Utah Upland Game Management Plan

Utah Division of Wildlife Resources

Utah Department of Natural Resources

Table of Contents

Contents

Utah Upland Game Plan Committee:

Dave Cook……..Bureau of Land Management

Dave Dahlgren……..Utah State University

Wade Garrett……Utah Farm Bureau

Stan Gurley…….National Resource Conservation Service

Natasha Hadden……..United States Forest Service

Charlie Holtz……..….Pheasants Forever

Randy Hutchison……...Northern Regional Advisory Committee

Randy Larsen…….Brigham Young University

Travis Proctor……..Utah Wild Chukar Foundation

Paula Richmond…….Sportsmen for Fish and Wildlife

Bryce Thurgood……..Utah Wildlife Board

Bret Wonnacott…….National Shoot and Retrieve Association

Lynn Worwood……..National Wild Turkey Federation

Division of Wildlife Resources Committee Members

James Christensen…….……..Northern Region Wildlife Manager

Avery Cook……..Upland Project Leader

Heather Talley…….Upland Game Coordinator

EXECUTIVE SUMMARY

The purpose of this Upland Game Management Plan is to create a more strategic approach to upland game management, and to implement measurable objectives and strategies for managing upland game species in Utah. While some upland species have management plans in Utah, most upland species do not. Greater sage-grouse (*Centrocercus urophasianus*), Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*), and wild turkey (*Meleagris gallopavo*) have individual plans (Appendix 1) and will not be incorporated into this document. This upland game management plan (hereinafter; the Plan) will provide guidance to the Utah Division of Wildlife Resources (DWR) for dusky grouse (*Dendragapus obscurus*), ruffed grouse (*Bonasa umbellus*), white-tailed ptarmigan (*Lagopus leucurus*), California quail (*Callipepla californica*), Gambel's quail (*Callipepla gambelii*), chukar partridge (*Alectoris chukar*), grey (Hungarian) partridge (*Perdix perdix*), ring-necked pheasant (*Phasianus colchicus*), mountain cottontail (*S. nuttallii*), desert cottontail (*S. audubonii*), and snowshoe hare (*Lepus americanus*). The Plan will direct the implementation of management practices to create, maintain or improve upland game habitat and populations, increase transparency by explicating objectives/goals, and offer recreational hunting opportunities that coincide with Utah hunters' preferences as much as possible, while maintaining biological integrity and adapting to new circumstances. The DWR conducted an opinion survey in January 2022 to gather the opinions of upland game hunters in Utah and ensure relevant topics were discussed during committee meetings for this plan (Appendix 5).

Utah Code §23-14-1 grants the Utah Division of Wildlife Resources (DWR) management authority for wildlife within the state under the authority of the Wildlife Board to serve as the trustee and custodian of protected wildlife to protect, propagate, manage, conserve and distribute protected wildlife throughout the state. The implementation of the Plan will direct the management actions that the DWR will execute to enhance, maintain or establish upland game populations and habitat, as well as maintain recreational hunting opportunities.

This Plan will serve as the action plan for upland game management in Utah. Key issues that impact upland game species are identified, and will comprehensively guide the direction for upland game management during the next ten years (2022-2032). This Plan incorporates management direction to the DWR via goals, objectives, strategies and tactics. The Plan will direct DWR's program prioritization and annual work plan development, and provide guidance in the creation of regulatory recommendations. The Plan indicates three goals for the Plan to address:

- Population Maintenance and Harvest Monitoring
- Habitat Improvement and Management
- Maintain and Increase Hunting Opportunity

INTRODUCTION

Utah hunters have a numerous upland game hunting opportunities available within the state. The variety of ecosystems in Utah provide habitat for 18 hunted upland game species, including three lagomorphs (rabbits and hares), 10 resident upland game birds, and five migratory upland game birds. Additionally there are turkey hunting opportunities throughout the state, and potential to add scaled quail as a huntable species in the future if their range continues to expand northward. Cottontail rabbits are ubiquitous throughout the state, and snowshoe hare are found in many higher elevation areas of Utah. Two species of forest grouse – dusky and ruffed – and two species of prairie grouse – Columbian sharp-tailed and greater sage-grouse, as well as Gambel's quail – are native to the state. Hunting of introduced species includes chukar, grey partridge, California quail and pheasants. Though in the past Utah had more abundant introduced ring-necked pheasant (hereinafter pheasant) populations, these populations have declined due to land-use changes, including urbanization and farming practices, which reduced the majority of available habitat in the state. The upland game hunting resources available in Utah are exceptional — especially considering the availability of public land, diversity of species, and variety of habitats available to hunters. Season dates and bag limits allow for ample hunter opportunity for these species.

A variety of upland game exists in Utah due to the diversity of habitats available, ranging from deserts to forests to wetlands. Typically, upland game have been managed with the following assumptions:

- Hunter harvest generally accounts for 10% or less of annual mortality in the population
- Populations cycle largely independently of hunter harvest mortality
- Harvest mortality is generally compensatory to overwinter survival

Though these principles are broadly applicable, species vary considerably their life histories necessitating the consideration of management specific to species and distinct populations. A recent review of upland game bird harvest management (Dahlgren et. al 2021) suggests the need for reassessment of long-held assumptions (see above) used for harvest strategies. Given our rapidly changing environments and habitat loss, combined with the results of more recent scientific literature concerning the effects of harvest on upland game, there is a need for more scientifically-based harvest strategies and/or assessment and justification for current management approaches. To accomplish this, more baseline data is necessary, such as monitoring population changes, productivity, hunter characteristics, etc. Furthermore, for many upland game species in Utah, there is a paucity of information on how populations respond to habitat management and other conservation efforts.

