Livneh B, Daly C, Lundquist JD. 2018. An assessment of differences in gridded precipitation datasets in complex terrain. Journal of Hydrology 556:1205–1219.

Hennig, JD, Beck JL, Gray CJ, Scasta JD. 2021. Temporal overlap among feral horses, cattle, and native ungulates at water sources. Journal of Wildlife Management 85(6):1084–1090.

Hess M. 2018. Evaluating the efficacy of early Nevada aerial pronghorn surveys. Proceedings of the Western States and Provinces Twenty-eighth Biennial Pronghorn Workshop 28:6–18.

Hofmann RR. 1989. Evolutionary steps of ecophysiological adaptation and diversification of ruminants: a comparative view of their digestive system. Oecologia 78:443–457.

Hoffman JD, Genoways HH, Jones RR. 2010. Factors influencing long-term population dynamics of pronghorn (*Antilocapra americana*): evidence of an Allee effect. Journal of Mammalogy 91(5):1124–1134.

Hohenlohe PA, Funk WC, Rajora OP. 2021. Population genomics for wildlife conservation and management. Molecular Ecology 30:62–82.

Holden ZA, Swanson A, Klene AE, Abatzoglou JT, Dobrowski SZ, Cushman SA, Squires J, Moisen GG, Oyler JW. 2015. Development of high-resolution (250 m) historical daily gridded air temperature data using reanalysis and distributed sensor networks for the US Northern Rocky Mountains. International Journal of Climatology DOI: 10.1002/joc.4580.

Hoskinson RL, Tester JR. 1980. Migration behavior of pronghorn in southeastern Idaho. Journal of Wildlife Management 44(1):132–144.

Idaho Department of Fish and Game (IDFG). 2015. Strategic Plan. Boise (ID): Idaho Department of Fish and Game.

Idaho Department of Fish and Game (IDFG). 2000. Policy for avian and mammalian predation management. Adopted by Idaho Fish and Game Commission, 24 August 2000. Boise (ID): Idaho Department of Fish and Game. http://idfg.idaho.gov/conservation/predators/policy-avian-mammalian (Accessed 9 Sep 2022).

Idaho Department of Fish and Game (IDFG). 2022a. Direction, FY2022–2025 Annual Strategic Plan. Boise (ID): Idaho Department of Fish and Game.

Idaho Department of Fish and Game (IDFG). 2022b. Idaho action plan (Version 4.0) for implementing the Department of the Interior Secretarial Order 3362: "Improving habitat quality in western big-game winter range and migration corridors". Boise (ID): Idaho Department of Fish and Game.

Idaho Department of Fish and Game (IDFG). 2022c. DRAFT Idaho State Wildlife Action Plan. Boise (ID): Idaho Department of Fish and Game.

Idaho Department of Labor (IDOL). 2021. Idaho 2020: Labor market and economic report. Boise (ID): Idaho Department of Labor. https://www.dol.gov/sites/dolgov/files/eta/Performance/pdfs/annual_economic_reports/2021/ID%20Labor_Market_Report_2020.pdf. (Accessed 23 September 2022).

Idaho Department of Parks and Recreation (IDPR). 2022. Statewide Comprehensive Outdoor Recreation (draft). Boise (ID): Idaho Department of Parks and Recreation. https://parksandrecreation.idaho.gov/wp-content/uploads/Draft-2023-SCORP.pdf (Accessed 23 September 2022).

Idaho Session Law. 1990. Chapter 370. In Cenarrusa PT, Secretary of State. General Laws of the State of Idaho. Boise (ID). p. 1007-1018. https://legislature.idaho.gov/wp-content/uploads/sessionlaws/sessionlaws_1990.pdf (Accessed 21 Sept 2022).

Jacques CN, Jenks JA, Grovenburg TW, Klaver RW. 2015. Influence of habitat and intrinsic characteristics on survival of neonatal pronghorn. PLoS ONE 10:e0144026.

Jakes AF. 2015. Factors influencing seasonal migrations of pronghorn across the Northern Sagebrush Steppe (dissertation). Calgary (AB): University of Calgary. https://prism.ucalgary.ca/handle/11023/2610.

Jakes AF. 2021. Pronghorn. In Remington TE, Deibert PA, Hanser SE, Davis DM, Robb LA, Welty JL, editors. Sagebrush Conservation Strategy—Challenges to Sagebrush Conservation. US Geological Survey Open-File Report 2020–1125. p. 37–42.

Jakes AF, Gates CC, DeCesare NJ, Jones PF, Goldberg JF, Kunkel KE, Hebblewhite M. 2018. Classifying the migration behaviors of pronghorn on their northern range. Journal of Wildlife Management 82: 1229–1242.

Jakes AF, DeCesare NJ, Jones PF, Gates CC, Story SJ, Olimb SK, Kunkel KE, Hebblewhite M. 2020. Multi-scale habitat assessment of pronghorn migration routes. PLoS ONE 15(12):e0241042.

Jesmer BR, Merkle JA, Goheen JR, Aikens EO, Beck JL, Courtemanch AB, Hurley MA, McWhirter DE, Miyasaki HM, Monteith KL, Kauffman MJ. 2018. Is ungulate migration culturally transmitted? Evidence of social learning from translocated animals. Science 361:1023–1025.

Johnson MK. 1979. Foods of primary consumers on cold desert shrub-steppe of southeastern Idaho. Journal of Range Management. 32:365–368.

Johnson BK, Lindzey FG, Guenzel RJ. 1991. Use of aerial line transect surveys to estimate pronghorn populations in Wyoming. Wildlife Society Bulletin 19(3):315–321.

Johnson M, MacGlover C, Peckham E, Killion H, Allen SE, Creekmore T, Edwards WH, Blaeser M, Davison M, Schwalbe E, Wray AK, Bragg TK, Sondgeroth KS, Malmberg JL. 2022. Source and seasonality of epizootic mycoplasmosis in free-ranging pronghorn (*Antilocapra americana*). Journal of Wildlife Diseases 58(3):524–536.

Jones NF, Pejchar L, Kiesecker JM. 2015. The energy footprint: How oil, natural gas, and wind energy affect land for biodiversity and the flow of ecosystem services. BioScience 65(3):290–301.

Jones PF, Hurly, TA, Jensen C, Zimmer K, Jakes A. 2017. Diel and monthly movement rates by migratory and resident female pronghorn. The Prairie Naturalist 49:3–12.

Jones PF, Jakes AF, Eacker DR, Hebblewhite M. 2020a. Annual pronghorn survival of a partially migratory population. Journal of Wildlife Management 84:1114–1126.

Jones PF, Jakes AF, MacDonald AM, Hanlon JA, Eacker DR, Martin BH, Hebblewhite M. 2020b. Evaluating responses by sympatric ungulates to fence modifications across the northern great plains. Wildlife Society Bulletin 44(1):130–141.

Jones PF, Jakes AF, Eacker DR, Seward BC, Hebblewhite M, Martin BH. 2018. Evaluating responses by pronghorn to fence modifications across the northern Great Plains. Wildlife Society Bulletin 42:225–236.

Jones PF, Jakes AF, Vegter SE, Verhage MS. 2022. Is it the road or the fence? Influence of linear anthropogenic features on the movement and distribution of a partially migratory ungulate. Movement Ecology 10:37.

Kauffman, M.J., E.O. Aikens, S. Esmaeili, P. Kaczensky, A. Middleton, K.L. Monteith, T.A. Morrison, T. Mueller, H. Sawyer, and J.R. Goheen. 2021. Causes, consequences, and conservation of ungulate migration. Annual Review of Ecology, Evolution, and Systematics 52:453–478.

Kauffman MJ, Copeland HE, Berg J, Bergen S, Cole E, Cuzzocreo M, Dewey S, Fattebert J, Gagnon J, Gelzer E, et al. 2020. Ungulate migrations of the western United States, Volume 1. Reston (VA): US Department of the Interior, US Geological Survey Scientific Investigations Report 2020–5101.

Kauffman M, Lowrey B, Beck J, Berg J, Bergen S, Berger J, Cain J, Dewey S, Diamond J, Duvuvuei O, et al. 2022. Ungulate migrations of the western United States, Volume 2. Reston (VA): US Department of the Interior, US Geological Survey Scientific Investigations Report 2022–5008.

Keegan TW, Ackerman BB, Aoude AN, Bender LC, Boudreau T, Carpenter LH, Compton BB, Elmer M, Heffelfinger JR, Lutz DW, Trindle BD, Wakeling BF, Watkins BE. 2011. Methods for monitoring mule deer populations. Boise (ID): Western Association of Fish and Wildlife Agencies, Mule Deer Working Group.

Koshmrl M. 2014 December 3. 100 pronghorn look to tough out winter in the Hole. Jackson Hole News & Guide. https://www.jhnewsandguide.com/news/environmental/100-pronghorn-look-to-tough-out-winter-in-the-hole/article_f3a307cb-996d-5032-9267-920dab05691b.html (Accessed 18 September 2022).

Kuck L, Nelson L, Turner J. 1990. Antelope. Boise (ID): Idaho Department of Fish and Game. Job Progress Report, Project W-170-R-14, 1 July 1989 – 30 June 1990.

Kuck L. 1994. Pronghorn Antelope. Boise (ID): Idaho Department of Fish and Game. Progress Report Project W-170-R-18, 1 July 1993 to 30 June 1994.

Lambert MS, Sawyer H, Merkle JA. 2022. Responses to natural gas development differ by season for two migratory ungulates. Ecological Applications e2652. https://doi.org/10.1002/eap.2652.

Leu M, Hanser SE, Aldridge CL, Nielsen SE, Suring LH, Knick ST. 2011. Occurrence of large and medium-sized mammals: Occurrence but not count models predict pronghorn distribution. In Hanser SE, Leu M, Knick ST, Aldridge CL, editors. Sagebrush Ecosystem Conservation and Management: Ecoregional assessment tools and models for the Wyoming Basins. Lawrence (KS): Allen Press. p. 315–336.

Linnell J, Aanes R, Andersen R. 1995. Who killed Bambi? The role of predation in the neonatal mortality of temperate ungulates. Wildlife Biology 1:209–223.

Lowrey B, McWhirter DE, Proffitt KM, Monteith KL, Courtemanch AB, White PJ, Paterson JT, Dewey SR, Garrott RA. 2020. Individual variation creates diverse migratory portfolios in native populations of a mountain ungulate. Ecological Applications 30(5):e2106.

Mackie RJ. 1976. Interspecific competition between mule deer, other game animals, and livestock. In Low JB, editor. Mule deer decline in the west: a symposium. Logan (UT): Utah State University, Agricultural Experiment Station. p. 49–54.

Maestas J, Jones M, Pastick NJ, Rigge MB, Wylie BK, Garner L, Crist M, Homer C, Boyte S, Witacre B. 2020. Annual herbaceous cover across rangelands of the sagebrush biome. US Geological Survey data release, https://doi.org/10.5066/P9VL3LD5.

Malpeli KC. 2022. Ungulate migration in a changing climate—An initial assessment of climate impacts, management priorities, and science needs. Reston (VA): US Department of the Interior, US Geological Survey Circular 1493.

Marshall AM, Abatzoglou JT, Link TE, Tennant CJ. 2019. Projected changes in interannual variability of peak snowpack amount and timing in the western United States. Geophysical Research Letters 46:8882–8892.

Mattson DJ, Holton PB. 2022. Use of water sources by pronghorn in a semi-arid Arizona grassland ecotone. Mountain Lion Ecology Project, Technical Paper MLEP-TP-2022-2.

McInnis MI, Vavra M. 1987. Dietary relationships among feral horses, cattle, and pronghorn in southeastern Oregon. Journal of Range Management 40(1):60–66.

Meehl GA, Tebaldi C, Walton G, Easterling D, McDaniel L. 2009. Relative increase of record high maximum temperatures compared to record low minimum temperatures in the U.S. Geophysical Research Letters 36:L23701.

Miller RF, Knick ST, Pyke DA, Meinke CW, Hanser SE, Wisdom MJ, Hild AL. 2011. Characteristics of sagebrush habitats and limitations to long-term conservation. Studies in Avian Biology 38:145–184.

Milligan MC, Johnston AN, Beck JL, Taylor KL, Hall E, Knox L, Cufaude T, Wallace C, Chong G, Kauffman MJ. 2023. Wind-energy development alters pronghorn migration at multiple scales. Ecology and Evolution 13:e9687.

Millspaugh J, DeVoe J, Proffitt K. 2021. Pronghorn Movement and Population Ecology. Federal Aid in Wildlife Restoration Grant W-176-R, Annual interim report. Helena (MT): Montana Fish, Parks, and Wildlife.

Mitchell CD, Maher CR. 2001. Are horn characteristics related to age in male pronghorns? Wildlife Society Bulletin 29:908–916.

Moeller AK, Lukacs PM, Horne JS. 2018. Three novel methods to estimate abundance of unmarked animals using remote cameras. Ecosphere 9(8):e02331.

Monroe AP, Drietz V, McPherron HH, Wightman CS. 2021. Land Use and Development. In Remington TE, Deibert PA, Hanser SE, Davis DM, Robb LA, Welty JL, editors. Sagebrush Conservation Strategy—Challenges to Sagebrush Conservation. US Geological Survey Open-File Report 2020–1125. p. 179–190.

Monteith KL, Long RA, Bleich VC, Heffelfinger JR, Krausman PR, Bowyer RT. 2013. Effects of harvest, culture, and climate on trends in size of horn-like structures in trophy ungulates. Wildlife Monographs 183:1–26.

Morton K, Jones PF, Grue M. 2008. Comparison between pronghorn age and horn size in Southern Alberta. Proceedings Pronghorn Workshop 23: 96–106.

Mote PW, Li S, Lettenmaier DP, Xiao M, Engel R. 2018. Dramatic declines in snowpack in the western US. Climate and Atmospheric Science 1(2). https://doi.org/10.1038/s41612-018-0012-1.

Murray TB. 1951. Statewide Trapping and Transplanting. Boise (ID): Idaho Department of Fish and Game. Completion Report Project W-75-D-4, 1 July 1950 to 30 June 1951.

Murray RB, Mayland HF, Van Soest PJ. 1978. Growth and nutritional value to cattle of grasses on cheatgrass range in southern Idaho. Ogden (UT): US Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Research Paper INT-199.

Musgrave RS, Parker S, Wolok M. 1993. The status of poaching in the United States—Are we protecting our wildlife? Natural Resources Journal 33:977–1014.

Musselman KN, Lehner F, Ikeda K, Clark MP, Prein AF, Liu C, Barlage M, Rasmussen R. 2018. Projected increases and shifts in rain-on-snow flood risk over western North America. Nature Climate Change 8:808–812.

Nelson ZJ, Weisberg PJ, Kitchen SG. 2014. Influence of climate and environment on post-fire recovery of mountain big sagebrush. International Journal of Wildland Fire 23(1):131–142.

Nicotra AB, Beever EA, Robertson AL, Hofmann GE, O'Leary J. 2015. Assessing the components of adaptive capacity to improve conservation and management efforts under global change. Conservation Biology 29:1268–1278.

O'Gara BW. 1978. Antilocapra americana. American Society of Mammalogists Mammalian species 90:1–7.

O'Gara BW, Yoakum JD, editors. 2004. Pronghorn Ecology and Management. Boulder (CO): University Press of Colorado.

Office of Energy and Mineral Resources (OEMR). 2022. Idaho Energy Landscape. Boise (ID): Idaho Governor's Office of Energy and Mineral Resources.

Oyster JH. 2014. Distance sampling as a technique to monitor pronghorn in Kansas [master's thesis]. Hays (KS): Fort Hays State University.

Paige C. 2020. Alberta Landholder's Guide to Wildlife Friendly Fencing. Sherwood Park (AB): Alberta Conservation Association.

Palencia P, Rowcliffe JM, Vicente J, Acevedo P. 2021. Assessing the camera trap methodologies used to estimate density of unmarked populations. Journal of Applied Ecology 58:1583–1592.

Panting BR, Gese EM, Conner MM, Bergen S. 2021. Factors influencing survival rates of pronghorn fawns in Idaho. Journal of Wildlife Management 85:97–108.

Pfannenstiel RS, Mullens BA, Ruder MG, Zurek L, Cohnstaedt LW, Nayduch D. 2015. Management of North American Culicoides biting midges: Current knowledge and research needs. Vector-Borne and Zoonotic Diseases 15(6):374–384.

Pfeffer SE, Spitzer R, Allen AM, Hofmeester TR, Ericsson G, Widemo F, Singh NJ, Cromsigt JPGM. 2018. Pictures or pellets? Comparing camera trapping and dung counts as methods for estimating population densities of ungulates. Remote Sensing in Ecology and Conservation 4:173–183.

Pfeiler SS, Conner MM, Mckeever JS, Stephenson TR, German DW, Crowhurst RS, Prentice PR, Epps CW. 2020. Costs and precision of fecal DNA mark-recapture versus traditional mark-resight. Wildlife Society Bulletin 44:531–542.

Pojar TM, Miller LLW. 1984. Recurrent estrus and cycle length in pronghorn. Journal of Wildlife Management 48:973–979.

Poor EE, Loucks C, Jakes A, Urban DL. 2012. Comparing habitat suitability and connectivity modeling methods for conserving pronghorn migration. PLoS ONE 7(11):e49390.

Purse BV, Mellor PS, Rogers DJ, Samuel AR, Mertens PP, Baylis M. 2005. Climate change and the recent emergence of bluetongue in Europe. Nature Reviews Microbiology 3:171–181.

Reinking AK, Smith KT, Mong TW, Read MJ, Beck JL. 2019. Across scales, pronghorn select sagebrush, avoid fences, and show negative responses to anthropogenic features in winter. Ecosphere 10(5):e02722. 10.1002/ecs2.2722.

Rimbey NR, Gardner RL, Patterson PE. 1991. Wildlife depredation policy development. Rangelands 13(6):272–275.

Rivera NA, Varga C, Ruder MG, Dorak SJ, Roca AL, Novakofski JE, Mateus-Pinilla NE. 2021. Bluetongue and epizootic hemorrhagic disease in the United States of America at the wildlife-livestock interface. Pathogens 10:915.

Robb BS, Merkle JA, Sawyer H, JL Beck, Kauffman MJ. 2022. Nowhere to run: semi-permeable barriers affect pronghorn space use. Journal of Wildlife Management 86:e22212.

Romme WH, Allen CD, Bailey JD, Baker WL, Bestelmeyer BT, Brown PM, Eisenhart KS, Floyd ML, Huffman DW, Jacobs BF, et al. 2009. Historical and modern disturbance regimes, stand structures, and landscape dynamics in piñon-juniper vegetation in the western United States. Rangeland Ecology and Management 62(3):203–222.

Rose H, Hoar B, Kutz SJ, Morgan ER. 2014. Exploiting parallels between livestock and wildlife: predicting the impact of climate change on gastrointestinal nematodes in ruminants. International Journal for Parasitology: Parasites and Wildlife. 3:209–219.

Rowland MM, Wisdom MJ, Johnson BK, Penninger MA. 2004. Effects of roads on elk: implications for management in forested ecosystems. Transactions of the North American Wildlife and Natural Resources Conference 69:491–508.

Rupp DE, Abatzoglou JT, Mote PW. 2017. Projections of 21st century climate of the Columbia River Basin. Climate Dynamics 49:1783–1799.

Rutherford RM. 1949. Ten years of Pittman-Robertson Wildlife Restoration, 1938–1948. Washington (DC): Wildlife Management Institute.

Rutherford RM. 1954. Five years of Pittman-Robertson Wildlife Restoration, 1949–1953. Washington (DC): Wildlife Management Institute.

Salwasser H. 1980. Pronghorn antelope population and habitat management in the northwestern Great Basin environments. Alturas (CA): Interstate Antelope Conference.

Samuel WM, Pybus MJ, Kocan AA, editors. 2001. Parasitic Diseases of Wild Mammals, Second Edition. Ames (IA): Iowa State University Press.

Sawyer H, Beckmann JP, Seidler RG, Berger J. 2019. Long-term effects of energy development on winter distribution and residency of pronghorn in the Greater Yellowstone Ecosystem. Conservation Science and Practice. 1:e83. https://doi.org/10.1111/csp2.83.

Sawyer H, Kauffman MJ. 2011. Stopover ecology of a migratory ungulate. Journal of Animal Ecology 80:1078–1087.

Sawyer H, Korfanta NM, Kauffman MJ, Robb BS, Telander AC, Mattson T. 2022. Trade-offs between utility-scale solar development and ungulates on western rangelands. Frontiers in Ecology and the Environment 20(6):345–351.

Sawyer H, Rodgers PA, Hart T. 2016. Pronghorn and mule deer use of underpasses and overpasses along U.S. Highway 191. Wildlife Society Bulletin 40(2):211–216.

Schoenecker KA, Doherty Jr PF, Hourt JS, Romero JP. 2018. Testing infrared camera surveys and distance analyses to estimate feral horse abundance in a known population. Wildlife Society Bulletin 42:452–459.

Schoenecker KA, King SRB, Ekernas LS, Oyler-McCance SJ. 2021. Using fecal DNA and closed-capture models to estimate feral horse population size. Journal of Wildlife Management 85:1150–1161.

Schroeder C. 2018. Western state and province pronghorn state report, 2018. Proceedings of the Western States and Provinces Pronghorn Workshop 28:29–35.

Schwartz CC, Nagy JG. 1976. Pronghorn diets relative to forage availability in Northeastern Colorado. Journal of Wildlife Management 40(3):469–478.

Seidler RG, Long RA, Berger J, Bergen S, Beckmann JP. 2015. Identifying impediments to long-distance mammal migrations. Conservation Biology 29:99–109.

Shinneman DJ, McIlroy SK. 2016. Identifying key climate and environmental factors affecting rates of postfire big sagebrush (Artemisia tridentata) recovery in the northern Columbia Basin, USA. International Journal of Wildland Fire 25(9):933–945.

Silverman NL, Maneta MP. 2016. Detectability of change in winter precipitation within mountain landscapes: spatial patterns and uncertainty. Water Resources Research 52:4301–4320.

Smith KT, Taylor KL, Albeke SE, Beck JL. 2020. Pronghorn winter resource selection before and after wind energy development in south-central Wyoming. Rangeland Ecology and Management 73(2):227–233.

Smyser TJ. 2005. Response of pronghorn (*Antilocapra americana*) populations to habitat conditions with modification to survey methods [master's thesis]. Moscow (ID): University of Idaho.

Smyser TJ, Guenzel RJ, Jacques CN, Garton EO. 2016. Double-observer evaluation of pronghorn aerial line-transect surveys. Wildlife Research 43:474–481.

Stauber EH, Autenrieth R, Markham OD, Whitbeck V. 1980. A seroepidemiologic survey of three pronghorn (*Antilocapra americana*) populations in southeastern Idaho, 1975-1977. Journal of Wildlife Diseases 16(1):109–115.

Strauss WM, Hetem RS, Mitchell D, Maloney SK, O'Brien HD, Meyer LCR, Fuller A. 2017. Body water conservation through selective brain cooling by the carotid rete: a physiological feature for surviving climate change? Conservation Physiology 5(1):cow078.

Switalski A. 2018. Off-highway vehicle recreation in drylands—A literature review and recommendations for best management practices. Journal of Outdoor Recreation and Tourism 21:87–96.

Tabak MA, Norouzzadeh MS, Wolfson DW, Sweeney SJ, Vercauteren KC, Snow NP, Halseth JM, Di Salvo PA, Lewis JS, White MD, et al. 2019. Machine learning to classify animal species in camera trap images: applications in ecology. Methods in Ecology and Evolution 10:585–590.

Taylor JC, Bates SB, Whiting JC, McMillan BR, Larsen RT. 2021. Using camera traps to estimate ungulate abundance: a comparison of mark-resight methods. Remote Sensing in Ecology and Conservation 8(1):32–44.

Taylor KL, Beck JL, Huzurbazar SV. 2016. Factors influencing winter mortality risk for pronghorn exposed to wind energy development. Rangeland Ecology and Management 69:108–116.

Taylor AR, Knight RL. 2003. Wildlife responses to recreation and associated visitor perceptions. Ecological Applications 13(4):951–963.

Terletzky PA, Koons DN. 2016. Estimating ungulate abundance while accounting for multiple sources of observation error. Wildlife Society Bulletin 40:525–536.

Thiessen J.1978. Antelope. Boise (ID): Idaho Department of Fish and Game. Progress Report Project W-170-R-1, 1 July 1976 to 30 June 1977.

Thomas AE, Rosentreter R. 1992. Utilization of lichens by pronghorn antelope in three valleys in east-central Idaho. Boise (ID): Bureau of Land Management, Idaho State Office. Technical Bulletin NO. 92-3.

Thurman LL, Stein BA, Beever EA, Foden W, Geange SR, Green N, Gross JE, Lawrence DJ, LeDee O, Olden JD, et al. 2020. Persist in place or shift in space? Evaluating the adaptive capacity of species to climate change. Frontiers in Ecology and Evolution 18(9):520–528.

Torbit SC, Gill RB, Alldredge AW, Liewer JC. 1993. Impacts of pronghorn grazing on winter wheat in Colorado. Journal of Wildlife Management 57:173–181.

Toweill D. 2002. Pronghorn Antelope. Boise (ID): Idaho Department of Fish and Game. Job Progress Report, Project W-170-R-26, 1 July 2001 – 30 June 2002.

Trent T, Naderman J. 1986. Antelope. Boise (ID): Idaho Department of Fish and Game. Progress Report Project W-170-R-8, 1 July 1983 to 30 June 1984.

Trent T, Naderman J, Parker T, Scott M, compilers. 1986. Antelope. Boise (ID): Idaho Department of Fish and Game. Progress Report Project W-170-R-10, 1 July 1985 to 30 June 1986.

Tucker RD, Garner GW. 1983. Habitat selection and vegetational characteristics of antelope fawn bedsites in west Texas. Journal of Range Management 36:110–113.

Twin Falls Times News. 1946, March 11. 64 Antelope transplanted from Challis section to rolling prairie country southwest of Castleford. *Twin Falls Times News*, p. 1. https://twinfalls.newspaperarchive.com/twin-falls-times-news/1946-03-11/

US Department of Agriculture (USDA). 2021. National Agricultural Statistics Service Cropland Data Layer. Washington (DC): USDA-NASS. Available at https://nassgeodata.gmu.edu/CropScape/ (Accessed 06 September 2022).

Van Moorter B, Engen S, Fryxell JM, Panzacchi M, Nilsen EB, Mysterud A. 2020. Consequences of barriers and changing seasonality on population dynamics and harvest of migratory ungulates. Theoretical Ecology 13:595–605.

Walker RN. 2012. Pronghorn state and provincial status reports and long-term trends. Proceedings of the Western States and Provinces Pronghorn Workshop 25:72–88.

Wang T, Hamann A, Spittlehouse D, Carroll C. 2016. Locally downscaled and spatially customizable climate data for historical and future periods for North America. PLoS ONE 11(6): e0156720.

Weaver JH. 2013. The role of parasites, diseases, mineral levels, and low fawn survival in a declining pronghorn population in the Trans-Pecos region of Texas [master's thesis]. Alpine (TX):Sul Ross State University.

Weber KT. 2021. Historic Fires Database, version 4.0. Pocatello (ID):Idaho State University GIS Training and Research Center. Available at http://giscenter.isu.edu/research/Techpg/HFD/ (Accessed 12 October 2021).

Whisenant SG. 1990. Changing fire frequencies on Idaho's Snake River plains—Ecological and management implications. In McArthur ED, Romney EM, Smith SD, Tueller PT, editors. Proceedings—Symposium on cheatgrass invasion, die-off, and other aspects of shrub biology and management. Ogden (UT): US Department of Agriculture, Forest Service, Intermountain Research Station. General Technical Report INT–276 p. 4–10.

White PJ, Davis TL, Barnowe-Meyer KK, Crabtree RL, Garrott RA. 2007. Partial migration and philopatry of Yellowstone pronghorn. Biological Conservation 135:502–510.

Wisdom MJ, Ager AA, Preisler HK, Cimon NJ, Johnson BK. 2004. Effects of off-road recreation on mule deer and elk. In Rahm J, editor. Transactions of the 69th North American Wildlife and Natural Resources Conference. Washington (DC):Wildlife Management Institute, Washington, DC. p. 531–550.

Woodruff SP, Lukacs PM, Christianson D, Waits LP. 2016. Estimating Sonoran pronghorn abundance and survival with fecal DNA and capture-recapture methods. Conservation Biology 30:1102–1111.

Xu W, Gigliotti LC, Royauté R, Sawyer H, Middleton AD. 2023. Fencing amplifies individual differences in movement with implications on survival for two migratory ungulates. Journal of Animal Ecology 00:1–13.

Yoakum JD, Jones PF, Cancino J, Guenzel RJ, Seidler R, Munguia-Vega A, Cassaigne I, Culver M. 2014. Pronghorn management guides, Fifth edition. Santa Ana Pueblo (NM): Western Association of Fish and Wildlife Agencies' Pronghorn Workshop and New Mexico Department of Game and Fish.

Yoakum JD, O'Gara BW. 2000. Pronghorn. In Demarais S, Krausman PR, editors. Ecology and Management of Large Mammals in North America. Upper Saddle River (NJ): Prentice-Hall. p. 559–577.

Zabransky CJ, Hewitt DG, DeYoung RW, Gray SS, Richardson C, Litt AR, DeYoung CA. 2016. A detection probability model for aerial surveys of mule deer. Journal of Wildlife Management 80:1379–1389.

Zeller KA, Schroeder CA, Wan HY, Collins G, Deryter K, Jakes AF, Cushman SA. 2021. Forecasting habitat and connectivity for pronghorn across the Great Basin ecoregion. Diversity and Distributions 27(12):2315–2329.

Zuliani A, Massolo A, Lysyk T, Johnson G, Marshall S, Berger K, Cork SC. 2015. Modelling the northward expansion of Culicoides sonorensis (Diptera: Ceratopogonidae) under future climate scenarios. PLoS ONE 10(8): e0130294.

APPENDIX A: Common and Scientific Names of Species in the Text

Taxa	Common name	Scientific name
Mammal	Bighorn sheep (includes California and Rocky Mountain)	*Ovis canadensis canadensis*
Mammal	Elk	*Cervus canadensis*
Mammal	Mule deer	*Odocoileus hemionus*
Mammal	White-tailed deer	*Odocoileus virginianus*
Mammal	Pronghorn	*Antilocapra americana*
Mammal	Mountain goat	*Oreamnos americanus*
Mammal	Gray wolf	*Canis lupus*
Mammal	Coyote	*Canis latrans*
Mammal	Mountain lion	*Puma concolor*
Mammal	Bobcat	*Lynx rufus*
Mammal	Black bear	*Ursus americanus*
Mammal	Cattle	*Bos taurus*
Mammal	Feral horse	*Equus caballus*
Mammal	Domestic sheep	*Ovis aries*
Bird	Golden Eagle	*Aquila chrysaetos*
Bird	Greater Sage-Grouse	*Centrocercus urophasianus*
Nematode	Barber Pole Worm	*Haemonchus contortus*
Insect	Biting flies	*Culicoides* spp.
Grass	Cheatgrass	*Bromus tectorum*
Grass	Crested wheatgrass	*Agropyron cristatum*
Grass	Medusahead	*Taeniatherum caput-medusae*
Grass	Red brome	*Bromus madritensis*
Grass	Ventenata	*Ventenata dubia*
Grass	Wheat	*Triticum* spp.
Grass	Barley	*Hordeum vulgare*
Forb	Alfalfa	*Medicago sativa*
Forb	Rush skeletonweed	*Chondrilla juncea*
Forb	knapweeds	*Centaurea* spp.
Shrub	Common winterfat	*Krascheninnikovia lanata*
Shrub	Sagebrush	*Artemisia* spp.
Shrub	Low sagebrush	*Artemisia arbuscula*
Shrub	Black sagebrush	*Artemisia nova*
Shrub	Basin big sagebrush	*Artemisia tridentata tridentata*
Shrub	Mountain big sagebrush	*Artemisia tridentata vaseyana*
Shrub	Wyoming big sagebrush	*Artemisia tridentata wyominensis*
Shrub	Juniper	*Juniperus* spp.
Shrub	Yew	*Taxus* spp.
Tree	Aspen	*Populus tremuloides*
Tree	Lodgepole Pine	*Pinus contorta*
Tree	Douglas Fir	*Pseudotsuga menziesii*
Tree	Subalpine Fir	*Abies lasiocarpa*
Tree	Pinyon pine	*Pinus monophylla*

APPENDIX B: Modeling Potential Pronghorn Habitat in Idaho

Several modeling approaches have been used to improve understanding of pronghorn habitat use and distribution (e.g., Leu et al. 2011, Poor et al. 2012, Duncan et al. 2016, Jakes et al. 2020, Zeller et al. 2021); however, none provide potential distribution information for pronghorn in Idaho using Idaho observation data. To aid in development of this management plan, we created a preliminary model of pronghorn annual distribution using maximum entropy methods (Maxent 3.4.1; Phillips et al. 2006, Phillips and Dudík 2008, Phillips et al. 2017). Given a set of environmental variables and species presence locations, Maxent identifies correlations between each variable and presence data, compares those correlations with the range of environmental conditions available in the modeled region, and develops a continuous model of relative likelihood, or probability, of suitable habitat across the study area based on environmental similarity to known occupied sites. Our modeling process incorporated several environmental variables hypothesized to influence distributions of pronghorn in the previously mentioned efforts. All spatial analyses were conducted in ArcGIS 10.8.1 (ESRI 2020), with a common geographic coordinate system, resolution (30 m x 30 m), and extent; then exported as ASCII files for input into R 4.0.0 (R Core Team 2020) and Maxent.

Pronghorn Observations

We compiled all known observations of pronghorn in Idaho as of 1 June 2021. We included observations from numerous GPS-collared animal studies (2004–2020), helicopter and fixed-wing survey efforts, remote camera survey detections, FS Natural Resource Information System database, IDFG regional data files, and IFWIS Species Diversity Database (including museum specimens, older survey efforts, and incidental observations). We uploaded compiled data to the IFWIS Species Diversity Database for long-term data storage and accessibility.