To capture the opinions of the upland game hunting community in Utah, a committee was formed to assist with the creation of the Plan. Members of the committee represented the stakeholders of the following parties: Brigham Young University, the Bureau of Land Management, the National Resource Conservation Service, National Shoot and Retrieve

Association, National Wild Turkey Federation, Pheasants Forever, DWR Regional Advisory Councils, Sportsmen for Fish and Wildlife, United States Forest Service, the Utah Farm Bureau, Utah State University, Utah Wild Chukar Foundation, and the Utah Wildlife Board. The individuals representing these agencies and organizations provided input during the committee meetings for this plan. Opinions and feedback were discussed during these meetings to ultimately guide the direction of the plan and address the concerns of different sectors of the hunting public. The upland game planning committee concluded that the three overarching goals of population and harvest monitoring, maintaining habitat through management projects, and maintaining and increasing hunter opportunities should be focal points of the Plan. One of the tools the committee used was the results of the upland game public opinion survey (Appendix 5). This survey reinforced the desire for baseline biological data to guide management, including habitat improvements and increased access for upland game hunters in Utah. The upland game public survey provided key insights on attitudes, perceptions and behaviors of hunters. This information, combined with the wide range of expertise of the committee members, helped the upland game planning committee determined that these overarching goals are paramount to achieve more precise management of upland game and to maintain or increase hunter opportunity.

Currently, long seasons for most species provide abundant opportunities for upland game hunters. Abundant youth hunts and mentoring opportunities, are important for R3, which stands for Recruitment, Retention, and Reactivation. Recruitment is the acquisition of new hunters into the sport, retention is keeping current hunters actively participating in the sport, and reactivation refers to individuals who hunted at one time, stopped, then started again and are currently members of the hunting public. The R3 effort is being implemented nationwide, as wildlife agencies strive to address the decline of hunters and anglers throughout the United States.

One of the first steps to implementing the R3 effort is identifying reasons why individuals are not currently participating in hunting — either actual or perceived. However, the barriers to participation are generally accepted to be less for upland game than for big game. Retention, or keeping hunters involved and active, is addressed as we consider the input of the public to better address the needs of current hunters as well as beginners. Reactivation oftentimes includes the older generation or any individual who may have stopped hunting, but their enthusiasm could be reignited by the appropriate opportunities (i.e. put-and-take pheasant hunting). Reactivation for some hunter segments usually involves hunts that don’t require rigorous physical activity, and can be done with grandchildren or other young family members. Other hunter segments may be reactivated through broadening knowledge of available hunting opportunities.

Population and Harvest Monitoring

For most upland game species in Utah annual changes in population size and productivity has not been monitored to date, although post-season hunter harvest information has been regularly collected for several decades, with published reports available from 1971. Accordingly, most upland species adaptive harvest management (AHM) strategies are precluded due to a lack of

data. Future management will strive to incorporate additional monitoring of annual population and productivity, although these efforts will be instituted strategically according to DWR priorities and available resources. Efficient and reliable monitoring techniques will be developed based on the best available science. The four primary sources of data for monitoring upland game trends that have been used to date include: 1) harvest data, 2) roadside or other opportunistic surveys, and 3) guzzler surveys.

The DWR does not have an upland-specific license or stamp for all species that allows upland hunters to be directly targeted for harvest survey participation. However, the DWR is able to contact a significant portion of hunting license holders each year to collect data on participation in upland game hunts and harvest. A large sample size and follow-up phone survey to account for non-response bias produces consistent year to year results and reliable trend estimates.

During fall hunts, DWR biologists collect hunter-harvested wings for sage-grouse at access points to sage-grouse hunting areas to identify age and sex of harvested sage-grouse, as well as an index of production (the proportion of juveniles to adults in the harvest sample), and hatch timing. Current wing collection is a small proportion of total harvest, usually limited to greater sage-grouse, and often comes from only a few locations. The DWR has created an objective in this plan to standardize and expand wing collection to other upland species to obtain a more extensive index of annual upland game bird productivity.

The DWR conducts standardized roadside surveys to track trends of lagomorphs (rabbits and hares), specifically, cottontail rabbit and jackrabbit populations, and participates in interagency pellet transects. Lagomorph roadside survey route methods have changed over the years in response to development. As a result, some portions of data collected via roadside surveys may now be of limited value. However, tracking and understanding trends in rabbit and hare populations may aid understanding of population dynamics of many other species. As the surveys continue, trends will be captured more accurately.

Guzzler camera surveys have already been adopted to assess chukar population trends and variations in production, with continued Gambel’s quail long period waterhole counts. The DWR will continue exploring new methods to survey populations and improve annual monitoring (i.e., modeling efforts that consider weather and vegetative indices in relation to annual harvest).

Habitat Improvement and Management

Healthy, functioning habitat is critical for survival and reproduction of upland species — these populations cannot be sustained if suitable habitat is unavailable. Long-term population trends of upland game species are determined by the quality and quantity (i.e. usable space) of available habitat. Annual (short-term) population levels oscillate primarily in response to annual weather patterns and the resulting habitat conditions with changes in survival and reproduction that manifest during the nesting, brood-rearing and/or winter seasons. Long term changes in populations tend to be associated with natural (e.g., wildfire) and human disturbances,

ecological succession, long-term climatic conditions, as well as management that maintains and expands habitat.

Species such as ring-necked pheasant that are associated with agriculture have been affected by the alteration of agricultural practices and urban development, reducing and/or fragmenting the amount of available habitat. Consequently, the longevity of upland game species associated with agriculture may be strongly influenced by private land management, such as farming practices that are conducive to upland game (i.e. leaving nesting cover, water sources, etc.). Additionally, private landowners choosing to participate in federal Farm Bill programs can positively impact upland species by altering grazing regimes, leaving lands undisturbed, and creating water improvements. In Utah, there are over 11.4 million acres of private land (21.1% of the state), much of which is in agricultural production, including livestock grazing on rangelands. Habitat for species that primarily occupy public lands will continue to be enhanced by the DWR through the Watersheds Restoration Initiative, and by working with partner agencies to develop habitat treatments that protect and improve upland game habitat (e.g., nesting and brood-rearing cover, riparian habitat areas, etc.).

The above actions are in line with opinion survey results that suggest pheasant, chukar, forest grouse and turkey are among the species upland game hunters enjoy hunting most. However, forest grouse, jackrabbit, turkey, chukar and cottontail rabbit have been identified by respondents as species easiest to find and access to provide additional hunting opportunities. The hunter opinion survey overwhelmingly showed that ring-necked pheasant was the upland game species that should be given highest management priority, despite limited opportunity, reduced habitat distribution and declining populations.