We carefully evaluated all data for use in the distribution model to ensure observational, spatial, and temporal accuracy. We compiled and categorized over 320,000 observations as verified (e.g., specimen, DNA, or photograph) or trusted (e.g., documented by a biologist, researcher, or taxonomic expert) and as having sufficient spatial accuracy (≤500 m) for our modeling purposes. However, compiled observation data such as these are prone to errors of sampling bias, both geographically and environmentally. Given most observations came from GPS-collared animals in IDFG Regions 3, 4, 6 and 7, data exhibited spatial clustering at fine scales in these portions of the state. In addition, data were lacking in known areas of occupancy including the Weiser area (Region 3) and southeast Idaho (Region 5).

Species distribution models can be sensitive to such locational data bias and spatial filtering is a solution to that sensitivity (Phillips et al. 2009, Kramer-Schadt et al. 2013, Boria et al. 2014, Radosavljevic and Anderson 2014). Spatial filtering involves randomly subsampling presence data with a minimum distance separating sample points, thereby limiting spatial autocorrelation and reducing environmental bias caused by uneven sampling. The minimum distance used is somewhat arbitrary and depends on environmental conditions of the study area as well as resolution of data

used for modeling. We reduced locally dense sampling of pronghorn by randomly subsampling with a minimum distance of 800 m. These filtering procedures (verified or trusted, ≤500-m accuracy, within Idaho, and >800-m separation) resulted in 10,970 observations available for use in our modeling effort (Figure B1).

Environmental Variables

Previous modeling efforts have focused on suites of topographic, vegetative, climatic, and disturbance covariates at a variety of spatial scales. We selected similar variables from a subset of fine-scale (30-m resolution) topographic, climatic, and landscape covariates (Table B1) which were already developed for use in other statewide species distribution modeling projects (LK Svancara, IDFG, unpublished data).

Topographic variables generally act as surrogates for factors influencing plant growth (e.g., temperature, light, and soils), but can also directly account for differences in local climate and be important in species distribution models (SDMs) (Luoto and Heikkinen 2008, Austin and Van Niel 2011). We included several topographic variables derived from National Elevation Data (30 m) (USGS 2016). The compound topographic index (CTI) measures catenary topographic position represented by slope and catchment size and aims to model soil water content (Moore et al. 1993). Roughness, like terrain ruggedness index (Riley et al. 1999), calculates amount of elevation difference between a grid cell and its neighbors; essentially variance of elevation within a neighborhood (8×8 cells in this analysis). The vector ruggedness measure (VRM), which measures terrain heterogeneity within a neighborhood (9×9 cells in this analysis), captures variability in both slope and aspect into a single measure (Sappington et al. 2007). We calculated CTI and roughness using Evans et al. (2014) and VRM using Sappington (2012), both freely available ArcGIS tools. All topographic variables, to varying degrees, were selected to reflect temperature, water, and light resources which may contribute to pronghorn distributions either directly (e.g., temperature) or indirectly (e.g., habitat). For example, CTI and roughness may serve as proxies for local temperature patterns (e.g., cold air drainage), whereas VRM, slope, and aspect act as surrogates for light or solar radiation.

Climatic variables typically used in SDMs rely on temperature and precipitation at moderate (~1 km) spatial resolution (Hijmans et al. 2005, Wang et al. 2012, Daly et al. 2015). To better represent Idaho climate, we used temperature data developed at finer spatial resolution (250 m) for the Northern Rocky Mountains (Holden et al. 2015) in combination with precipitation data (originally 800 m, resampled to 250 m resolution using cubic convolution) from the Parameterized Regression on Independent Slopes Model (PRISM, Version 14.1-20140502-1000) (PRISM Climate Group 2012, Daly et al. 2015). Both datasets represent monthly 30-year normals covering 1981–2010, from which we calculated 19 bioclimatic variables following Nix (1986) and Hijmans et al. (2005). These bioclimatic variables have been used extensively in SDMs for decades and characterize climatic conditions best related to species physiology (O'Donnell and Ignizio 2012, Booth et al. 2014).

Vegetation characteristics typically identified as important to pronghorn include height, canopy cover, and presence of sagebrush. We developed several representative variables from LANDFIRE 2016 land cover classification (USGS 2019) (Table B1). In addition, we included distance to intermittent streams and distance to perennial streams and waterbodies based on National Hydrography Data (USGS 2017) (FCodes 46006 and 46003, respectively). We did not include anthropogenic features and linear barriers (e.g., fences, roads, railways), which may influence pronghorn habitat use and distribution, due to a lack of readily available spatial data.

Current Habitat Suitability

We supplied Maxent with occurrence data as described above, as well as background points consisting of approximately 25,000 randomly generated pseudo-absences across Idaho which were >800 m apart, >800 m from presence locations, and outside of waterbodies. Following recommended approaches (Elith et al. 2010, 2011; Anderson and Gonzalez 2011; Merow et al. 2013; Porfirio et al 2014; Radosavljevic and Anderson 2013), we addressed collinearity and calculated species-specific model parameters for the regularization multiplier and feature types.

In an iterative approach, we optimized each model for regularization multiplier (values tested included 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, 10) and feature types (linear, quadratic, product, threshold, hinge, and interactions) using the *enmSdm* package (Smith 2017) in R 4.0.0 (R Core Team 2020) and selected the best performing combination based on AICc (Warren and Seifert 2011, Wright et al. 2015). Beginning with a full model inclusive of all covariates (n = 40), we implemented 5-fold cross-validation with jackknifing to measure importance of each variable to the resulting model. Variables were then ranked based on their permutation importance and removed if <2%. Correlated variables with P >0.75 were also removed, keeping the variable with higher permutation importance. This iterative process of model optimization, development, and variable ranking and removal was repeated until remaining variables displayed a minimum importance of ≥2%. Final models represent the average of 5 replicates using the optimized parameters and most important variables.

We imported the mean model output into ArcGIS 10.8.1 (ESRI 2020) and, after careful evaluation of Maxent calculated model thresholds, defined suitable habitat based on the "balance training omission, predicted area and threshold value area" threshold (Table B2). Lower thresholds, such as this, may overestimate suitable habitat (Radosavljevic and Anderson 2014) but can be useful in identifying areas of potential habitat with unknown occupancy status (Pearson et al. 2007).

Results and Discussion

Maxent accurately predicted pronghorn annual distribution (Area Under Curve [AUC] = 0.799) with the best-fit model based on AICc including linear, product, and hinge features with a regularization multiplier of 0.5. Averaged over 5 replicate runs, the most important variables were precipitation in the coldest quarter (bio19), elevation, precipitation seasonality (bio15), distance to dense (>60%) canopy cover, distance to steep (>30°) slope, tree canopy cover, maximum temperature of the warmest month (bio5), and percent natural landscape within 1km (in order of permutation

importance) (Figure B2). Jackknife tests indicated precipitation in the coldest quarter (bio19) had the most useful information both by itself and the most information that was not present in other variables. Predicted pronghorn suitability was greatest in areas of low winter precipitation and moderate elevation, with moderate to high precipitation seasonality (annual variability) and moderate maximum summer temperatures. These areas were generally characterized as open areas at greater distance from dense canopy and steep slopes and with a greater proportion of surrounding natural landscapes.

Because selection of specific model thresholds is somewhat arbitrary and biologically meaningful thresholds can be difficult to determine, careful consideration of resulting model accuracy is necessary and reporting a range of threshold values is often recommended (Liu et al. 2005, Merow et al. 2013). Using the selected threshold described above, our final pronghorn model predicted 79,750 km^2 (30,790 mi^2) of suitable habitat across the state (Figure 2). Little observation data are available outside of SRD boundaries which may indicate that few, if any, pronghorn regularly occur in these areas despite the presence of modeled suitable habitat. Additional observations (incidental and survey) would likely improve model results in these areas.

Additional biologic- and programmatic-model refinements may improve model results. Biologically, developing region-specific and season-specific models would address the sometimes dramatically different landscapes used by pronghorn across the state at different times of the year. Programmatically, further refinement of background data, as well as inclusion of different covariates, may result in better fitting models. Because Maxent uses background locations where presence or absence of target species is unknown or unmeasured, choice of background data influences what is modeled and perceptions about results (Elith et al. 2011, Merow et al. 2013). By default, Maxent assumes the species is equally likely to be anywhere in the study extent (Phillips and Dudík 2008), thus, modifying the background sample is equivalent to modifying prior expectations for species distribution (Merow et al. 2013). Assessing a range of background extents, instead of just the full extent of IDFG Regions 3-7, may increase model performance (e.g., VanDerWal et al. 2009, Anderson and Raza 2010, Iturbide et al. 2015). Similarly, including additional covariates such as landscape disturbance (e.g., roads, fences), Normalized Difference Vegetation Index, solar radiation, snow depth, and multi-scale variations of these covariates, may improve model performance. Lastly, assessing potential future changes in modeled distribution of pronghorn under various climate change scenarios would be beneficial.

Literature Cited

Anderson RP, Gonzalez Jr I. 2011. Species-specific tuning increases robustness to sampling bias in models of species distributions: an implementation with Maxent. Ecological Modelling 222:2796–2811.

Anderson RP, Raza A. 2010. The effect of the extent of the study region on GIS models of species geographic distributions and estimates of niche evolution: preliminary test with montane rodents (genus *Nephelomys*) in Venezuela. Journal of Biogeography 37:1378–1393.

Austin MP, Van Niel KP. 2011. Improving species distribution models for climate change studies: variable selection and scale. Journal of Biogeography 38:1–8.

Booth TH, Nix HA, Busby JR, Hutchinson MF. 2014. BIOCLIM: the first species distribution modelling package, its early applications and relevance to most current MaxEnt studies. Diversity and Distributions 20:1–9.

Boria RA, Olson LE, Goodman SM, Anderson RP. 2014. Spatial filtering to reduce sampling bias can improve the performance of ecological niche models. Ecological Modelling 275:73–77.

Daly C, Smith JI, Olson KV. 2015. Mapping atmospheric moisture climatologies across the conterminous United States. PLoS ONE 10:e0141140.

Duncan NP, Kahl SS, Gray SS, Salice CJ, Stevens RD. 2016. Pronghorn habitat suitability in the Texas Panhandle. Journal of Wildlife Management 80(8):1471-1478.

Elith J, Kearney M, Phillips S. 2010. The art of modeling range-shifting species. Methods in Ecology and Evolution 1:330–342.

Elith J, Phillips SJ, Hastie T, Dudík M, Chee YE, Yates CJ. 2011. A statistical explanation of MaxEnt for ecologists. Diversity and Distributions 17:43–57.

ESRI. 2020. ArcGIS 10.8.1. Redlands (CA): ESRI.

Evans JS, Oakleaf J, Cushman SA. 2014. An ArcGIS toolbox for surface gradient and geomorphometric modeling, version 2.0-0. <https://github.com/jeffreyevans/GradientMetrics>. Accessed 4 April 2020.

Hijmans RJ, Cameron SE, Parra JL, Jones PG, Jarvis A. 2005. Very high resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25:1965–1978.

Holden ZA, Swanson A, Klene AE, Abatzoglou JT, Dobrowski SZ, Cushman SA, Squires J, Moisen GG, Oyler JW. 2015. Development of high-resolution (250 m) historical daily gridded air temperature data using reanalysis and distributed sensor networks for the US Northern Rocky Mountains. International Journal of Climatology DOI: 10.1002/joc.4580.

Iturbide M, Bedia J, Herrera S, del Hierro O, Pinto M, Gutierrez JM. 2015. A framework for species distribution modelling with improved pseudo-absence generation. Ecological Modelling 312:166–174.

Jakes AF, DeCesare NJ, Jones PF, Gates CC, Story SJ, Olimb SK, Kunkel KE, Hebblewhite M. 2020. Multi-scale habitat assessment of pronghorn migration routes. PLoS ONE 15(12):e0241042.

Kramer-Schadt S, Niedballa J, Pilgrim JD, Schröder B, Lindenborn J, Reinfelder V, Stillfried M, Heckmann I, Scharf AK, Augeri DM, et al. 2013. The importance of correcting for sampling bias in MaxEnt species distribution models. Diversity and Distributions 19:1366–1379.

Leu M, Hanser SE, Aldridge CL, Nielsen SE, Suring LH, Knick ST. 2011. Occurrence of large and medium-sized mammals: Occurrence but not count models predict pronghorn distribution. In Hanser SE, Leu M, Knick ST, Aldridge CL, editors. Sagebrush Ecosystem Conservation and Management: Ecoregional assessment tools and models for the Wyoming Basins. Lawrence (KS): Allen Press. p. 315–336.

Liu C, Berry PM, Dawson TP, Pearson RG. 2005. Selecting thresholds of occurrence in the prediction of species distributions. Ecography 28:385–393.

Luoto M, Heikkinen RK. 2008. Disregarding topographical heterogeneity biases species turnover assessments based on bioclimatic models. Global Change Biology 14:483–494.

Merow C, Smith MJ, Silander JA Jr. 2013. A practical guide to MaxEnt for modeling species' distributions: what it does, and why inputs and settings matter. Ecography 36:1058–1069.

Moore ID, Gessler PE, Nielsen GA, Petersen GA. 1993. Terrain attributes: estimation methods and scale effects. In Jakeman AJ, Beck MB, McAleer MJ, editors. Modeling change in environmental systems. London (UK): Wiley. p. 189–214.

Nix HA. 1986. A biogeographic analysis of Australian elapid snakes. In Longmore R, editor. Atlas of elapid snakes of Australia. Canberra (AU): Australian Government Publishing Service. Australian flora and fauna series number 7:4–15.

O'Donnell MS, Ignizio DA. 2012. Bioclimatic predictors for supporting ecological applications in the conterminous United States. Reston (VA): US Geological Survey, Data Series 691.

Phillips SJ, Anderson RP, Dudík M, Schapire RE, Blair ME. 2017. Opening the black box: an open-source release of Maxent. Ecography 40:887–893.

Phillips SJ, Anderson RP, Schapire RE. 2006. Maximum entropy modeling of species geographic distributions. Ecological Modelling 190:231–259.

Phillips SJ, Dudík M. 2008. Modeling of species distributions with Maxent: new extensions and a comprehensive evaluation. Ecography 31:161–175.

Phillips SJ, Dudík M, Elith J, Graham CH, Lehmann A, Leathwick J, Ferrier S. 2009. Sample selection bias and presence-only distribution models: implications for background and pseudo-absence data. Ecological Applications 19:181–197.

Poor EE, Loucks C, Jakes A, Urban DL. 2012. Comparing habitat suitability and connectivity modeling methods for conserving pronghorn migrations. PLoS ONE 7(11):e49390.

Porfirio LL, Harris RMB, Lefroy EC, Hugh S, Gould SF, Lee G, Bindoff NL, Mackey B. 2014. Improving the use of species distribution models in conservation planning and management under climate change. PLoS ONE 9:11.

PRISM Climate Group. 2012. 30-year normal monthly climate data, 1981–2010 (800 m). <http://www.prism.oregonstate.edu/>. Accessed 5 Jun 2018.

R Core Team. 2020. R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org>. Accessed 5 Apr 2020.

Radosavljevic A, Anderson RP. 2014. Making better Maxent models of species distributions: complexity, overfitting and evaluation. Journal of Biogeography 41:629–643.

Riley SJ, DeGloria SD, Elliot R. 1999. A terrain ruggedness index that quantifies topographic heterogeneity. Intermountain Journal of Sciences 5:1–4.

Sappington M. 2012. Vector Ruggedness Measure (Terrain Ruggedness) ArcGIS tools. <https://www.arcgis.com/home/item.html?id=9e4210b3ee7b413bbb1f98fb9c5b22d4>. Accessed 1 March 2018.

Sappington JM, Longshore KM, Thompson DB. 2007. Quantifying landscape ruggedness for animal habitat analysis: a case study using bighorn sheep in the Mojave Desert. Journal of Wildlife Management 71:1419–1426.

Smith AB. 2017. *enmSdm*: tools for modeling species niches and distributions. R package version 0.3.0.0. <https://github.com/adamlilith/enmSdm>. Accessed 30 March 2020.

US Geological Survey (USGS). 2016. 1 arc-second Digital Elevation Models (DEMs) – USGS national map 3DEP downloadable data collection. <https://catalog.data.gov/dataset/4c7396d3-21c7-4cc2-8c34-e42c4cc50ec3>. Accessed 18 August 2017.

US Geological Survey (USGS). 2017. National hydrography dataset (NHD) for Idaho, Version 2.2.0. <https://usgs.gov/core-science-systems/ngp/tnm-delivery/>. Accessed 1 May 2017.

US Geological Survey (USGS). 2019. LANDFIRE existing vegetation product suite. <https://www.landfire.gov/>. Accessed 5 April 2020.

VanDerWal J, Shoo LP, Graham C, Williams SE. 2009. Selecting pseudo-absence data for presence-only distribution modeling: how far should you stray from what you know? Ecological Modelling 220:589–594.

Wang T, Hamann A, Spittlehouse DL, Murdock TQ. 2012. ClimateWNA—high-resolution spatial climate data for western North America. Journal of Applied Meteorology and Climatology 51:16–29.

Warren DL, Siefert SN. 2011. Ecological niche modeling in Maxent: the importance of model complexity and the performance of model selection criteria. Ecological Applications 21:335–342.

Wright AN, Hijmans RJ, Schartz MW, Shaffer HB. 2015. Multiple sources of uncertainty affect metrics for ranking conservation risk under climate change. Diversity and Distributions 21:111–122.

Zeller KA, Schroeder CA, Wan HY, Collins G, Denryter K, Jakes AF, Cushman SA. 2021. Forecasting habitat and connectivity for pronghorn across the Great Basin ecoregion. Diversity and Distributions 27(12):2315-2329.

Table B1. Environmental variables used in modeling pronghorn distributions in Idaho.

Type	Variable	Code	Units	Source
Topography	Aspect	Asp	Degree	3D Elevation Program (USGS 2016), Evans et al. (2014) [CTI and Rough8], Sappington et al. (2007) [VRM]
	Slope	Slp	Degree	
	Elevation	Elev	m	
	Distance to steep slopes (>30°)	D2Slp	m	
	Compound Topographic Index	CTI	Index	
	Roughness (250m neighborhood)	Rough8	m	
	Topographic Solar-Radiation Index	TRASP10	Index	
	Heat Load Index	HLI	Index	
	Relative Slope Position (250m neighborhood)	SLPPOST10	Index	
	Vector Ruggedness Measure (250m neighborhood)	VRM	Index	
	Solar Radiation Index	SRI	Index	Aycrigg et al. (2017)
Climate	Mean annual temperature	Bio1	°C	Holden et al. (2015), PRISM (2012), *dismo* package in R.
	Mean diurnal range	Bio2	°C	
	Isothermality (bio2 / bio7) (*100)	Bio3	%	
	Temperature seasonality (std deviation * 100)	Bio4	°C	
	Maximum temperature of warmest month	Bio5	°C	
	Minimum temperature of coldest month	Bio6	°C	
	Temperature annual range (bio5 – bio6)	Bio7	°C	
	Mean temperature of the wettest quarter[1]	Bio8	°C	
	Mean temperature of the driest quarter[1]	Bio9	°C	
	Mean temperature of warmest quarter[1]	Bio10	°C	
	Mean temperature of coldest quarter[1]	Bio11	°C	
	Total annual precipitation	Bio12	mm	
	Precipitation of wettest month	Bio13	mm	
	Precipitation of driest month	Bio14	mm	
	Precipitation seasonality (coefficient of variation)	Bio15	%	
	Precipitation of wettest quarter[1]	Bio16	mm	
	Precipitation of driest quarter[1]	Bio17	mm	
	Precipitation of warmest quarter[1]	Bio18	mm	
	Precipitation of coldest quarter[1]	Bio19	mm	
	Annual mean growing degree days	gdd	*n*	
Land cover	Natural land cover (within 300 m)	PN300	%	LANDFIRE 2016 (USGS 2019)
	Natural land cover (within 1000 m)	PN1000	%	
	Heraceous canopy cover	HbCC	%	
	Shrub canopy cover	ShCC	%	
	Tree canopy cover	TreeCC	%	
	Distance to >60% tree canopy cover	D2CC60	m	
	Tree and shrub height	TSHght	m	
Water	Distance to all perennial streams and lakes	D2Peren	m	National Hydrography Data (USGS 2017)
	Distance to intermittent streams	D2Inter	m	

[1] Quarter is any 3-month time period.

Table B2. Maxent modeled Cloglog thresholds used in aiding interpretation of habitat suitability. Values used in displaying final model are highlighted in bold.

Threshold	PH r1
Prevalence	0.3287
Minimum training presence	0.0006
10 percentile training presence	0.4059
Equal test sensitivity and specificity	0.5754
Maximum test sensitivity plus specificity	0.4141
Balance training omission, predicted area and threshold value area	0.12
Equate entropy of thresholded and original distributions	0.1881

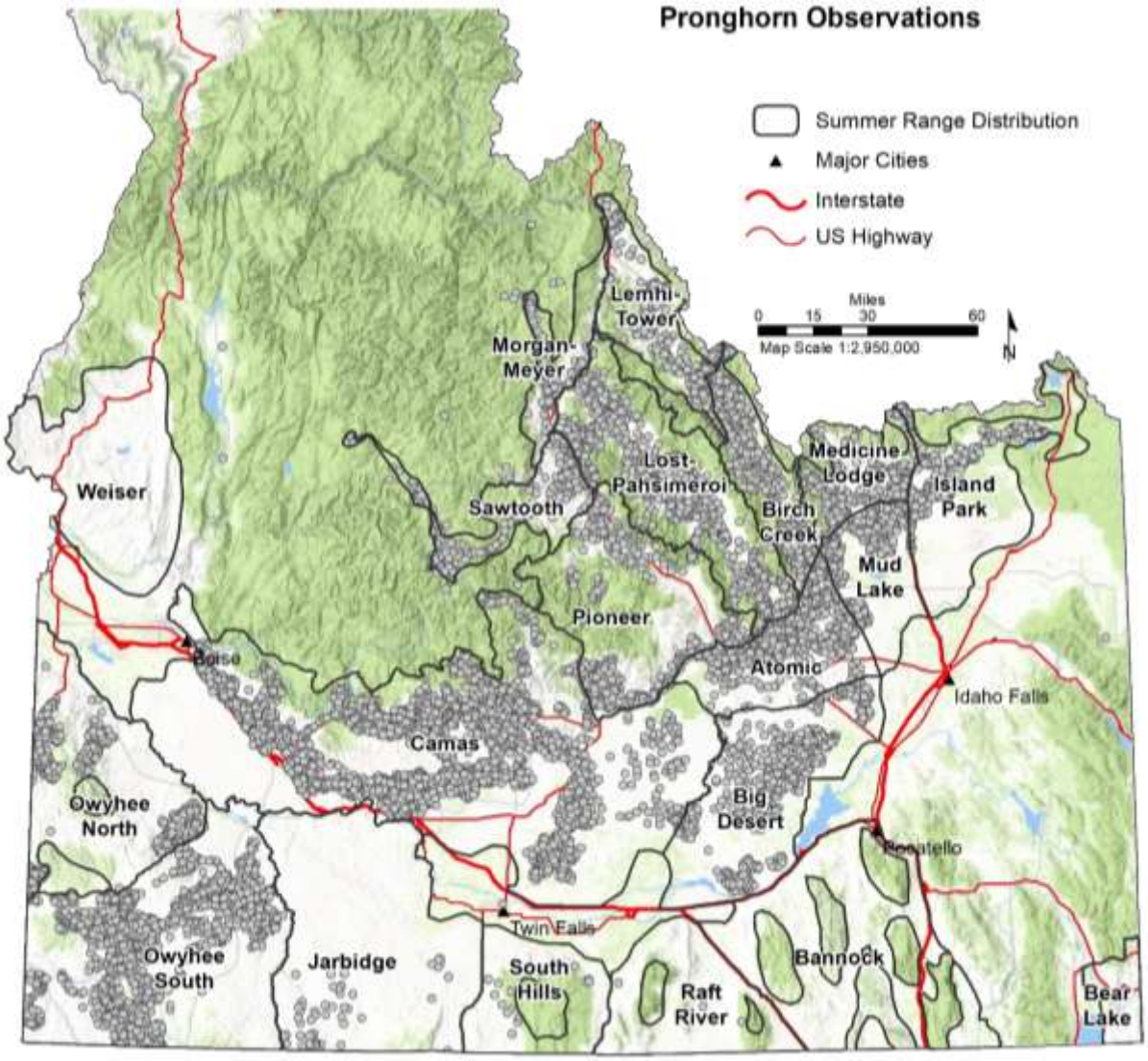
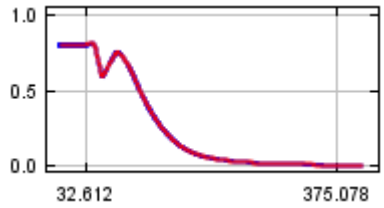
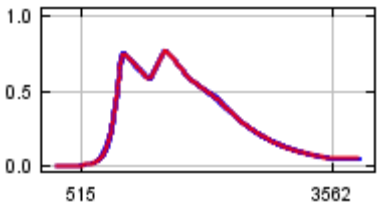


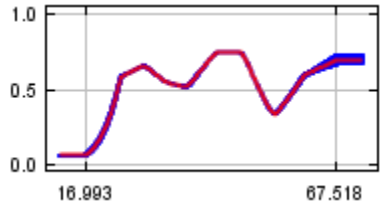
Figure B1. Pronghorn observations (1874-2020) used in distribution modeling in Idaho. Point data are from various Idaho Department of Fish and Game databases as of 1 June 2021 and are filtered to include only verified or trusted locations with ≤500 m accuracy and >800 m apart.



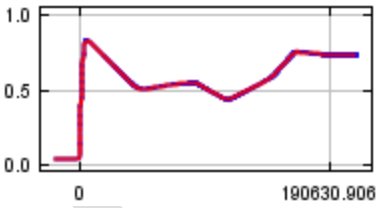
Precipitation of coldest quarter (Bio19)



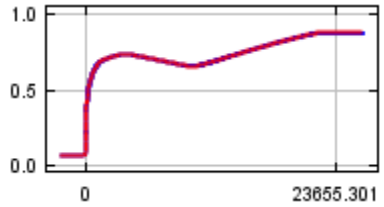
Elevation (Elev)



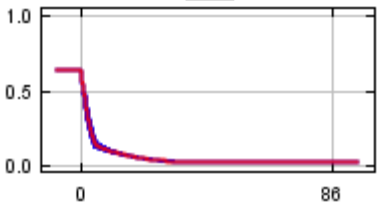
Precipitation seasonality (Bio15)



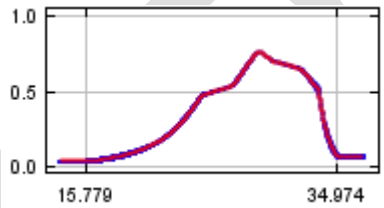
Distance to Dense (>60%) Canopy Cover (D2CC60)



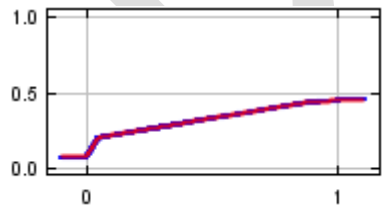
Distance to Steep (>30°) Slope (D2Slp)



Tree Canopy Cover (TreeCC)



Maximum temperature of warmest month (Bio5)



Percent natural landscape within 1km (PN1000)

Variable	Permutation Importance
Bio19	30.2
Elev	18.3
Bio15	12.9
D2CC60	9.9
D2Slp	8.7
TreeCC	7.8
Bio5	6.4
PN1000	5.8

Figure B2. Response curves and permutation importance for the most important variables (see Table B1 for codes) in the final distribution model for pronghorn. Each of the curves represents a model created using only that variable, thus these plots reflect dependence of predicted suitability both on the selected variable and on dependencies induced by correlations among selected variable and other variables. Mean response of 5 replicate runs is in red and mean +/- 1 standard deviation is in blue.

APPENDIX C: Translocations of Pronghorn in Idaho

Table C1. Documented pronghorn translocations in or near Idaho, 1946–2022. Data shown represent the best supported values as inconsistencies in dates, locations, sex-age composition, or total numbers often occur among sources.

Date	Capture Site		Release Site		Adults		Fawns		Total	Source
	GMU[a]	Location (County)	GMU[a]	Location (County)	M	F	M	F		
Jan 1946	36B?	Challis (Custer)	73	Holbrook–Malad (Oneida)	41	41	-	-	82[b]	Davis 1946, Twin Falls Times News 1946, Beck 1946
10 Mar 1946	36B?	Challis (Custer)	46, 47	Grassy Hill, West of House Creek, SW of Castleford (Owyhee)	32	32	-	-	64[b]	
Mar 1948	50?	Big Lost River (Custer?)	46, 47	Devil Creek (Owyhee)	-	-	-	-	101[c]	Murray 1948, Edson 1949, Shaw 1950
Mar 1948	50?	Big Lost River (Custer?)	56	SW of Holbrook (Oneida)	-	-	-	-	29[c]	
15 Nov 1949	50	North Fork of Warm Springs Creek (Custer)	40	Browns Creek, Oreana (Owyhee)	0	-	-	-	50[d]	Edson 1949, Rich 1950, Shaw 1950
18 Nov 1949	58	Cedar Canyon (Butte), Birch Creek (Clark)	46	Clover Crossing, Owyhee County[e]	0	-	-	-	48[d]	
18 Nov 1949	58	Cedar Canyon (Butte), Birch Creek (Clark)	46, 47	Devil Creek, (Owyhee)	0	-	-	-	50[d]	
18 Nov 1949	58	Cedar Canyon (Butte), Birch Creek (Clark)	57	Point Springs (Cassia)	0	-	-	-	72[d]	
6–7 Nov 1950[f]	59A	Crooked Creek (Clark)	57	Point Springs, near Minidoka (Cassia)	-	-	-	-	37[g]	Anonymous 1951; Rich 1951a,b; Murray 1952; Shaw 1953
6–7 Nov 1950[f]	59A	Crooked Creek (Clark)	52A?	North of Lake Walcott, (Minidoka)[h]	-	-	-	-	33[g]	

Date	Capture Site		Release Site		Adults		Fawns		Total	Source
	GMU[a]	Location (County)	GMU[a]	Location (County)	M	F	M	F		
15 Nov 1950[f]	58	Birch Creek (Clark)	68	Gifford Spring (Power)[h]	-	-	-	-	48[g]	
15 Nov 1950[f]	58	Birch Creek (Clark)	46	Cedar Creek (Twin Falls)	-	-	-	-	89[g]	
15 Nov 1950[f]	58	Birch Creek (Clark)	40	Browns Creek (Owyhee)	-	-	-	-	51[g]	
17 Oct 1961	50	Copper Basin (Custer)	32	Crane Creek, Weiser (Washington)	1	5[i]	0	0	6	Shaw 1963, Woodworth 1962
16 Jan 1988	NV	Granite Range (Washoe)	NV	Gollaher Mountain[j], Jackpot (Elko)	-	-	-	-	44	Oldenburg et al. 1988, Tanner et al. 2003
Jan 1989	UT	Parker Mountain, Loa (Wayne)	NV	Gollaher Mountain[j], Jackpot (Elko)	-	-	-	-	50	Tanner et al. 2003, UDWR 2017
3 Aug 1989	63	6 mi east of Howe (Butte), 3 mi west of Mud Lake (Jefferson)	54	Shoshone Basin (Twin Falls)	8	18	2	1	29[k]	Smith 1989
Dec 2004	UT	Parker Mountain, Loa (Wayne)	40	Browns Creek (Owyhee)	17[l]	27[m]	5	2[n]	51[o]	Compton 2005, UDWR 2017
Dec 2004	UT	Parker Mountain, Loa (Wayne)	68	Big Desert (Bingham)	20[p]	22[q]	6	8	56[o]	
Dec 2004	UT	Parker Mountain, Loa (Wayne)	58	Eightmile Canyon, Birch Creek (Clark)	38[r]	32[s]	9	10	89[o, t]	

[a] Game Management Unit (GMU) and county assigned based on 2022 boundaries and the best location description provided by sources. Locations with inadequate detail to confidently assign GMU or county identified with a question mark.
[b] A total of 152 animals were transplanted in 1946 (Beck 1946, Davis 1946, Edson 1949), "approximately 80 animals" in January (Beck 1946) and 70 animals in March, 64 of which were released and 6 additional that died in transit (Davis 1946). Sex composition was either "about evenly divided between males and females" (Twin Falls Times News 1946) or "perhaps a few more bucks than does" (Davis 1946).
[c] A total of 130 animals were transplanted in 1948, but sex-age composition and detailed locations not provided (Murray 1948, Edson 1949).
[d] A total of 220 animals were transplanted in 1949, an additional 3 females (unknown age) died in transit. No adult males were transplanted as "all mature bucks were released at trap site to

provide migration information on the Birch Creek herd" (Rich 1950). Larger total number (*n* = 298) provided by Edson (1949) appears to include animals released at the trap sites.
[e] Listed as Haws Ranch (Rich 1950) and as Clover Crossing (Shaw 1950), assumed to be the same location.
[f] Reported dates of capture noted as 06–07 November 1950 for Crooked Creek, but not specified for Birch Creek (Rich 1951b). However, Shaw (1953) indicated Birch Creek capture occurred on 15 November 1950.
[g] A total of 258–262 animals were transplanted in 1950 (Anonymous 1951; Rich 1951a,b; Murray 1952). Numbers reported here are from Rich (1951b), an additional 103 animals were tagged and released.
[h] Release site described as Clifford Springs (Blaine County) in Rich (1951b), but no such place name exists. Described as two different release sites ("North of Lake Walcott in Minidoka county" and "Gifford Springs [sic] in Blaine county") in Murray (1952). Both may refer to the same site. Reported here following Murray (1952) except Gifford Spring is in Power County.
[i] Includes 1 yearling doe. One of the mature does was fatally injured upon release (Woodworth 1962, Shaw 1963).
[j] Nevada release site described as "east of Jackpot and within two miles of the state line" by Oldenburg et al. (1988) but listed as Gollaher Mountain (Elko County) by Tanner et al. (2003).
[k] Tagging sheet indicates 2 capture sites adjacent to Idaho National Lab (INL). An additional 4 animals died in transit (Smith 1989).
[l] Includes 2 yearling males (Compton 2005).
[m] Includes 7 yearling females (Compton 2005).
[n] 1 additional female fawn died in transit to Browns Creek (Compton 2005).
[o] Utah records indicate a total of 205 animals were released in Idaho (UDWR 2017).
[p] Includes 3 yearling males. 1 adult sex unknown, assumed to be male (Compton 2005).
[q] Includes 3 yearling females (Compton 2005).
[r] Includes 2 yearling males (Compton 2005).
[s] Includes 4 yearling females and 1 female age unknown, assumed to be adult (Compton 2005).
[t] 1 additional animal of unknown sex and age died in transit to Eightmile Canyon (Compton 2005).