Maintaining and Increasing Hunter Opportunities

Utah offers a variety of upland game species and has vast amounts of accessible public land. Private land access is less critical to maintaining upland game hunting opportunities relative to many states. However, there are a few species that primarily occur on private lands, notably sharp-tailed grouse, grey partridge, and pheasant. Access programs should be focused on species with limited opportunity on public lands. Consequently, the DWR will prioritize public access to private land geared toward the private land-associated species (above). This includes seeking land acquisitions and conservation easements.

MANAGEMENT ISSUES

The DWR has identified multiple issues that affect upland game populations and management in Utah. These issues can be categorized into the three sections that define the DWR's priorities for this upland game plan:

- Population Maintenance and Harvest Monitoring
- Habitat Improvement and Management
- Maintain and Increase Hunting Opportunity

HARVEST MANAGEMENT

Through the mid-20th century, research on upland game harvest reported results that indicated compensatory harvest mortality for nearly all upland game species. The data supporting these conclusions showed winter bottlenecks or in other words that limited resources could only support a portion of the fall population through the winter. Additionally, high productivity and low annual survival rates in upland game and high juvenile-to-adult ratios in fall populations seemed to support the idea of a “doomed surplus” of individuals within populations that were available for harvest with no negative impact (i.e., additive harvest mortality) to breeding populations.

In the decades following this research and as wildlife professionals were educated with these harvest principles, a general liberalization of bag limits and season lengths occurred for upland game across the U.S. However, as research continued to develop wildlife scientists began to point out problems with some of the past research. In some earlier studies emigration and immigration within the harvested population were not accounted for, and conclusions of compensatory harvest mortality may have been misinterpreted because immigration into the harvested population during the breeding season could have mitigated the loss of animals harvested during the previous hunting season. Additionally, many upland game populations do not experience a winter bottleneck in most years and therefore the underlying mechanism for compensatory harvest mortality was not occurring within those populations. More recent research has shown that harvest impacts on upland game populations can be highly variable, even within the same population or between years. (Connelly et al. 2012). The DWR has been a leader in responding to these issues by implementing some of the first AHM strategies for upland game. In Utah, greater sage-grouse and sharp-tailed grouse harvest is managed with AHM. These more defensible strategies that base harvest on annual changes in population numbers were established to help conserve declining populations while maintaining important harvest opportunities.

Modern research has shown that upland game harvest impacts are variable and likely land somewhere on a gradient between compensatory to additive, rather than strictly one or the other (Dahlgren 2021). Long-term population trends, however, seem to be tightly correlated to the amount of available habitat, while short-term annual variations in populations are likely due to annual climatic conditions. At times, disease outbreaks may also contribute to population fluctuations. Due to data gaps concerning long-term trends in populations and habitat conditions for our upland game species, current harvest regulations for species within the scope of this plan remain similar to those recommended in the 2021-2022 Upland Game and Turkey Guidebook. Some level of population monitoring data is needed for AHM strategies to be implemented. As needs, opportunities, and resources emerge the DWR will begin to assess current harvest strategies and consider where AHM may be appropriate or not within Utah’s upland harvest management.

Currently, the DWR offers relatively liberal seasons and bag limits for chukar, grey partridge, quail, cottontail rabbit, and snowshoe hare. These species generally have relatively high adult mortality and productivity potential, and thus are less vulnerable to overharvest compared to

other upland game species. Forest grouse and ptarmigan have relatively liberal bag limits with shorter seasons to reflect lower annual production, although ruffed grouse can have high productivity (Table 1). Pheasant harvest regulations are less liberal than other species — reflecting declines in wild pheasant populations, high hunting pressure, and their reliance on private land habitat quality and federal farm bill programs, as well as the finite number of pen-reared pheasants that are offered to hunters each year. As mentioned above, greater sage-grouse and Columbian sharp-tailed grouse regulations are further restricted based on their AHM strategy and require a hunter to draw a permit.

Table 1. Current Utah upland game species, season dates and bag limits (2021-2022).

Species	Opening Date	Closing Date	Daily Bag Limit	Possession Limit	Notes
Forest grouse	September 1	December 31	4	12	Single species or in aggregate
White-tailed ptarmigan	September 1	October 31	4	12	Must obtain free permit
Partridge Youth	Saturday prior to partridge general season	Monday prior to partridge general season	5	15	Limits for each species independently
Partridge General	Last Saturday in September	February 15	5	15	Limits for each species independently
Quail Youth*	Last Saturday in October	Following Monday	5	15	Single species or in aggregate
Quail General*	First Saturday in November	December 31	5	15	Single species or in aggregate
Pheasant Youth	Last Saturday in October	First Thursday in November	2	6	
Pheasant General	First Saturday in November	First Sunday in December	2	6	
Cottontail rabbit	September 1	February 28	10	30	Mountain and desert in aggregate
Snowshoe hare	September 1	March 15	5	15	

*The season is closed to hunting scaled quail.

MONITORING

Increasing population monitoring is a high priority to expand Utah's understanding and management of its upland game resources. However, it is recognized that to meet this objective resources need to be prioritized and managed strategically over time. Goals, objectives and strategies are described in the tables of this plan to assuage this issue via research priorities, updated monitoring efforts, and other avenues for increasing baseline knowledge of all upland species in Utah.

Chukar surveys are an example of population monitoring in Utah. From 1996 through 2018, helicopter surveys were utilized as a tool to keep track of relative densities and long-term population trends of chukar in Tooele and Box Elder counties. In 2018, it was determined that the helicopter surveys were a safety hazard and more expensive than alternative survey methods. In 2019, new survey methods began via motion cameras at water sources, including guzzlers. Due to this new method, the metrics that index populations also changed. Rather than coveys flushed, chukars per square mile and total chukars collected by helicopter surveys, the camera survey method measures chicks per adult ratios, average number of adult visits per day and average chick visits per day. Other current surveys include Gambel's quail camera-based water source counts, sage-grouse and sharp-tailed lek counts, and rabbit routes (described above).