Literature Cited

Anonymous. 1951. Birch, Crooked Creek antelope trapping nets 262 pronghorns. Idaho Wildlife Review 3(3):7.

Beck JO. 1946. Twenty-first Biennial Report of the Fish and Game Department of the State of Idaho, 1 Jan 1945 – 30 June 1946. Boise (ID): Idaho Department of Fish and Game.

Compton B. 2005. Pronghorn Antelope. Boise (ID): Idaho Department of Fish and Game. Progress Report Project W-170-R-29, 1 July 2004 to 30 June 2005.

Davis GG. 1946 April 2. Subject: Grassy Hill Antelope. Filer (ID): Personal letter from Davis GC, Conservation Officer, to Thoman PJ, Idaho Fish and Game Commissioner.

Edson M. 1949. Antelope transplanting project on Lost River and Birch Creek ranges removes 298 pronghorn. Idaho Wildlife Review 2(4):8–9.

Edson M. 1960. The pronghorn antelope in Idaho. Idaho Wildlife Review 13(2):3–5.

Murray TB. 1948. Twenty-second Biennial Report of the Fish and Game Department of the State of Idaho, 1 July 1946 – 30 June 1948. Boise (ID): Idaho Department of Fish and Game.

Murray TB. 1952. Twenty-fourth Biennial Report of the Fish and Game Department of the State of Idaho, 1 July 1950 – 30 June 1952. Boise (ID): Idaho Department of Fish and Game.

Oldenburg LE, Nelson LJ, Turner J, Mulligan B. 1988. Antelope, Statewide Surveys and Inventory. Boise (ID): Idaho Department of Fish and Game. Job Progress Report, 1 July 1987 – 30 June 1988, Project W-170-R-12.

Rich VB. 1950. Part IV, Statewide Trapping and Transplanting. Boise (ID): Idaho Department of Fish and Game, Wildlife Restoration Division. Quarter Progress Report, 1 Oct 1949 – 31 Dec 1949, Project 75-D-3. p. 96–100.

Rich VB. 1951a. 75-D, State-wide trapping and transplanting. Pittman-Robertson Quarterly 11:160.

Rich VB. 1951b. Statewide Trapping & Transplanting. Boise (ID): Idaho Department of Fish and Game. Job Completion Report, 26 July 1951, Project W 75-D-4.

Shaw WM. 1950. Part VII (c), Antelope Survey. Boise (ID): Idaho Department of Fish and Game, Wildlife Restoration Division. Quarterly Progress Report, Project 85-R-2. p. 201–216.

Shaw WM. 1953. "Trapping and Tagging", Idaho Game Population Census and Range Study. Boise (ID): Idaho Department of Fish and Game. Job Completion Report, 1 June 1952 – 30 June 1953, Project W 85-R-4.

Shaw WM. 1963. "Trapping and Tagging", Idaho Big Game Harvest Census and Range Study. Boise (ID): Idaho Department of Fish and Game. Job Completion Report, 1 July 1961 – 30 June 1962, Project W 85-R-13.

Smith R. 1989. Big Game Tagging Sheet. Boise (ID): Idaho Department of Fish and Game.

Tanner G, Beckstrand K, Gilbertson L, Mortimore C, Himes J. 2003. Nevada's pronghorn antelope: Ecology, management and conservation. Reno (NV): Nevada Division of Wildlife. Biological Bulletin No. 13.

Twin Falls Times News. 1946 March 11. 64 Antelope transplanted from Challis section to rolling prairie country southwest of Castleford. *Twin Falls Times News*, p. 1. https://twinfalls.newspaperarchive.com/twin-falls-times-news/1946-03-11/

Utah Division of Wildlife Resources (UDWR). 2017. Utah Pronghorn Statewide Management Plan. Salt Lake City (UT): Utah Division of Wildlife Resources.

Woodworth JR. 1962. Twenty-ninth Biennial Report of the Fish and Game Department of the State of Idaho, 1 July 1960 – 30 June 1962. Boise (ID): Idaho Department of Fish and Game.

APPENDIX D: Pronghorn Hunter Opinion Survey Final Report (Jan 2022)

Kenneth E. Wallen, University of Idaho

Executive Summary

Social assessment of IDFG's constituencies and users, alongside ecological and economic assessments, form the foundation of wildlife resource management. To inform the Pronghorn Management Plan, IDFG conducted an opinion survey of pronghorn tag purchasers in summer 2021 to assess their preferences, perceptions, and experiences in Idaho. This report outlines the methodology used and summarizes the results of the 2021 Pronghorn Hunter Opinion Survey. A primary objective of the survey was to assess hunter experiences related to their (a) history applying for a controlled hunt and, subsequently, hunting pronghorn, (b) preferred weapon, unit, and land type, (c) satisfaction and motivations, and (d) encounters and interactions with other hunters.

In general, the social assessment showed that Idaho pronghorn hunters are relatively recent applicants for the controlled hunts, with 58% having applied within the past 9 years and 74% of those respondents reporting having hunted only in 1 to 4 pronghorn seasons. However, 20% of respondents reported having applied for more than 20 years, which indicates there is a substantial avid hunter population segment. Findings support parity between the number of respondents who report hunting most often with a bow or rifle. These results are partially reflected in the 58% of respondents who report they will hunt with any weapon allowable by tag, suggesting pronghorn hunters are adaptable to season structure regulations in their pursuit of pronghorn hunting opportunities.

Overall, the 2021 Pronghorn Hunter Opinion Survey revealed satisfaction was high among pronghorn hunters over the past 5 years. Similar satisfaction was reported for harvest success, pronghorn numbers, and the amount of pronghorn habitat. Based on a revised importance-performance analysis (RIPA), hunters report that what is important to them for a high-quality pronghorn hunting experience is also what they are most satisfied with in Idaho. The survey revealed that Idaho pronghorn hunters are primarily motivated by appreciative goals (i.e., "to enjoy nature and the outdoors" and "excitement of pronghorn hunting") and less by achievement goals (i.e., "to get a mature buck" or "to demonstrate my hunting skills").

A majority of respondents report hunting pronghorn on public land but those that hunt on both public and private land (n = 865) split time near equally between public and private land. Within Idaho, game management unit (GMU) 41 is the most preferred GMU among respondents, followed by GMUs 40 then 45, 63, 46, 50, 44, 42, and 51. In terms of crowding and social interactions while hunting pronghorn in Idaho, respondents report relatively low perceptions of crowding, but also report that pronghorn hunter numbers have increased since 2015. The juxtaposition of low perceived crowding but growing perceptions of other hunters on the landscape was reflected in 46% of respondents reporting it was difficult or very difficult to hunt in their preferred GMU, but 53% reporting it was easy or very easy. In general,

encounters with other pronghorn hunters are a ubiquitous experience as 41% report encountering other pronghorn hunters often or always.

Methods

Population, Sample Frame, and Sample

The target population of the 2021 Pronghorn Hunter Opinion Survey was Idaho pronghorn hunters, represented by an email-based sample frame of individuals who had purchased at least 1 pronghorn tag between 2015 and 2020 (n = 17,865). IDFG customer license database entries within the sample frame that (a) were under the age of 18, (b) did not provide an email address (n = 1,218), and (d) duplicate emails were omitted (n = 779). The final sample consisted of 14,477 eligible respondents; 92% of tag purchasers in the past 5 years provided email contact information (as of June 2021). This indicates an 8% coverage bias (and associated sampling bias), which is below the threshold of statistical concern. The 2021 Pronghorn Hunter Opinion Survey used a census sampling procedure that included all eligible individuals in the sample frame.

Data Collection

Data collection began on 17 June 2021; (a) contact mode was email via GovDelivery and (b) response mode was online via web-based questionnaire hosted by Qualtrics. Email invitations were sent to 14,477 eligible respondents, followed by automated reminders on 19 June and 21 June to individuals who did not open the invitation email. A second email was sent on 29 June (n = 10,165), followed by automated reminders on 01 July and 03 July. By late July 2021, 5,987 responses were received; the effective response rate for this survey effort was 41.3% (Table D1). The margin of sampling error for the 2021 Pronghorn Hunter Opinion Survey was +/-1.3% (at a 99% confidence level). No nonresponse follow-up survey was conducted.

Measures

The 2021 Pronghorn Hunter Opinion Survey focused on management relevant measures and concepts assessed via a 34-question survey instrument. Six sections focused on: (1) pronghorn hunting experience, preferences, and behaviors; (2) perception of pronghorn populations; (3) satisfaction and motivations; (4) perceptions of crowding, access, and negative interactions with other hunters; (5) hunt attribute importance and actualization; and (6) hunter demographics.

Demographics

A fundamental contribution of public opinion surveys is their ability provide a profile or segment a target population based on basic demographic information. Results from the 2021 Pronghorn Hunter Opinion Survey reveal Idaho pronghorn hunters tend to be white males in their mid-40s with a majority reporting pretax income of between $50,000–100,000 and $100,000–150,000. This age and ethnicity profile is a common finding among big game hunter opinion surveys. Of note, 15% of respondents indicated they are currently retired.

Findings

Hunter Experience: History and Weapon Type

Like demographics, history and experience hunting pronghorn in Idaho is essential to profile or segment IDFG constituents. An additional dimension is the controlled hunt application process and draw odds associated with being able to purchase a pronghorn tag. In general, Idaho pronghorn hunters are relatively recent applicants for controlled hunts, 58% have applied within the past 9 years (Table D3). Relatedly, 74% of respondents reported having hunted in 1 to 4 pronghorn seasons (Table D4a, b); of those, 75% reported hunting pronghorn within the past 3 seasons. These results are likely partially connected to recent changes to pronghorn season structure and regulations. However, 20% of respondents reported having applied for more than 20 years, which indicates a substantial avid segment of the hunter population.

Given the common methods of take, findings indicate there is parity between the number of hunters who bow or rifle hunt for pronghorn (Tables D5, D7). These results are partially reflected in the 58% of respondents who report they will hunt with any weapon allowable by tag (Table D6), indicating the pronghorn hunters are adaptable to season structure regulations in their pursuit of pronghorn hunting opportunities. Broadly, harvest success aligns with IDFG mandatory harvest report data, i.e., 2016–2020 harvest success averaged between 36–50% (Table D8).

While scoping and anecdotes sometimes indicate ATV/UTV usage is problematic, these results indicate usage during hunting does not seem to be common among respondents as 42% report never bringing an ATV/UTV to hunt pronghorn (Table D9).

Hunter Experience: Satisfaction

A common metric to understand the general sentiment of hunters is satisfaction. Overall, the 2021 Pronghorn Hunter Opinion Survey revealed that satisfaction was notably high (Table D10). This finding is particularly consequential as consumptive recreational users (e.g., hunters and anglers) tend to be less satisfied than other types of recreational users (e.g., hikers and wildlife viewers). Similar satisfaction was reported for harvest success, pronghorn numbers, and the amount of pronghorn habitat. As previously mentioned, there is a controlled hunt dimension to pronghorn hunting in Idaho. To that point, respondents were less satisfied with pronghorn tag draw odds compared to other attributes measured, which is expected given draw odds are a "game of chance" and not in direct control of the user.

Based on a revised importance-performance analysis (RIPA), all measured hunt attributes (Table D11a, b) were located in Quadrant 1 (Figure D1). Respondents' actualization was measured via satisfaction, and results indicate these measured hunt attributes align with the importance they assign to each for their pronghorn hunting experience. In other words, what hunters say is important to them for a quality pronghorn hunting experience is also what they are most satisfied with.

Hunter Experience: Motivation

Pronghorn hunters are motivated by multiple goals and preferences. The 2021 Pronghorn Hunter Opinion Survey indicates 88% of respondents report "to enjoy nature and the outdoors" mostly or completely described why they hunt pronghorn and 77% indicated "excitement of pronghorn hunting" mostly or completely described

why they hunt pronghorn (Table D12). In general, only "to get a mature buck" and "to demonstrate my hunting skills" were not rated as high as other motivations.

Results indicate that pronghorn hunters tend to be appreciative-oriented and seek a sense of peace, belonging, familiarity, or excitement from the activity. Affiliative motivations—to accompany another person and to enjoy their company or to strengthen and reaffirm a personal relationship—are also important. Achievement-oriented and harvest-related experiences—wherein a specific hunt goal like meat or trophy is the objective—seem to be less of a motivation.

Hunter Perceptions: Pronghorn Population Status
Half of respondents reported they perceived pronghorn numbers have not changed in their preferred hunting areas (Table D13). However, 40% perceive pronghorn populations are decreasing or greatly decreasing, whereas 11% perceive pronghorn populations are increasing or greatly increasing. Similar to pronghorn numbers, respondents reported worse to no change in their harvest success; 74% reported no change in their harvest success (Table D14).

Of those who reported pronghorn numbers are greatly decreasing or decreasing, severe winters was perceived as the issue that has decreased the number of pronghorn populations in their preferred hunting area (Table D15a). That was followed by overharvest, habitat loss, predators, competition with grazing, and presence of ATVs/UTVs. The extent to which IDFG can manage or influence these issues for the benefit of pronghorn herds or hunters is variable.

Of those who reported pronghorn numbers are increasing or greatly increasing, harvest limits and mild winters were credited with increasing pronghorn numbers in their preferred hunting areas (Table D15b). The somewhat paradoxical (conflicting) perceptions between those who perceive pronghorn numbers as increasing or decreasing may warrant attention and outreach, with a particular focus on open and transparent communication of harvest and its effect on herds.

Hunter Perceptions: Pronghorn Bucks
Most respondents indicate that they consider a mature buck to be one with a horn length of at least 12 inches, but that length does not need to exceed 16 inches to be considered a mature buck (Table D16).

Hunter Preferences: GMU and Land Type
GMU 41 is the most preferred GMU among respondents, followed by GMU 40 then GMUs 45, 63, 46, 50, 44, 42, and 51 (Table D17).

Most respondents report hunting pronghorn on public land (Table D18) but those that hunt on both public and private land (n = 873) split time near equally between public and private land (Table D19).

Hunter Preferences: Harvest Opportunity
Given a forced-choice between harvest-focused (Table D20a) or hunt-focused (Table D20b) attributes, 62% of respondents responded in favor of hunt-focused attributes

(Table D21). In other words, the opportunity to (a) hunt pronghorn with either less competition from other hunters or (b) hunt every year is preferred to harvest. While the opportunity to hunt is preferred to the opportunity to harvest this result may be a product of time order issue (i.e., the hunt comes before the harvest), but further inquiry is required to understand this more thoroughly.

Hunter Experience: Crowding

Compared to other types of big game hunters, respondents indicate a lower perception of crowding while hunting pronghorn (Table D22). Because pronghorn are a controlled hunt species that uses a draw system could explain lower levels of perceived crowding. In contrast to these low levels of perceived crowding, respondents indicate a perception that the number of pronghorn hunters has increased since 2015 (Table D23). That perception is likely tied to the reality of changes to pronghorn season structure that have facilitated more opportunities to hunt pronghorn in Idaho.

If the respondent considered crowding an issue, other people were the main reason for crowding (Table D24) and other pronghorn hunters were the primary user group that contributes to crowding (Table D25a). If access to land to hunt pronghorn was considered the main reason for crowding, access to private property was the primary factor that contributes to their perceived crowding (Table D25b).

Hunter Experience: Social Interactions

In total, 46% of respondents report it was difficult or very difficult to hunt in their preferred unit; 53% easy or very easy (Table D26). Interpretation of this finding is not straightforward since the "why" is unknown. However, it should be noted that perception of difficultly or ease may be influenced by the controlled hunt season structure. In general, encounters with other pronghorn hunters are a ubiquitous experience, 41% encountered other pronghorn hunters often or always (Table D27). If it is not already, it should be an expectation of pronghorn hunters that they will encounter others in the field. Moreover, 27% reported never having been displaced by other pronghorn hunters while 23% were displaced often or always (Table D28). Displacement is an understudied experience, but regional- or GMU-focused scoping could reveal more details about this potential issue. Encounters with, or displacement due to, sage-grouse hunters rarely to never occurred (Tables D29, D30). In general, physical altercations and vandalism were not experienced or seen by respondents (Tables D31, D32). However, 12–13% of respondents indicated they did experience or see vandalism or altercations.

Table D1. Summary statistics of Idaho Pronghorn Hunter Opinion Survey, 2021.