Dependable and effective monitoring techniques still need to be developed for most upland game species in Utah. It is difficult to estimate population size or even index population change for most upland game species due to their furtive nature and vast distribution throughout a variety of habitat types. Unlike some big game species that congregate on winter range (i.e., mule deer and elk), most upland game species do not concentrate in areas where they can easily be counted or classified— therefore, research should be done to develop new monitoring techniques and avenues to monitor populations. As these developments have not yet occurred, the DWR has relied on two primary sources of data for monitoring upland game trends: counts/classifications at water sources or lekking/dancing grounds, and data gathered on roadside surveys. The DWR also utilizes harvest data as a source of information (postseason mail and telephone surveys, and age ratios from hunter-harvested wings).

HARVEST SURVEYS

The DWR conducts a postseason upland game harvest survey every year. The survey methods utilized to estimate statewide harvest and hunter participation for upland game have changed over the years — therefore it is difficult to make precise inferences about trends in upland game harvest over time. For a more thorough description of harvest survey methodology, (see Appendix 5). The upland game harvest survey is designed to monitor statewide harvest trends from year to year. The more extensively a species is hunted, the more accurately the survey is able to measure the trend data. To improve the accuracy of the indices for species that receive very little hunting pressure, have low densities, and/or a limited distribution, a unique survey is used. Each species of that type must be hunted using a special permit so that information can

be obtained for survey purposes directly from hunters who successfully received permits. The only species covered by this plan that requires an additional (free) permit is white-tailed ptarmigan.

To estimate harvest data for all active upland game hunters, survey respondent answers are extrapolated based on the portion of license holders invited to take part in the survey and response rates. A random sampling protocol is followed to conduct this survey (accomplished by identifying groups of people who hunt upland game using previous surveys — this can be referenced in the annual reports), and a large enough sample size is compiled (400 or more survey responses meet this criteria) to ensure the results are precise. These methods result in estimated metrics such as total harvest, hunter numbers, and hunter effort. By following the same harvest survey protocol each year trends can be established over time.

WING BARRELS

In recent years wing barrel collection has been used in Utah, albeit somewhat inconsistently by species and area. Only the northeastern region administers wing barrels for forest grouse (the northern, northeastern and southern regions utilize wing barrels for sage-grouse, as sage-grouse hunts are limited to those regions). A DWR biologist places barrels at strategic access points in popular hunting areas to collect hunter-harvested wings each fall. Information can be determined for dusky grouse such as age, sex, hatch date, and peak harvest (weekly barrel checks can determine peak harvest). The age can be determined from ruffed grouse wings, but rump feathers would be necessary to determine sex. The ratio of juveniles to adults in the harvest provides an index to annual productivity. Currently the number of wings collected annually is low and geographically limited precluding representative statewide estimates. To improve the ability to monitor populations, this plan has the objective to expand the wing collection program to obtain more comprehensive indices of forest grouse productivity. If this effort is successful, the sample size of wings will increase and the collection will expand in spatial representation.

ROADSIDE SURVEYS

Standardized roadside surveys have been utilized to obtain indices to lagomorph trends. As DWR biologists conduct field-based work, especially during the breeding and brooding seasons, they opportunistically record upland game sightings to get an idea of whether numbers seem higher or lower from the previous year, whether broods are observed, etc. Although this provides biologists with some information to share with hunters, the data is anecdotal, not standardized, and cannot be used to reliably monitor population trends. The DWR will investigate and implement new methods to monitor populations to improve annual monitoring as needs arise and funding becomes available (i.e., research studies involving telemetry, band recovery, etc.).

STOCKING

Pheasants and other non-endemic birds (i.e. chukar, grey partridge and California quail) were first introduced into Utah during the late 1800s and early 1900s, when farming practices were able to support more habitat and populations and other environmental factors were very different. For example, during that time climatic precipitation regimes were more favorable, habitat was less fragmented with less disturbances, and predator densities (e.g., corvids and raptors) were likely lower. Some have suggested releasing pen-reared birds to bolster populations, however, these birds have extremely low survival rates when released compared to wild birds, and the very small percentage that do survive to breeding season do not readily reproduce. Although pen-reared birds were released in the past, the available evidence suggests that it was the wild-trapped and translocated birds, along with emigration from already established populations, which were responsible for the expansion of these exotic game bird populations. Stocking has proven to be ineffective at maintaining or increasing established breeding populations. Alternatively, the amount of quality habitat tends to influence abundance the most and established wild populations will be maintained, increased, or lowered depending on the amount of suitable habitat available. The most effective use of stocking programs is to provide additional hunting opportunities via put and take programs, such as Utah's chukar and pheasant releases just prior to the hunting seasons. The DWR currently stocks pen-reared pheasants on 60 public areas including Wildlife Management Areas, Waterfowl Management Areas, Walk-In Access properties and other public lands. Utah's pheasant stocking program is intended solely as a "put and take" opportunity, and does not include an objective to maintain or restore wild pheasant populations.

PREDATION

Predation can impact upland game populations, especially when habitat is degraded in quality and/or quantity. However, upland species have evolved with predation and are generally adapted to regular predation pressure. Reproductive rates tend to be high and can offset predation including large clutch or litter sizes, potential for litters per year, and breeding/nesting again if a clutch or litter fails to survive. Increased predation on upland game bird nests, chicks, or adults is typically caused by insufficient habitat. For example, habitat lacking sufficient vegetative cover can result in elevated predation on nests and adults. Habitats modified for human purposes can allow for distribution and abundance of predators to expand by creating artificial sources of food, water, or nesting and denning areas (Bui et al. 2010, Newsome et al. 2014, Coates et al. 2016). Habitat fragmentation can also result in elevated predation rates if predators have increased access to native habitats, or game birds are forced to move through unfamiliar or exposed habitats (Schroeder and Baydack 2001, Vander Haegen et al. 2002).

Predator bounty programs are often suggested as a way to improve upland game populations, however they have been shown to be ineffective and costly having little influence on predator population trends since at least the mid 1900's (Bennitt 1948, Douglas and Stebler 1946). More recent research shows that bounty programs did not increase hunter participation or reduce

coyote populations (Bartel and Brunson 2003). Predator control programs may be effective in small areas where high level of control can be maintained to protect imperiled populations, improve translocation success or on select wildlife management areas (Côté and Sutherland 1997, Frey et al. 2003, Dinkins et al. 2016, Conover and Roberts 2017).

Expanding, manipulating, or otherwise managing habitats will generally be the most efficient practice to manage the influence of predators on upland game populations. For example, if nesting cover is subpar, habitat restoration or a change in habitat management may be needed for improvement. Moreover, the modification of human-caused food or removal of perching sources (i.e. landfills, feed stores, artificial nesting structures like transmission lines, etc.) that predators utilize can be an effective long-term strategy. Habitat fragmentation and human-created impacts increase across the landscape, predator communities within these altered landscapes will likely respond, and thus have potential to influence upland game populations.

ECONOMIC IMPACT

Surveys have not been conducted to decipher the economic benefit of upland game hunting in Utah in recent years. However, Southwick Associates (2018) reported that the economic impact from upland game birds at a national level is significant. In 2018, an estimated 97,831 hunters spent over six million dollars on expenses relating to upland game bird and small game hunting. Additionally, the 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation gathered data for United States residents that were 16 years-old and older. The survey depicts that 11.5 million hunters spent 26.2 billion dollars in the U.S. in 2016 (USFWS, 2018). Though this data is not broken down by state, hunters clearly have a positive impact on the economy.

HABITAT IMPROVEMENT AND MANAGEMENT

Habitat management is the most crucial aspect of preserving and bolstering upland game populations. Furthermore, respondents to the upland game opinion survey rated habitat loss due to land development as the most important factor affecting upland game populations. Upland game species' populations are impacted long-term by the quality and quantity of available habitat. Short-term population densities vary in response to weather conditions during the nesting, brood-rearing and/or winter periods, while population abundance will remain relatively stable unless suitable habitats are modified.

Utah is a geographically diverse state; therefore, fluctuations in weather conditions at relatively small scales can result in fluctuating production rates. Most of Utah's upland game species thrive in diverse, natural habitats, ranging from coniferous forests and aspen stands to shrub-steppe rangelands, and rocky outcroppings. These habitats are subject to natural disturbances (wildfire), and human disturbances (recreation, timber harvest, etc.). The balance of disturbances and habitat succession creates a mosaic variation of habitat suitability for each species.

Past agricultural practices have benefited ring-necked pheasant, grey partridge, California quail, and cottontail rabbits by supplying food sources such as waste grain and an amalgamate of habitat types conducive to game birds. Small grain or hay fields surrounded by weeds, pasturelands, fence lines, irrigation ditch banks, rocky outcroppings, and crop stubble provided the necessary mixture of food and cover for breeding, brood rearing, and wintering upland game. As agricultural practices shifted and individual agriculture operations moved towards monocultures, the diversity of habitat types that benefited upland game birds (especially pheasants) has reduced over time (Joselyn and Warnock 1964, Dahlgren 1988, Warner 1988, Hiller et al. 2009).

Moreover, previously unused areas and road ditches have been cultivated; fence rows and farmstead windbreaks were discarded; and more grasslands were grazed. Ditch banks and edges of fields that were seasonally flooded disappeared due to conversion to pivot irrigation rather than flood irrigation. The spraying of herbicide to control noxious weeds, the burning of crop stubble and ditch banks, and general removal of vegetation (outside of farmed areas) further reduced habitat quality for brood-rearing and wintering (Rodgers 1999). Upland game populations experienced a coinciding rapid decline in those areas of Utah where modernized, industrial agriculture is most prevalent. In addition to revised agricultural practices, urbanization, population growth, and the subsequent loss and fragmentation of habitats have also negatively affected upland game populations.

As available habitat has deteriorated, upland game habitat management has concentrated on restoring the curtailing land cover types beneficial to upland game species (Taylor et al. 2018). Therefore, the future of some upland game species, especially those associated with agriculture, will depend on private land management and federal Farm Bill programs. In Utah, there are 11,456,608 acres of private land out of 54,315,461 total land acres (21.1% private), most of which is rangeland or in agricultural production.

Conservation efforts by ranchers, farmers and landowners have been supported by a sequence of federal laws collectively established as the Farm Bill. Implemented by Congress in 1985, the Farm Bill is a landowner-friendly tool that has been integral in successful conservation of habitat on private lands. Farm Bill conservation programs fund easements to safeguard agricultural lands, execute efforts to protect vulnerable species on working lands, and provide technical advisors to consult with landowners about enhancing the efficacy of their operations while conserving natural resources.

While individual programs and amounts funded have varied, Congress continues to champion conservation on private lands. The Farm Bill Agricultural Act of 2014, dedicated about 28 billion dollars through 2018, for conservation in four main areas: the Conservation Reserve Program, partnerships, conservation easements, and working lands programs. Currently, the Agriculture Improvement Act of 2018 is in place and will continue through 2023.