Description	Count	Number Removed	Notes
Population	17,865	—	Tag purchasers from 2015–2020
Eligible	16,474	1,391	Under 18 years old
Email contact	15,256	1,218	Did not provide email
Duplicate email	779	779	All duplicate emails removed
Sample	14,477	—	92% email coverage
Started	6,223	—	

Completes	5,082	—	100% complete
Partials	905	—	39% complete average
Responses	5,987	—	Partials and completes
Exclusion	230	230	Empty responses but 100% progress
Exclusion	217	217	30% complete threshold for analysis (Q8)
Dataset	5,540	—	
Effective response rate	41%	—	(5,987/14,477)
Completed response rate	35%	—	(5,082/14,477)

Table D2. Respondent demographics of Idaho Pronghorn Hunter Opinion Survey, 2021.

	Mean	SD
Age (years)	46.7	14.7
Idaho residency (years)	34.5	17.6
	n	**%**
Gender		
Female	401	8
Male	4,617	92
Ethnicity		
Asian	26	<1
Black/African American	10	<1
Hispanic/Latino	66	1
Indigenous	28	1
Native Hawaiian	14	<1
White	4,644	93
Don't Know	65	1
Other	136	3
Income		
Less than $20,000	194	4
$20,000–$49,999	885	19
$50,000–$99,999	1,206	26
$75,000–$99,999	728	15
$100,000–$149,999	1,005	21
$150,000–$199,999	369	8
Greater than $200,000	329	7
Employment status		
Full-time	3,810	77
Part-time	168	3
Temporary	35	1
Unemployed	97	2
Retired	757	15
Disabled	73	2

Table D3. How many years have you applied to hunt pronghorn in Idaho?

	n	%
1–4 years	1,953	35
5–9 years	1,272	23
10–14 years	752	14
15–19 years	423	8
20+ years	1,130	20

Table D4a. How many seasons have you hunted pronghorn in Idaho?

	n	%
Never hunted pronghorn in Idaho	3	<1
1–4 years	4,071	74
5–9 years	856	16

10–14 years	295	5
15–19 years	122	2
20+ years	187	3

Table D4b. When was the last (most recent) year you hunted pronghorn in Idaho?

	n	%
prior to 2015	287	5
2015	282	5
2016	354	7
2017	471	9
2018	711	13
2019	1,118	21
2020	2,212	41

Table D5. Since you started hunting pronghorn in Idaho, which weapon have you used most often?

	n	%
Bow	2,618	47
Rifle	2,490	45
Muzzleloader	367	7
Other	55	1

Table D6. Do you only hunt pronghorn with preferred weapon?

	n	%
No, I will hunt with any weapon allowed by tag	3,175	58
Yes, I will only hunt with my preferred weapon	2,342	42

Table D7. Which weapon did you use to hunt pronghorn (during the most recent season you hunted)?

	n	%
Bow	2,539	47
Rifle	2,366	44
Muzzleloader	411	8
Other	47	1

Table D8. Did you harvest a pronghorn (during the most recent season you hunted)?

	n	%
No	2,807	53
Yes	2,518	47

Table D9. How often do you bring an ATV/UTV to hunt pronghorn?

	n	%
Never	2,320	42
Rarely	907	16
Sometimes	1,015	18
Often	619	11
Always	667	12

Table D10. Since you started hunting pronghorn in Idaho, how satisfied are you with the following:

	Descriptive			Frequency (%)				
	n	mean	SD	1	2	3	4	5

Amount of pronghorn habitat	5,501	3.7	0.9	2	8	18	58	13
Overall pronghorn hunting experience	5,511	3.6	1.0	4	12	18	53	14
Pronghorn harvest success	5,512	3.5	1.1	6	12	23	45	13
Number of pronghorn	5,497	3.4	1.0	4	18	20	47	9
Pronghorn tag draw odds	5,493	2.6	1.2	22	31	21	22	4

Note. Scale: very dissatisfied (1), dissatisfied (2), neither (3), satisfied (4), very satisfied (5)

Table D11a. How satisfied were you with the following (during the most recent season you hunted)?

	Descriptive			Frequency (%)				
	n	mean	SD	1	2	3	4	5
Seeing any bucks	5,137	3.6	1.0	4	12	20	53	11
Having a long season	5,110	3.5	0.9	4	10	32	45	9
Seeing lots of pronghorn	5,114	3.3	1.1	8	19	22	41	10
Seeing mature bucks	5,120	3.2	1.1	8	20	23	42	7
Filling my tag	5,119	3.2	1.2	12	16	26	33	13
Shooting at any bucks	5,095	3.1	1.0	8	15	37	33	6
Shooting at mature bucks	5,094	3.0	1.1	12	20	35	28	6

Note. Scale: very dissatisfied (1), dissatisfied (2), neither (3), satisfied (4), very satisfied (5)

Table D11b. How important are the following experiences to your Idaho pronghorn hunting satisfaction?

	Descriptive			Frequency (%)				
	n	mean	SD	1	2	3	4	5
Seeing lots of pronghorn	5,088	4.0	0.8	0	3	22	49	25
Seeing any bucks	5,120	3.8	0.9	2	4	24	50	20
Seeing mature bucks	5,101	3.8	0.9	2	6	27	43	22
Shooting at mature bucks	5,079	3.5	1.1	5	12	33	33	17
Having a long season	5,087	3.4	1.0	4	11	37	32	16
Filling my tag	5,090	3.3	1.1	7	15	35	26	17
Shooting at any bucks	5,096	3.2	1.1	9	14	36	30	11

Note. Scale: very dissatisfied (1), dissatisfied (2), neither (3), satisfied (4), very satisfied (5)

Table D12. How well do each of the following statements describe why you hunt pronghorn in Idaho?

	Descriptive			Frequency (%)				
	n	mean	SD	1	2	3	4	5
To enjoy nature and the outdoors	5,086	4.3	0.7	—	1	11	41	47
Excitement of pronghorn hunting	5,077	4.0	0.9	1	3	19	45	32
To enjoy time spent with friends/family	5,082	3.9	1.1	5	7	19	35	34
Challenge of hunting pronghorn	5,077	3.8	0.9	3	5	27	41	25
To bring meat home for food	5,086	3.7	1.1	5	10	27	31	27
To get a mature buck	5,071	3.2	1.1	8	15	38	27	12
To demonstrate my hunting skills	5,069	2.8	1.3	22	14	33	20	11

Note. Scale: not at all (1), a little bit (2), somewhat (3), mostly (4), completely (5)

Table D13. Since you started hunting pronghorn in Idaho, how has the number of pronghorn changed in your preferred hunting area?

	Descriptive			Frequency (%)				
	n	mean	SD	1	2	3	4	5
Hunter numbers change	5,501	2.6	0.8	10	30	50	9	2

Note. Scale: greatly decreased (1), decreased (2), no change (3), increased (4), greatly increased (5)

Table D14. Since you started hunting pronghorn in Idaho, how has your harvest success changed?

	Descriptive			Frequency (%)				
	n	mean	SD	1	2	3	4	5
Harvest success change	5,512	2.8	0.6	4	17	74	5	1

Note. Scale: much worse (1), worse (2), no change (3), better (4), much better (5)

Table D15a. In your opinion, what one issue has most caused the number of pronghorn populations to decrease in your preferred hunting area?

	n	%
Severe winters	424	20
Overharvest	267	12
Habitat loss	252	12
Predators	240	11
Competition with grazing	237	11
Presence of ATVs/UTVs	232	11
Water availability	181	8
Water hole locations	103	5
High road densities	96	4
Connectivity	70	3
Fencing	58	3

Note. Respondent answered only if Table D13 = greatly decreased (1), decreased (2)

Table D15b. In your opinion, what one issue has most caused the number of pronghorn populations to increase in your preferred hunting area?

	n	%
Harvest limits	188	33.2
Mild winters	151	26.6
Lack of competition	54	9.5
Water availability	40	7.1
Habitat improvements	33	5.8
Reduced predation	30	5.3
Low road densities	20	3.5
Water hole abundance	20	3.5
Lack of ATVs/UTVs	19	3.4
Connectivity improvement	12	2.1

Note. Respondent answered only if Table D13 = increased (4), greatly increased (5)

Table D16. What do you consider a mature pronghorn buck?

	n	%
Any adult male	291	6
Horn length greater than 10 inches	627	12
Horn length greater than 12 inches	1,923	38
Horn length greater than 14 inches	1,932	38
Horn length greater than 16 inches	247	5

Other	83	2

Table D17. Among the Game Management Units (GMU) you could hunt during the most recent season you hunted, which three units did you hunt pronghorn the most? Please list up to three units in order from the most to least about amount of time spent hunting pronghorn.

GMU	Rank1	Rank2	Rank3	Score1	Score2	Score3	Total
41	501	289	151	1,503	578	151	2,232
40	422	220	160	1,266	440	160	1,866
45	320	171	117	960	342	117	1,419
63	339	116	114	1,017	232	114	1,363
46	326	129	96	978	258	96	1,332
50	291	136	98	873	272	98	1,243
44	261	160	84	783	320	84	1,187
42	192	174	145	576	348	145	1,069
51	223	137	96	669	274	96	1,039
68	183	86	70	549	172	70	791
37	183	87	67	549	174	67	790
58	165	102	88	495	204	88	787
52A	158	78	58	474	156	58	688
52	128	110	78	384	220	78	682
54	138	42	37	414	84	37	535
29	108	69	72	324	138	72	534
47	102	95	35	306	190	35	531
30A	123	62	38	369	124	38	531
36	140	31	45	420	62	45	527
59	80	106	55	240	212	55	507
59A	92	74	65	276	148	65	489
49	96	62	63	288	124	63	475
37A	72	108	30	216	216	30	462
30	101	62	33	303	124	33	460
36A	73	67	44	219	134	44	397
39	78	49	51	234	98	51	383
60A	60	43	31	180	86	31	297
61	62	32	37	186	64	37	287
21A	47	26	29	141	52	29	222
53	30	42	24	90	84	24	198
36B	33	32	23	99	64	23	186
60	29	34	22	87	68	22	177
48	26	37	24	78	74	24	176
38	18	9	8	54	18	8	80
55	15	14	7	45	28	7	80
28	12	12	16	36	24	16	76
57	8	10	5	24	20	5	49
76	10	4	2	30	8	2	40
56	6	4	9	18	8	9	35
32	6	4	8	18	8	8	34
32A	1	5	1	3	10	1	14

Note: Score 1–3 is a calculated rank score (Rank1*3; Rank2*2; Rank3*1). Total is a summation of Score 1–3 and indicates the most preferred GMU among respondents.

Table D18. Which land type did you hunt on most often for pronghorn?

	n	%
Public	4,218	79
Private	284	5
A mix of public and private land	873	16

Table D19. When you hunted pronghorn on both private and public land, what percentage of your time did you hunt on each?

	mean	SD
Public	55.1	23.0
Private	44.9	23.0

Note. Respondents answered only if Table D18 = "A mix of public and private land" (n = 865).

Table D20a. Which pronghorn hunting opportunity do you value the most (harvest)?

	n	%
Harvest a mature buck in a given year	2,715	54
Harvest any pronghorn in a given year	2,359	47

Table D20b. Which pronghorn hunting opportunity do you value the most (hunt)?

	n	%
Hunt pronghorn every year	2,766	54
Hunt pronghorn with less competition from other hunters	2,314	46

Table D21. Which pronghorn hunting opportunity do you value the most (forced choice)?

	n	%
Hunt-focused selection	3,109	62
Harvest-focused selection	1,929	38

Table D22. Which rating — from "not crowded" to "extremely crowded" — best describes the level of crowding you experienced (during the most recent season you hunted)?

Descriptive			Frequency (%)								
n	M	SD	1	2	3	4	5	6	7	8	9
5,282	3.9	2.6	26	13	11	8	12	9	10	4	7

Note. Scale: 1–2 (not at all), 3–4 (slightly), 5–7 (moderately), 8–9 (extremely)

Table D23. Which rating — from "fewer hunters" to "more hunters" — best describes how you feel the number of other pronghorn hunters have changed since 2015?

Descriptive			Frequency (%)								
n	M	SD	1	2	3	4	5	6	7	8	9
5,183	6.0	2.4	5	4	7	8	20	10	13	7	24

Note. Scale: 1 (fewer hunters) – 9 (more hunters)

Table D24. What contributes most to the crowding you experience hunting pronghorn in your preferred units?

	n	%
Other people	2,388	45
Access to land	1,329	25
Crowding is not an issue	1,540	29

Table D25a. In terms of other people, who contributes most to the crowding issues you experience?

	n	%
Other pronghorn hunters	1,563	66
Nonresident pronghorn hunters	458	19
Nonhunters that use the same areas	307	13
Sage-grouse hunters	41	2

Table D25b. In terms of land access, what contributes the most to access issues you experience?

	n	%
Limited access to private property	728	56
Competition for specific hunting locations	348	27
Limited road or trail access	151	12
Waterholes are too close to roads	46	4
Personal issues	36	3

Table D26. How difficult or easy was it for you to hunt pronghorn in your preferred units?

Descriptive			Frequency (%)			
n	M	SD	1	2	3	4
5,204	2.5	0.8	7	39	45	8

Note. Scale: very difficult (1), difficult (2), easy (3), very easy (4)

Table D27. How often did you encounter other pronghorn hunters?

Descriptive			Frequency (%)				
N	M	SD	1	2	3	4	5
5,223	3.3	1.1	6	19	35	28	13

Note. Scale: never (1), rarely (2), sometimes (3), often (4), always (5)

Table D28. How often did you move to another location because of other pronghorn hunters?

Descriptive			Frequency (%)				
N	M	SD	1	2	3	4	5
5,224	2.5	1.2	27	19	31	19	4

Note. Scale: never (1), rarely (2), sometimes (3), often (4), always (5)

Table D29. How often did you encounter sage-grouse hunters?

Descriptive			Frequency (%)				
N	M	SD	1	2	3	4	5
5,194	1.6	0.9	62	23	11	3	1

Note. Scale: never (1), rarely (2), sometimes (3), often (4), always (5)

Table D30. How often did you move to another location because of sage-grouse hunters?

Descriptive			Frequency (%)				
N	M	SD	1	2	3	4	5
5,202	1.2	0.6	84	9	5	1	<1

Note. Scale: never (1), rarely (2), sometimes (3), often (4), always (5)

Table D31. How many verbal or physical altercations did you personally see or experience while on a pronghorn hunting trip?

Descriptive			Frequency (%)		
n	M	SD	1	2	3

5,192	1.2	0.6	87	11	2

Note. Scale: none (1), a few (2), several (3)

Table D32. How often did you personally see or experience vandalism or theft while on a hunting trip?

Descriptive			Frequency (%)		
n	M	SD	1	2	3
5,207	1.2	0.6	89	10	2

Note. Scale: never (1), once or twice (2), more than twice (3)

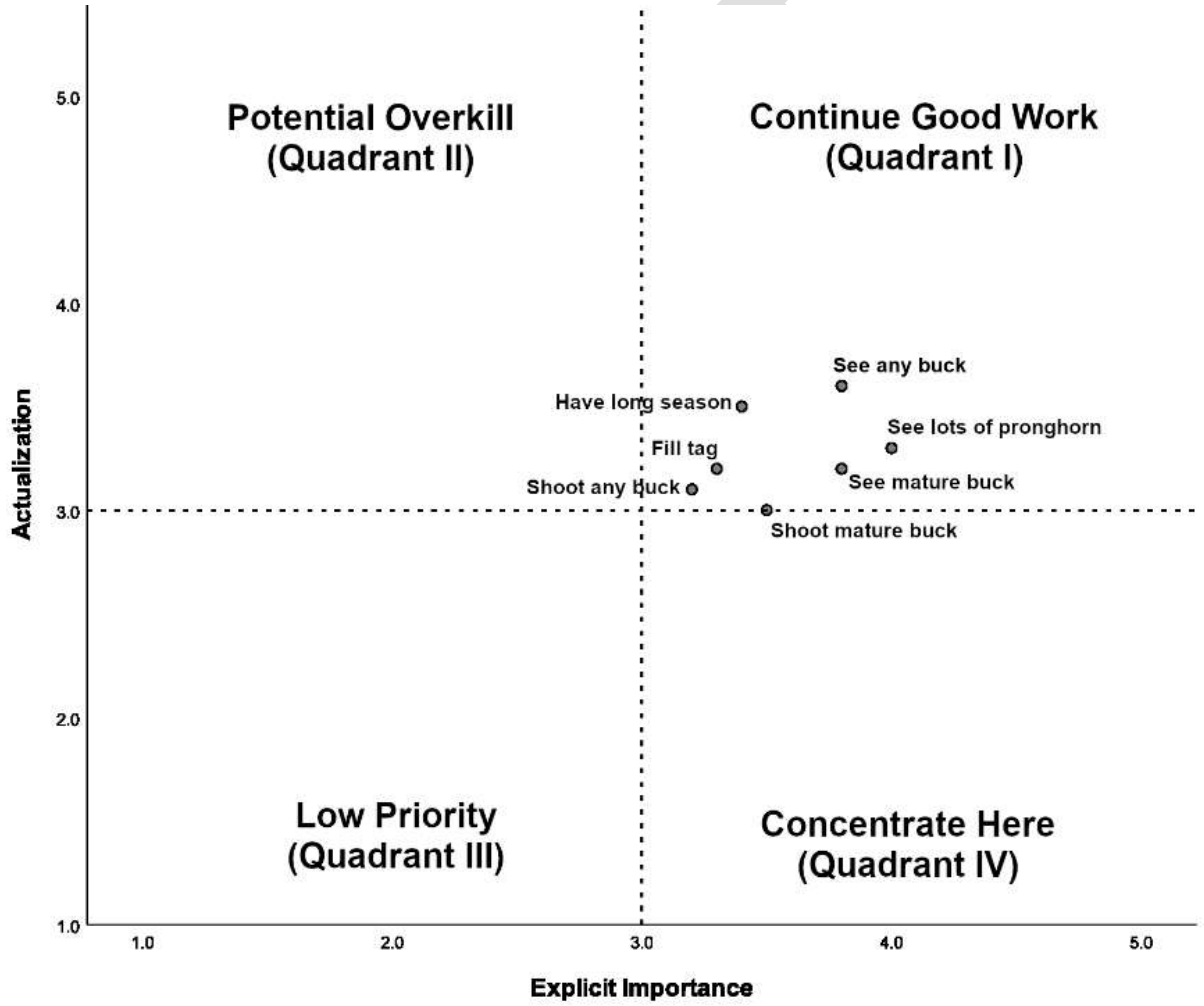


Figure D1. Revised importance-performance analysis (RIPA) measuring respondents' satisfaction (actualization) and importance of seven hunt attributes, Idaho Pronghorn Hunter Opinion Survey, 2021.