Table 2. Current Farm Bill programs benefiting upland game species in Utah. Here is a summary of current Farm Bill programs in Utah:

Name	Description	Acres Enrolled (3-year average)
EQIP - Environmental Quality Incentives Program	Provides financial and technical assistance to agricultural producers to address natural resource concerns	320,000
CRP - Conservation Reserve Program	Helps voluntary farmers and ranchers improve water quality, prevent soil erosion and reduce the loss of wildlife habitat on private lands.	137,021.99
CSP - Conservation Stewardship Program	Helps agricultural producers maintain and improve their existing conservation systems and adopt additional conservation activities to address priority resources concerns.	620,000
AMA - Agricultural Management Assistance Program	Helps agricultural producers manage financial risk through diversification, marketing or natural resource conservation practices.	300
ACEP - Agricultural Conservation Easement Program	Helps landowners, land trusts, and other entities protect, restore, and enhance wetlands, grasslands, and working farms and ranches through conservation easements.	1,723.52
RCPP - Regional Conservation Partnership Program	Promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners.	12,000

(M. Phillippi, personal communication, April 6, 2022)

In 1992, in response to dwindling pheasant populations, the DWR initiated an additional fee for upland hunters, known as the “upland game habitat stamp” — this facilitated funding for upland game habitat. Funding for the program was derived from the sale of an upland game stamp (five dollars per hunter), which was authorized by the Utah legislature. This stamp was required of all pheasant, partridge, quail sage-grouse, dusky grouse, ruffed grouse, mourning dove, cottontail rabbit, and snowshoe hare hunters. From 1992 to 1995, it was required for hunters 16 years old and older, but in 1996, the stamp was required for hunters 14 years old and older. The name of the stamp also changed in 1996 to the “wildlife habitat authorization.” In 1997, the cost of the authorization increased to $5.25. In 2001, the stamp requirement was removed and was funded through a direct budget line item from the sale of hunting licenses.

During the 1995 general session, the Utah Legislature created the Wildlife Habitat Account. This account provides dedicated funds from hunting and fishing license sales that must be used to enhance, preserve, manage, acquire and protect fish and wildlife habitat. The funds may also be used to improve public access to fishing and hunting areas. The Wildlife Habitat Account generates about $2.8 million each year for habitat projects. The Habitat Council makes recommendations on how to distribute the funds in the Wildlife Habitat Account. Council members include four individuals from the DWR and four citizens who represent big game, waterfowl, upland game and sport fishing interests. Any organization or individual can submit habitat project proposals, which are reviewed and prioritized by regional teams. Then, the Habitat Council completes a final review and makes its recommendations. According to Utah Code, each year up to $230,000 or 12% of the annual deposits to the account, whichever amount is greater, shall be allocated to upland game projects. The DWR director authorizes projects and the funds to implement them. In 2021, the Habitat Council provided $555,125 in funds towards upland game.

Over time the DWR has developed a program for additional funding for habitat-related projects through Utah's Watershed Restoration Initiative (WRI). WRI is a partnership based program designed to improve high priority watersheds throughout the state. WRI is sponsored by the Utah Partners for Conservation and Development and is in its 15th year. The Watershed Program focuses on improving three ecosystem values: 1) watershed health and biological diversity, 2) water quality and yield, and 3) opportunities for sustainable uses of natural resources. WRI is a bottom-up initiative where project planning, review, and ranking occur at a local level. Five regional teams elect their own leaders, establish focus areas, review, score and rank project proposals using a comprehensive project prioritization score sheet, and assist their members in implementing projects. These projects have the ability to benefit upland game, even if another species is the primary objective of the project. For example, a project for increasing bitterbrush, sagebrush, and forbs on a wildlife management area benefits mule deer and elk, but also positively impacts pheasant and quail.

Table 3. Utah Watershed Restoration Initiative projects benefiting upland game species listed by number of acres by year. Multiple species may be benefitting species for a single project, resulting in yearly totals for all projects being lower than if all individual species were totaled for each year.

	Black-tailed Jack-rabbit	CA Quail	Chukar	Desert Cotton-tail	Dusky Grouse	Gambel's quail	Grey Partridge	Mt. Cotton-tail	Ring-necked Pheasant	Ruffed Grouse	Scaled Quail	Snowshoe Hare	White-tailed Jack-rabbit	Total
2005	0	0	0	0		0	0	0	0	0	0	0	0	1,592
2006	0	10	249	269	0	0	0	0	0	0	0	0	0	44,552
2007	0	88	0	267	0	0	0	0	265	0	0	0	0	54,001
2008	7,663	23	8,810	7,345	737	0	0	0	8,638	737	0	0	0	262,884
2009	2,238	3	1,494	575	540	540	0	0	454	0	0	0	0	64,105
2010	5,409	6	2,698	2,360	0	332	0	0	2,676	489	0	501	0	46,872
2011	0	69	0	0	134	2,801	0	0	343	134	0	0	0	75,865
2012	0	50	50	0	6,125	1,025	0	0	767	9,918	0	1,079	0	51,947
2013	2	313	287	2	21	195	0	2	1,651	590	0	0	2	94,150
2014	721	318	1,092	0	2,808	0	0	721	806	2,808	0	283	721	63,077
2015	150	50	2,257	0	31	0	1	150	1,171	31	0	740	0	59,249
2016	4,503	158	281	4,833	86	200	0	0	900	86	0	0	0	80,124
2017	1,892	315	6,227	2,023	3,303	0	3,587	1,202	606	3,950	0	1,202	0	100,831
2018	3,360	128	3,857	436	27,307	0	344	6,226	753	4,322	0	2,987	0	152,891
2019	9,337	1,848	1,656	2,659	468	3,711	86	5,420	6,411	0	0	0	4,875	126,989
2020	2,114	3,090	19,449	2,232	129	1,503	532	1,940	750	235	0	0	0	173,584
2021	0	3,840	5,606	4,524	149	2,019	422	0	1,542	149	0	29	0	57,782
2022	0	0	0	1,508	0	0	0	0	0	0	0	0	0	7,689

ARTIFICIAL WATER SOURCES

Water developments, also known as guzzlers, have been installed throughout Utah and other western states to expand the range and density of upland game birds, with most efforts targeted at chukar partridge. Utah has 1,226 guzzlers in the DWR database, 511 guzzlers installed with upland game as the target species, with an additional 669 big game guzzlers that in many cases are also used by upland species. Chukar partridge is the primary target species for the vast majority of upland game guzzlers with 435 listed with chukar as a primary species, and an additional 67 with chukar listed as a secondary species. Gambel's quail is listed on 77 guzzlers as a primarily benefiting species. There are 11 guzzlers listed as primarily benefiting turkey. There are an additional 14 listed as benefiting sage-grouse, however free water needs of sage-grouse is minimal, and may be of primary benefit by generating mesic areas. For additional detail on guzzlers for chukar partridge see page 42.

Associated with a better understanding of wildlife water developments, an additional management plan for upland game water developments will be developed and attached to this plan as Appendix 3 to address:

1. Needed density of water developments for chukar partridge
2. Areas where water development is complete
3. Areas in which additional water developments are needed
4. Potential unintended consequences of water developments including predator subsidies
5. Effectiveness and need for water developments targeted at species other than chukar partridge

HUNTER OPPORTUNITY

The upland game opinion survey conducted in 2022 demonstrated that 77.1% of upland game hunters spend more time hunting on public lands, 17% spend more time hunting on private lands, and six percent spend their time hunting on both private and public lands. The survey further indicated that 28% of Utah hunters were dissatisfied with the availability of public land access, and 55% were dissatisfied with the availability of private land access. An indirect effect of limited access is crowding. Crowding was the most important factor to limiting the enjoyment of a hunt. For hunters that indicated dissatisfaction with their hunt, access and crowding were often mentioned. To address this demand, the DWR will continue to explore avenues in which access to and through private lands and landlocked public lands can be expanded. To offer more public access and hunting opportunity, Utah provides the following resources:

- The Walk-In Access program; designed to secure access to private land or through landlocked public land. As of 2022, approximately 65,880 acres of land have been enrolled in the WIA program statewide.
- Bureau of Land Management (BLM) and Forest Service (USFS) properties are multiple use lands. Their missions are to sustain the health, diversity and productivity of public lands to meet the needs of present and future generations.
- The SITLA Access Payment between DWR and the State of Utah School and Institutional Trust Lands Administration (SITLA) keeps 3.4 million acres of trust lands open to hunters and anglers and those interested in viewing wildlife and runs through 2032.
- The DWR purchases Wildlife Management Areas and Waterfowl Management Areas through land acquisitions, and actively seeks opportunities to attain conservation easements, which benefit wildlife through the preservation of habitat. These properties also provide hunting, trapping and angling opportunities to the public.

HUNTER OPINION SURVEY

To gain perspective of upland game hunters in Utah and guide management decisions for the Plan, the DWR conducted an opinion survey of licensed hunters in 2022. Though previous surveys were conducted in 1991 and 2006, the DWR found value in gathering up-to-date information from upland hunters.

Previous surveys were conducted as mail surveys, however the 2022 survey was conducted digitally. The sampling frame consisted of two sample populations: a convenience sample on social media and a random sample of individuals that indicated they hunt upland game on a previously administered hunter harvest survey.

The convenience sample used a ‘boosted’ social media advertisement. Using key words we targeted upland game hunters in Utah. This boosted post reached 17,040 people and had 533 clicks which resulted in 838 survey responses. Because there were more survey responses than clicks on the survey link we suspect people shared the link. In addition to the social media post, the survey was directly shared with upland game groups which added 65 more responses

to this group. The random sample portion was obtained by emailing 1,386 people. For this portion we sent the survey directly to their email, and only one response was possible per email. The emails generated 573 responses.

In total, 1,477 people completed the survey – 97% were Utah residents and 3% were non-residents – and 91% of respondents reported hunting upland game in Utah in the last three years. Results from this survey have provided guidance in development of this upland game management plan. The average age of the respondents was 44.4 years old. Ninety-four percent of respondents were male and 83% indicated they hunted or applied to hunt deer or elk in the last three years.

To better understand the perspectives of upland game hunters, a subset of respondents were identified as “upland game enthusiasts” if they spent 10 or more days hunting upland game in the past year. There were 931 (63%) hunters in this category. In addition to the enthusiast classification, we also identified hunters that were new (hunted 0-3 years), seasoned (hunted for 4-25 years, or veteran hunters (hunted for over 25 years). We received responses from 56 (4%) new hunters, 437 (35%) seasoned hunters and 773 (61%) veteran hunters.

There were 118 people who took this upland game hunting survey that indicated they did not hunt upland game in the last three years. When asked what would make them more likely to participate in the future, over 52% said knowledge of where to hunt followed next by having closer hunting opportunities (32%).

Even though pheasant numbers have declined in Utah since peak harvest, wild pheasants were the most commonly listed when asked what species you prefer to hunt (63% of hunters picked pheasants as one of the most enjoyable species to hunt). Pheasants were followed by chukar partridge (46%) and ruffed grouse (38%). When combined, 44% of hunters selected forest grouse – dusky and ruffed – as a most enjoyable upland game hunting opportunity. American crow, band-tailed pigeon, white-winged dove and white-tailed ptarmigan were least often picked as an enjoyable species (less than 3% of hunters). When hunters were asked to rate the overall quality of their hunting experience over the last three years, 28% of them reported a good or extremely good experience hunting for upland game.

When seeking just the new hunters’ experience, 41% reported having a good or extremely good experience. For any experience rated as poor (44% of all responses), hunters were asked to identify what factors contributed to this rating. The top three factors identified were lack of game animals (71% of responses), access issues (22% of responses) and too many other hunters (20% of responses). Many of the responses specifically mentioned pheasants. This is not surprising, given 53% of pheasant hunters rated the quality of their hunting experience as poor.

Over 77% of hunters identified public land as the property type they hunt the most in Utah. Only 28% of hunters reported being dissatisfied with the public access. When asked about factors affecting game populations, the most important was ‘loss of upland game habitat due to land development’ with 90% saying it was important to extremely important. Of the factors asked

about, excessive harvest levels was the least important with only 50% saying it was important to extremely important. Respondents were asked how important various factors were to their enjoyment of upland game hunting. The most important factors were to be outdoors and enjoying nature while hunting and not losing wounded birds. The least important factor was to harvest at least one game animal on most of your trips. When asked about what is limiting the enjoyment of the hunt, crowding and low numbers of game were rated highest and finding time for hunting was rated lowest.

There was a series of questions asked about management priorities. While all strategies were rated high, maintaining and enhancing habitats was rated higher than monitoring game population trends.