APPENDIX E: Capture & Handling Guidelines

Idaho has a long history of pronghorn capture, dating back to 1946 (see Translocation chapter). Notes from early captures discuss the high rate of mortality observed, which were likely in large part due to long chase times, transportation methods, and a lack of understanding of the fragility of pronghorn. Since that time, IDFG has continued to catch pronghorn and procedures have been refined following each capture to minimize animal stress and mortality, as well as prioritize crew safety.

When performed correctly, the capture, processing, and release procedure has minimal ill effects on the animal. If injury or mortality rates exceed 5% the operation will be reassessed to identify and fix problems. If this is not possible, the capture may be stopped.

Planned capture events should be discussed with the IDFG wildlife veterinarian. Helicopter net-gunning, corral traps, and ground-based chemical immobilization are the common methods for capturing pronghorn. Capture techniques and necessary resources to address injuries, overheating, and other potential problems (e.g., temperature checks, banamine) will be decided prior to capture. Current information from Idaho and others suggest:

- Pronghorn capture by helicopter net-gunning should be scheduled in late summer at least 2 months after fawning to address overheating in the winter due to their thick coats. Capture sites with heavy sage or rugged terrain will slow the animals for safer capture. Capture of pronghorn in heavy snow cover during the winter is acceptable, but pronghorn winter range in southern Idaho is composed of lava rock, and without substantial snow (≥0.3 m [1 ft]), the risks of injury to pronghorn are higher. If pronghorn are congregated in large herds on winter range, the group will accumulate too much stress prior to capture of multiple animals. A maximum of 2 animals should be captured from large groups.
- When helicopter net-gunning, avoid catching multiple pronghorn in one net.
- Helicopter capture teams of 2 are recommended. Pronghorn should not be hobbled because they can break their backs straining against the hobbles. One person restraining the animal by stretching them out while the second person collars and processes the animal results in reduced handling time.
- When releasing a pronghorn, maintain physical contact with the animal throughout the entire release process (i.e., until it outruns the handler) to persuade the animal to flee the handler and prevent it from fixating on the collar. This can help prevent the animal from causing injury to itself upon release.
- When net gunning, smaller nets (i.e., 12 foot X 12 foot) with larger squares (i.e., 7X7 inch squares) are preferred. Smaller nets should be used to avoid capturing multiple animals at once. Larger squares allow animals to get their entire heads through, seem to tangle the pronghorn better, and reduce injury. Additionally, once caught, pronghorn are easier to remove from the larger squares, reducing overall processing time.

Capture is often situation dependent, and some aspects of the guidelines may need to shift to address the questions being asked (i.e., winter capture vs summer). What may work well for one capture may not work well during another, and capture guidelines will remain flexible.

APPENDIX F: Pronghorn Survey Data

Compiled survey information for each pronghorn summer range distribution (SRD) and winter range distribution (WRD) in Idaho, including minimum counts of bucks, does, fawns, unclassified (Unc), and total pronghorn.

Birch Creek SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
Aug 1973	54	132	84	0	270	41:100:64	Helicopter	30A, 58
Aug 1974	73	164	127	0	364	45:100:77	Helicopter	30A, 58
Aug 1975	58	167	124	0	349	35:100:74	Helicopter	30A, 58
Aug 1976	80	127	76	0	283	63:100:60	Helicopter	30A, 58
Aug 1977	61	130	79	0	270	47:100:61	Helicopter	30A, 58
Aug 1978	80	153	146	0	379	52:100:95	Helicopter	30A, 58
Aug 1979	73	136	126	0	335	54:100:93	Helicopter	30A, 58
Aug 1980	96	147	134	0	377	65:100:91	Helicopter	30A, 58
Aug 1981	81	135	90	0	306	60:100:67	Helicopter	30A, 58
Aug 1982	139	282	156	0	577	49:100:55	Helicopter	30A, 58
Aug 1984	107	336	158	0	601	32:100:47	Helicopter	30A, 58
Aug 1986	114	345	149	0	608	33:100:43	Helicopter	30A, 58
Aug 2000	94	230	102	0	426	41:100:44	Helicopter	30A, 58[a]
Aug 2003	68	175	58	0	301	39:100:33	Helicopter	30A, 58[a]
Aug 2004	75	210	61	0	346	36:100:29	Helicopter	30A, 58[a]
Aug 2017					114	47:100:43	Ground	30A
Aug 2018	88	128	42	45	303	60:100:36	Ground	30A, 58
Aug 2019					214	62:100:37	Ground	30A
Aug 2019					398	30:100:45	Ground	58

[a] Survey only included part of the GMU.
Sources:

Camas SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
1964					49		Fixed wing	52A
1965					59		Fixed wing	52A
1966					92		Fixed wing	52A
1967					147		Fixed wing	52A
Sep 1968					113		Fixed wing	52A
Aug 1974	14	43	32		89	33:100:74	Helicopter	"Magic Valley"
Aug 1975	21	44	37		102	48:100:84	Helicopter	"Magic Valley"
Aug 1975	10	13	13		36	-	Helicopter	53
Aug 1976	14	42	26		82	33:100:62	Helicopter	53
Aug 1977	39	64	29		132	61:100:45	Helicopter	53
Aug 1978					141	23:100:65	Helicopter	52A
Aug 1978	14	39	36		89	36:100:92	Helicopter	53
Aug 1979					108	70:100:75	Helicopter	52A
Aug 1979	36	89	66		191	40:100:74	Helicopter	53
Aug 1980					165	15:100:50	Helicopter	52A
Aug 1980	28	90	51		169	31:100:57	Helicopter	53
Aug 1981					184	60:100:22	Helicopter	52A
Aug 1981	23	64	28		115	36:100:44	Helicopter	53

Aug 1982					84	22:100:22	Helicopter	52A
Aug 1982	14	51	44		109	27:100:86	Helicopter	53
Aug 1983	32	175	84		291	18:100:48	Helicopter	44
Aug 1983					101	22:100:62	Helicopter	52A
Aug 1983	19	51	32		102	37:100:63	Helicopter	53
Aug 1984					98	15:100:73	Helicopter	52A
Aug 1984	13	49	25		87	27:100:51	Helicopter	53
Aug 1978	17	75	49		141	23:100:65	Helicopter	52
Aug 1979	31	44	33		108	70:100:75	Helicopter	52
Aug 1980	15	100	50		165	15:100:50	Helicopter	52
Aug 1981	50	84	50		184	60:100:22	Helicopter	52
Aug 1982	13	58	13		84	22:100:22	Helicopter	52
Aug 1983	12	55	34		101	22:100:62	Helicopter	52
Aug 1984	8	52	38		98	15:100:73	Helicopter	52
Aug 1996	8	27	30		65	30:100:111	Ground	44, 45, 52
Aug 1997	18	39	28		85	46:100:72	Ground	44, 45, 52
Aug 1998	20	58	57		135	34:100:98	Ground	44, 45, 52
Aug 1999	30	104	104		238	29:100:100	Ground	44, 45, 52
Aug 2000	47	111	134		292	42:100:121	Ground	44, 45, 52
Aug 2001	62	90	83		235	69:100:92	Ground	44, 45, 52
Aug 2002	41	81	43		165	51:100:53	Ground	44, 45, 52
Aug 2003	37	136	133		306	27:100:98	Ground	44, 45, 52
Aug 2004	83	125	126		334	66:100:101	Ground	44, 45, 52
Aug 2005	45	69	30		144	65:100:43	Ground	44, 45, 52
Aug 2006	42	63	49		154	67:100:78	Ground	44, 45, 52
Aug 2007	80	137	80		297	58:100:58	Ground	44, 45, 52
Aug 2008	75	190	113		378	39:100:59	Ground	44, 45, 52
Aug 2009	84	142	107		333	59:100:75	Ground	44, 45, 52
Aug 2010	115	207	212		534	56:100:102	Ground	44, 45, 52
Aug 2011	120	270	198		588	44:100:73	Ground	44, 45, 52
Aug 2012	140	271	232		643	52:100:86	Ground	44, 45, 52
Aug 2013	135	305	204		644	44:100:67	Ground	44, 45, 52
Aug 2014	197	394	260		851	50:100:66	Ground	44, 45, 52
Aug 2015	223	351	252	0	826	64:100:72	Ground	44, 45, 52
Aug 2016	134	247	131	0	512	54:100:53	Ground	44, 45, 52
Aug 2017	82	110	101	0	293	75:100:92	Ground	44, 45, 52
Aug 2018	83	171	82	0	336	49:100:48	Ground	44, 45, 52
Aug 2019	94	175	89	0	358	54:100:51	Ground	44, 45, 52
Aug 2020	69	148	125	0	342	47:100:85	Ground	44, 45, 52
Aug 2021	70	143	136	0	349	49:100:95	Ground	44, 45, 52
Aug 2022	87	194	195	0	476	45:100:100	Ground	44, 45, 52

Sources: w-160-r-3, PR76

Island Park SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
Aug 1983	35	59	73	0	167	59:100:124	Helicopter	60

Source: PR85

Lost-Pahsimeroi SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
Aug 1973	64	238	98	0	400	27:100:41	Helicopter	37, 37A
Aug 1973	90	235	125	0	450	38:100:53	Helicopter	51

Aug 1974	77	136	70	0	283	57:100:51	Helicopter	37, 37A
Aug 1974	43	109	86	0	238	39:100:79	Helicopter	51
Aug 1975	74	277	101	0	452	27:100:36	Helicopter	37, 37A
Aug 1975	58	171	105	0	334	34:100:61	Helicopter	51
Aug 1976	94	386	188	0	668	24:100:49	Helicopter	37, 37A
Aug 1976	97	145	98	0	340	67:100:68	Helicopter	51
Aug 1977	99	315	193	0	607	31:100:61	Helicopter	37, 37A
Aug 1977	113	288	170	0	571	39:100:59	Helicopter	51
Aug 1978	137	370	251	0	758	37:100:68	Helicopter	37, 37A
Aug 1978	107	354	203	0	664	30:100:57	Helicopter	51
Aug 1979	158	529	270	0	957	30:100:51	Helicopter	37, 37A
Aug 1979	114	301	178	0	593	38:100:59	Helicopter	51
Aug 1980	156	515	194	0	865	30:100:38	Helicopter	37, 37A
Aug 1980	94	293	152	0	539	32:100:52	Helicopter	51
Aug 1981	236	484	178	0	898	49:100:37	Helicopter	37, 37A
Aug 1981	172	504	299	0	975	34:100:59	Helicopter	51
Aug 1982	203	545	164	0	912	37:100:30	Helicopter	37, 37A
Aug 1982	176	500	232	0	908	35:100:46	Helicopter	51
Aug 1983	152	561	152	0	865	27:100:27	Helicopter	37, 37A
Aug 1983	134	495	284	0	913	27:100:57	Helicopter	51
Aug 1984	124	473	236	0	833	26:100:50	Helicopter	37, 37A
Aug 1984	309	830	462	0	1601	37:100:56	Helicopter	51
Aug 1986	241	596	342	0	1179	40:100:57	Helicopter	51
Mar 1989[b]	-	-	-	-	1976	-	Fixed wing	37, 37A
Mar 1989[b]	-	-	-	-	4062	-	Fixed wing	51
July 1996[c]	309	1565	506	0	2380	20:100:32	Helicopter	51
Aug 2001[c]	149	417	137	0	703	36:100:33	Helicopter	51
Aug 2003	68	232	96	0	396	29:100:41	Helicopter	37, 51[a]
Aug 2004	85	185	68	0	338	46:100:37	Helicopter	37, 51[a]
Aug 2009	49	127	51	17	244	39:100:40	Ground	37, 37A
2010	42	160	65	14	281	26:100:41	Ground	37, 37A
2011	56	110	51	2	219	51:100:46	Ground	37, 37A
2012	35	167	65	25	292	21:100:39	Ground	37, 37A
2013	16	40	20	15	91	40:100:50	Ground	37, 37A
2014	49	158	55	61	323	31:100:35	Ground	37, 37A
2015	78	211	108	36	433	37:100:51	Ground	37, 37A
2016	80	265	66	55	466	30:100:25	Ground	37, 37A
2017	69	286	22	0	377	24:100:8	Ground	37, 37A
2018	121	193	69	40	423	56:100:37	Helicopter	37, 37A, 51
2019	191	497	135	58	881	31:100:29	Ground	37, 37A, 51

[a] Survey only included part of the GMU.
[b] Line-transect estimate.
[c] Pojar et al. estimate.
Sources: Autenrieth 1983

Medicine Lodge SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
Aug 1974	23	91	78	0	192	25:100:86	Helicopter	59, 59A
Aug 1975	63	132	77	0	272	48:100:58	Helicopter	59, 59A
Aug 1976	110	189	154	0	453	58:100:81	Helicopter	59, 59A
Aug 1977	105	158	94	0	357	66:100:59	Helicopter	59, 59A
Aug 1978	86	202	173	0	461	43:100:86	Helicopter	59, 59A
Aug 1979	97	221	230	0	548	44:100:104	Helicopter	59, 59A
Aug 1980	53	130	104	0	287	41:100:80	Helicopter	59, 59A

Aug 1981	68	162	149	0	379	42:100:92	Helicopter	59, 59A
Aug 1982	129	251	171	0	551	51:100:68	Helicopter	59, 59A
Aug 1984	105	295	235	0	635	36:100:80	Helicopter	59, 59A
1986	99	281	269		649	35:100:96	Helicopter	59, 59A
2002	42	230	89		361	18:100:39	Helicopter	59, 59A

Morgan-Moyer SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
1960					147		Aerial	
1961					158		Aerial	
1962					34		Aerial	
1963					28		Aerial	
1966					86		Aerial	
1968					3		Aerial	
1969					24		Aerial	
1971					38		Aerial	
1975					57		Aerial	
1978					113		Aerial	
Aug 1983	15	98	42	0	155	15:100:42	Helicopter	36B
Mar 1989					156		Fixed wing	36B
1990					156		Aerial	
2002					116		Incidental	
2003					41		Incidental	
2004					20		Incidental	
2005					241		Incidental	
2006					114		Incidental	
2007					155		Incidental	
2008					155		Incidental	
2009					22		Incidental	
2010					193		Incidental	
2011					124		Incidental	
2012					38		Incidental	
2014					75		Incidental	
2016					311		Incidental	

Mud Lake SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe: Fawn	Survey Type	GMUs
Spring 1949					443		Fixed wing	63
Spring 1952					1,056		Fixed wing	63
Spring 1953					198		Fixed wing	63
Spring 1954					123		Fixed wing	63
Spring 1955					216		Fixed wing	63
Spring 1956					339		Fixed wing	63
Spring 1957					332		Fixed wing	63
Aug 1983	32	175	84	0	291	18:100:48	Helicopter	63, E of INL
Aug 1987					423	47:100:62	Helicopter	63, E of INL
Aug 1988					655	85:100:75	Helicopter	63, E of INL
July 1990					277	71:100:41	Helicopter	63, E of INL
2002					2,111		Fixed Wing	63
Aug 2003	45	141	70		256	32:100:60	Helicopter	63, N of Hwy 33, E of INL

Aug 2004	47	163	117		327	29:100:72	Helicopter	63, N of Hwy 33, E of INL

Pioneer SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
Apr 1949					1289		Fixed wing	50
Apr 1950					1499		Fixed wing	50
Apr 1951					1516		Fixed wing	50
Apr 1953					924		Fixed wing	50
Apr 1955					459		Fixed wing	50
Apr 1956					465		Fixed wing	50
Apr 1957					954		Fixed wing	50
1958					842		Fixed wing	50
1959					824		Fixed wing	50
1960					947		Fixed wing	50
1961					196		Fixed wing	50
1962					926		Fixed wing	50
1963					1014		Fixed wing	50
Apr 1964					782		Fixed wing	50
1964					128		Fixed wing	49
1965					850		Fixed wing	50
1965					81		Fixed wing	49
1966					177		Fixed wing	49
1967					104		Fixed wing	49
1968					126		Fixed wing	49
Aug 1973	70	201	97	0	368	35:100:48	Helicopter	50
Aug 1974	98	250	82	0	395	39:100:33	Helicopter	50
Aug 1974	9	15	12	0	36	60:100:80	Helicopter	49
Aug 1975	75	222	49	0	346	34:100:22	Helicopter	50
Aug 1975	3	23	20	0	46	13:100:87	Helicopter	49
Aug 1976	90	343	164	0	597	26:100:48	Helicopter	50
Aug 1976	32	87	76	0	195	37:100:87	Helicopter	49
Aug 1977	197	484	189	0	870	41:100:39	Helicopter	50
Aug 1977	34	117	100	0	251	29:100:85	Helicopter	49
Aug 1978	119	337	181	0	637	35:100:54	Helicopter	50
Aug 1978	42	134	134	0	310	31:100:100	Helicopter	49
Aug 1979	96	260	139	0	495	37:100:53	Helicopter	50
Aug 1979	67	143	133	0	343	47:100:93	Helicopter	49
Aug 1980	200	354	191	0	745	56:100:54	Helicopter	50
Aug 1980	95	191	150	0	436	50:100:79	Helicopter	49
Aug 1981	148	482	285	0	915	31:100:59	Helicopter	50
Aug 1981	71	127	126	0	324	56:100:99	Helicopter	49
Aug 1982	230	367	211	0	808	63:100:57	Helicopter	50
Aug 1982	75	179	133	0	387	42:100:74	Helicopter	49
Aug 1983	48	180	138		366	27:100:77	Helicopter	49
Aug 1984	39	159	132		330	25:100:83	Helicopter	49
Aug 1988	42	192	181		415	22:100:94	Ground	49
Aug 1991	83	205	142		430	40:100:69	Ground	49
Aug 1992	85	168	125		378	51:100:74	Ground	49
Aug 1993	42	107	41		190	39:100:38	Ground	49
Aug 1994	23	129	96		248	18:100:74	Ground	49
Aug 1995	28	88	58		174	32:100:66	Ground	49
Aug 1996	19	126	110		255	15:100:87	Ground	49
Aug 1997	46	138	102		286	33:100:74	Ground	49
Aug 1998	49	138	98		285	36:100:71	Ground	49

Aug 1999	43	110	102		255	39:100:93	Ground	49
Aug 2000	33	121	107		261	27:100:88	Ground	49
Aug 2001	46	171	141		358	27:100:82	Ground	49
Aug 2002	40	137	110		287	29:100:80	Ground	49
Aug 2003	44	98	75		217	45:100:77	Ground	49
Aug 2004	52	153	147		352	34:100:96	Ground	49
2005	27	123	70		220	22:100:57	Ground	49
2006	16	120	75		211	13:100:63	Ground	49
2007	30	110	70		210	27:100:64	Ground	49
2008	18	93	84		195	19:100:90	Ground	49
Aug 2009	27	95	70		192	28:100:74	Ground	49
2010	33	147	100		280	22:100:68	Ground	49
2011	26	76	45		147	34:100:59	Ground	49
2012	13	70	48		131	19:100:69	Ground	49
2013	15	75	56		146	20:100:75	Ground	49
2014	47	143	100		290	33:100:70	Ground	49
2015	51	69	33		153	74:100:48	Ground	49
2016	32	137	89		258	23:100:65	Ground	49
2017	23	92	57		172	25:100:62	Ground	49
2018	24	64	18	0	106	38:100:28	Ground	49
2019	24	68	18	0	110	35:100:26	Ground	49
2020	24	49	45	0	118	49:100:92	Ground	49
2021	20	96	59	0	175	21:100:61	Ground	49
2022	27	88	55	0	171	31:100:63	Ground	49

Sources: Autenrieth 1983

Sawtooth SRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
1949					861		Aerial	
1950					792		Aerial	
1951					1183		Aerial	
1952					725		Aerial	
1953					490		Aerial	
1954					435		Aerial	
1955					337		Aerial	
1956					347		Aerial	
1957					249		Aerial	
1959					326		Aerial	
1960					331		Aerial	
1961					134		Aerial	
1962					177		Aerial	
1963					308		Aerial	
1966					237		Aerial	
1968					96		Aerial	
1969					278		Aerial	
1970					87		Aerial	
1971					216		Aerial	
1972					130		Aerial	
1975					180		Aerial	
Aug 1976	54	154	20		228	35:100:13	Helicopter	36A
Aug 1977	27	114	11		152	24:100:10	Helicopter	36A
Aug 1978	30	188	51		269	16:100:27	Helicopter	36A
Aug 1979	54	247	85		386	22:100:34	Helicopter	36A
Aug 1980	112	287	62		461	39:100:22	Helicopter	36A

Aug 1981	110	302	80		492	36:100:26	Helicopter	36A
Aug 1982	105	263	46		414	40:100:17	Helicopter	36A
Aug 1983	58	101	26		195	58:100:26	Helicopter	36A
Aug 1984	64	348	89		501	18:100:26	Helicopter	36A
Mar 1989	-	-	-	-	612	-	Fixed wing	36A
1990					1223		Aerial	
2002					43		Incidental	
2004					49		Incidental	
2007					103		Incidental	
2008					129		Incidental	
2011					182		Incidental	
2012					72		Incidental	
2014	70	77	44	2	193	91:100:57	Ground	
2015	20	32	25	0	77	63:100:78	Ground	
2017	12	23	9	3	45	52:100:39	Ground	36
2021	86	99	49	45	291	87:100:49	Ground	

Big Desert SRD & WRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
1980	30	19	12	0	61	158:100:63		68
Aug 1984	78	174	145	0	397	45:100:83	Fixed wing	68
Aug 1987	-	-	-	-	65		Fixed wing	68
May 1988	-	-	-	-	70		Fixed wing	68
May 1990	-	-	-	-	29		Fixed wing	68
Spring 1991					54		Fixed wing	68
Aug 1999	5	28	10	21	64	18:100:36	Fixed wing	68
Aug 2014	80	92	46	34	252	87:100:50	Ground	68
Aug 2015	62	103	41	21	227	60:100:40	Ground	68
Aug 2016	60	204	54	14	332	29:100:26	Ground	68
Aug 2017	35	74	32	6	147	47:100:43	Ground	68
Aug 2018	43	93	32	11	179	46:100:34	Ground	68
Aug 2019	30	44	11	13	98	68:100:25	Ground	68
Aug 2020	18	34	10	49	111	53:100:29	Ground	68
Aug 2021	39	107	39	40	225	36:100:36	Ground	68

Jarbidge SRD & WRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
Mar 1949					80		Fixed wing	46
Feb 1950					79		Fixed wing	46
1954					179		Fixed wing	46, 47
Apr 1957					92		Fixed wing	47
1958					243		Fixed wing	47
1959					222		Fixed wing	47
1960					69		Fixed wing	47
1961					207		Fixed wing	47
1967					61		Fixed wing	
1968					57		Fixed wing	
June 1977	7	10	4		21	70:100:40	Ground	
Aug 1980	16	39	26		81	44:100:63	Helicopter	47
Aug 1982	71	133	51		255	53:100:38	Helicopter	46, 47
Aug 1983	40	122	46		208	33:100:38	Helicopter	46, 47

Aug 1984	22	86	25		134	26:100:29	Helicopter	46, 47
1985	17	30	19		66	57:100:63	Ground	
Aug 1988	61	102	39		202	60:100:38	Helicopter	46, 47
Sept 1989	35	126	72		233	28:100:57	Helicopter	46, 47
Aug 1990	65	206	81		352	32:100:39	Fixed wing	46, 47
Aug 1991	76	149	77		302	51:100:52	Ground	46
Aug 1992	65	153	80		298	42:100:52	Ground	46
Aug 1993	51	170	83		304	30:100:49	Ground	46
Aug 1994	57	132	71		260	43:100:54	Ground	46
Aug 1995	36	120	76		232	30:100:63	Ground	46
Aug 1996	53	144	73		270	37:100:51	Ground	46
Aug 1997	37	127	78		242	29:100:61	Ground	46
Aug 1998	41	86	34		161	48:100:40	Ground	46
Aug 1999	34	133	56		223	26:100:42	Ground	46
Aug 2000	21	78	44		143	27:100:56	Ground	46
Aug 2001	27	70	40		137	39:100:57	Ground	46
Aug 2002	23	57	47		127	40:100:82	Ground	46
Aug 2003	49	105	52		206	47:100:50	Ground	46, 47
Aug 2004	39	90	55		184	43:100:61	Ground	46, 47
2005	29	55	30		114	53:100:55	Ground	
2006	29	86	55		170	34:100:64	Ground	
2007	18	41	22		81	44:100:54	Ground	
2008	26	78	38		142	33:100:49	Ground	
Aug 2009	21	44	17		82	48:100:39	Ground	46, 47
2010	92	153	44		289	60:100:29	Ground	
2011	21	56	13		90	38:100:23	Ground	
2012	37	94	19		150	39:100:20	Ground	
2013	48	184	113		345	26:100:61	Ground	
2014	70	116	50		236	60:100:43	Ground	
Aug 2015	29	127	67	0	223	54:100:48	Ground	
Aug 2016	91	218	79	0	416	42:100:36	Ground	
Aug 2017	53	112	34	0	212	47:100:30	Ground	46
Aug 2018	83	195	33	0	311	43:100:17	Ground	
Aug 2019	90	178	54	0	322	51:100:31	Ground	46, 47
Aug 2020	66	209	72	0	347	32:100:34	Ground	
Aug 2021	37	98	33	0	168	38:100:34	Ground	
Aug 2022	69	116	48	0	242	59:100:41	Ground	

Sources: Kuck et al. 1990

Lemhi-Tower SRD & WRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe: Fawn	Survey Type	GMUs
1949					173		Aerial	
1951					833		Aerial	
1952					244		Aerial	
1953					615		Aerial	
Apr 1954					428		Aerial	
Spring 1955					337		Aerial	
Spring 1956					496		Aerial	
Spring 1957					360		Aerial	
1958					188		Aerial	
1959					437		Aerial	
Spring 1960					593		Aerial	
Feb 1961					611		Aerial	
1962					667		Aerial	

1963					928		Aerial	
Spring 1965					551		Aerial	
Spring 1966					378		Aerial	
Spring 1968					828		Aerial	
Apr 1969					703		Aerial	
May 1970					301		Aerial	
1971					600		Aerial	
Sept 1972					491		Aerial	
Aug 1973	44	127	59		230	35:100:47	Helicopter	29
Aug 1974	39	128	81		248	31:100:63	Helicopter	29
Aug 1975	15	118	64		197	13:100:54	Helicopter	29[a], 30
Aug 1976	8	56	12		188	14:100:21	Helicopter	29[a], 30
Aug 1977	44	185	128		357	24:100:69	Helicopter	29, 30
Aug 1978	67	268	129		464	25:100:48	Helicopter	29, 30
Aug 1979	49	287	182		518	17:100:63	Helicopter	29, 30
Aug 1980	81	261	107		449	31:100:41	Helicopter	29, 30
Aug 1981	75	339	215		629	22:100:63	Helicopter	29, 30
Aug 1982	138	399	191		728	35:100:48	Helicopter	29, 30
Aug 1983	87	340	184		611	26:100:54	Helicopter	21A, 29[a], 30
Aug 1984	138	411	91		640	34:100:22	Helicopter	29
Aug 1988	30	82	43		396	37:100:52	Fixed wing	29
Mar 1990[b]					1179		Fixed wing	21A, 29, 30
Autumn 2002					258		Incidental	
2003					664		Incidental	
2004					704		Incidental	
2005					150		Incidental	
2007					329		Incidental	
2009					196		Incidental	
2010					122		Incidental	
2011					181		Incidental	
2014					189		Incidental	
2016					735		Incidental	

[a] Survey only included part of the GMU.
[b] Some progress reports identify this fixed wing survey as occurring in March 1990, others indicate 1989.
Sources: Autenrieth 1983

Owyhee North SRD & WRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe: Fawn	Survey Type	Comments
Aug 1974	6	44	26	0	76	14:100:59	Helicopter	40, Cow Ck
Aug 1975	2	7	4	0	13	29:100:57	Helicopter	40, Cow Ck
Aug 1976	8	31	25	0	64	26:100:81	Helicopter	40, Cow Ck
Aug 1977	19	43	25	0	87	44:100:58	Helicopter	40, Cow Ck
Aug 1978	15	47	28	0	90	32:100:60	Helicopter	40, Cow Ck
Aug 1979	13	32	23	0	68	41:100:72	Helicopter	40, Cow Ck
Aug 1980	15	46	23	0	84	33:100:50	Helicopter	40, Cow Ck
Aug 1981	20	54	29	0	103	37:100:54	Helicopter	40, Cow Ck
Aug 1982	14	28	15	0	57	50:100:54	Helicopter	40, Cow Ck
Aug 1983	5	24	16	0	45	21:100:67	Helicopter	40, Cow Ck

Sources: Autenrieth 1983, Kuck et al. 1990

Owyhee South SRD & WRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe: Fawn	Survey Type	GMUs
Winter 1948					535		Fixed wing	Owyhee Cty
Winter 1949					863		Fixed wing	Owyhee Cty
Winter 1950					898		Fixed wing	Owyhee Cty
Spring 1951					168		Fixed wing	Owyhee Cty
Winter 1952					631		Fixed wing	Owyhee Cty
Winter 1953					339		Fixed wing	Owyhee Cty
Winter 1954					413		Fixed wing	Owyhee Cty
Winter 1956					426		Fixed wing	Owyhee Cty
Aug 1973	5	23	10	0	38	22:100:44	Helicopter	42, Battle Ck
Aug 1974	9	15	14	0	38	60:100:93	Helicopter	42, Battle Ck
Aug 1975	31	127	43	0	201	24:100:34	Helicopter	42, Battle Ck
Aug 1976	31	41	34	0	106	76:100:83	Helicopter	42, Battle Ck
Aug 1977	46	94	60	0	200	49:100:64	Helicopter	42, Battle Ck
Aug 1978	76	187	98	0	361	41:100:52	Helicopter	42, Battle Ck
Aug 1979	56	143	125	0	336	39:100:87	Helicopter	42, Battle Ck
Aug 1980	95	205	95	0	395	46:100:46	Helicopter	42, Battle Ck
Aug 1981	68	142	116	0	326	48:100:82	Helicopter	42, Battle Ck
Aug 1982	49	154	62	0	265	41:100:58	Helicopter	42, Battle Ck
Aug 1983	74	166	83	0	324	45:100:50	Helicopter	42, Battle Ck
Aug 1985	102	221	145	0	468	46:100:66	Helicopter	42, Battle Ck
Aug 1987	156	193	108	0	457	81:100:56	Helicopter	42, Battle Ck
1993					191		Fixed wing	
1994					381		Fixed wing	
1995					402		Fixed wing	
2006					266	56:100:47	Ground	
Aug 2009					276	31:100:95	Ground	
2010					1178	28:100:42	Ground	
July 2011					629	24:100:20	Ground	
2012					1041	33:100:58	Ground	
2013					356	26:100:55	Ground	
2014					72	27:100:68	Ground	
Apr 2022	39	43	32	67	181		Helicopter	

Sources: Folker 1956, Autenrieth 1983, Kuck et al. 1990

Raft River SRD & WRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	GMUs
Mar 1954					66		Fixed wing	N part of 57
Mar 1956					60		Fixed wing	N part of 57
Mar 1957					130		Fixed wing	N part of 57
1958					68		Fixed wing	
1959					80		Fixed wing	
1960					85		Fixed wing	

Mar 1961					64		Fixed wing	
1962					102		Fixed wing	
1963					123		Fixed wing	
1964					66		Fixed wing	
1965					79		Fixed wing	
1966					1		Fixed wing	
1967					35		Fixed wing	
Sep 1968					27		Fixed wing	
Aug 1982					64		Aerial	
Sept 1999							Ground	55, 57
Sept 2000							Ground	55, 57
Sept 2001					66		Ground	55, 57
Sept 2002					27		Ground	55, 57
Sept 2003					65		Ground	55, 57
Sept 2004					12		Ground	55, 57
Sept 2005							Ground	55, 57
Sept 2006							Ground	55, 57
Sept 2007							Ground	55, 57
Sept 2008					71		Ground	55, 57
Aug 2017					139	59:100:19	Ground	54, 57

South Hills SRD & WRD

Month Year	Bucks	Does	Fawns	Unc	Total	Buck:Doe:Fawn	Survey Type	Comments
2014	26	108	60		194	24:100:56	Ground	
2015	33	77	28		138	43:100:36	Ground	
2016	49	105	36		190	47:100:34	Ground	
Aug 2017	46	77	15	9	147	60:100:19	Ground	54, 57
Aug 2018					59		Ground	54
Aug 2019					160	52:100:32	Ground	54

APPENDIX G: Public Input Summary

To be completed after public review.