Upland Game Species Accounts

In Utah, upland game species data is collected each year through harvest surveys (see Appendix 4). This information is available on the DWR website (https://wildlife.utah.gov/upland-reports.html). Harvest trends, success rates, weather conditions, license sales, and other data are summarized in these reports. The harvest information, history of each species in Utah, their physical description, habitat requirements, and behavior are summarized in the following species-specific sections.

FOREST GROUSE

The term “forest grouse” refers to ruffed and dusky grouse. Although they are grouped under the “forest grouse” umbrella due to occurrence in forested habitats, their life histories and habitat needs vary significantly. Ruffed grouse occur in northern and central Utah, mainly in the Cache, Wasatch and Uinta Mountains, and Utah provides the most southern distribution of the species rangewide. Dusky grouse are more widely distributed throughout the state, including distinct pockets of habitat unconnected to the Wasatch Range.

Ruffed Grouse

Ruffed grouse are endemic to the United States, including Alaska and Canada. They occur in a variety of forest habitats throughout Utah, but are generally found in areas with deciduous trees and shrubs, such as aspen, willow and berry-producing mountain shrubs (Figure 2). Ruffed grouse are frequently associated with riparian areas, or moist, brushy areas such as north-facing slopes and draws.

Ruffed grouse are medium-sized birds with feathered legs, a rounded tail, and a short crest on the top of their heads. The male’s feathers are generally a mottled, brownish-gray color to aid them in camouflage. Their tails have broad, muted bands of color; usually gray, with narrow bands of black lining the gray edges. Each side of their neck has long patches of feathers that can be flexed into a ruff, and fleshy bright orange combs around the eyes are often displayed

when the ruff is erect. Females look similar, but the dark band on the tail is usually more blotchy, and their tails, ruffs and eye combs are smaller (BNA, 2000).

Ruffed grouse emit a variety of sounds, though vocal noises are not loud due to their simplistic vocal organs. They are known for the male's unique mating drumming display during the mating season. By spreading and rotating their wings forward and backward quickly, air pressure creates a drumming sound. Drumming can occur at any time of the year, though peak drumming is displayed in April or May. Females will build nests within a week after breeding, and they will breed again if they lose their first nest. Hens will incubate the clutch for approximately 24 days, and the chicks are able to leave the nest within 24 hours of hatching. Females will stay with their brood until late August to mid-September (BNA, 2000).

Potential threats to ruffed grouse habitat in Utah include fire suppression policies that impede aspen regeneration, other forest management practices that precludes early successional habitat availability such as degradation of dense understory vegetation, and long-term drought impacts. Timber harvest, fire, and other management practices that support dense, early successional habitats are known to benefit ruffed grouse throughout their range. Practices that degrade riparian areas resulting in erosion or loss of water retention or management that promotes older sparser forests is likely detrimental.

Dusky Grouse

Dusky grouse, also known as blue grouse, are native to western North America, and present throughout forested portions of Utah (Figure 3). Dusky grouse move between habitat types throughout the year and exhibit reverse migration moving up in elevation and wintering in high elevation conifer stands. During the summer months, dusky grouse are found in areas with mixed tree cover, dense understory vegetation, and they regularly used more open shrub habitats adjacent to tree cover, especially when brooding young. As summer transitions to fall, they begin their elevational migration to conifer areas, which in Utah are most often dominated by Douglas-fir (*Pseudotsuga menziesii*). Their winter diet shifts to nearly 100% conifer needles until the spring breeding season.

Dusky grouse are stocky birds with a long tail and long, rounded wings, and feathered legs and feet. Males and females are distinct in color; males are dark shades of blue and gray, while female feathers are dark to medium brown in color, and females are smaller than males. Males also have a patch of bare skin on the neck that is exposed as part of their mating display. Additionally, dusky grouse males are the only grouse with eye combs that change color during mating season — they are yellow for most of the year, but turn bright red during courtship (BNA, 1992).

The dusky grouse breeding season occurs in late April to early May. Males sing and use "flutter-flights" to entice females during the breeding season. Their courtship display begins with spreading their feathers, then wooting and rushing if a female is present, and then head bobbing. Only the female incubates the nest, which lasts approximately 26 days. Chicks can move within the nest shortly after hatching, and can move out of the nest in short distances

within the first day of hatching. Hens leave their broods or brood breakup occurs in late summer and early fall. (BNA, 1992)

Rugged mountain habitat has helped protect the dusky grouse; however, habitat loss and degradation due to pine beetle infestation, loss of understory and fire suppression can be threats to localized populations. Although impacts of forest management practices on dusky grouse are poorly understood, removal of conifers at higher elevations could potentially have a negative impact on winter ranges.

Population Status/Monitoring

Currently, forest grouse are not monitored extensively in Utah. The Northeastern Region has facilitated some wing collection via wing barrels in 2020 and 2021. There were eight locations in 2020 and ten locations in 2021. This effort will be continued, and the compiled data will be available in the annual harvest report on the DWR website.

Harvest

Research on ruffed grouse has shown that hunting mortality can be partially additive, with immigration sustaining populations (Small et al. 1991). Research suggests the harvest of dusky grouse may only have minor influence on populations (Mussehl 1960, Zwickel 1982, Hoffman 1985), and seasonal migrations may reduce hunting effects (Zwickel 1992). Dusky grouse are relatively long-lived and have lower reproductive rates compared to many upland bird species, which makes them more vulnerable to overharvest. However, recent studies in Utah suggest that current levels of hunting pressure likely have little to zero probability of negatively impacting dusky grouse populations (Farnsworth 2020).

Both forest grouse species share season dates with aggregate bag and possession limits. From the 2010-2011 to 2020-2021 seasons, an average of 9,918 hunters spent 47,515 days to harvest 37,145 forest grouse annually. Number of birds harvested/day by hunters averaged 0.8, and hunters averaged 3.7 birds/season. The number of forest grouse hunters and birds harvested per day has remained stable with some year to year variation over the last 10 years, however the number of hunter days shows a generally increasing trend with a concomitant increase in overall harvest. In the 2020-2021 season, approximately 50% of the forest grouse harvest was made up of ruffed grouse; 47% of the harvest is dusky grouse, with 3% unknown (Figure 1).

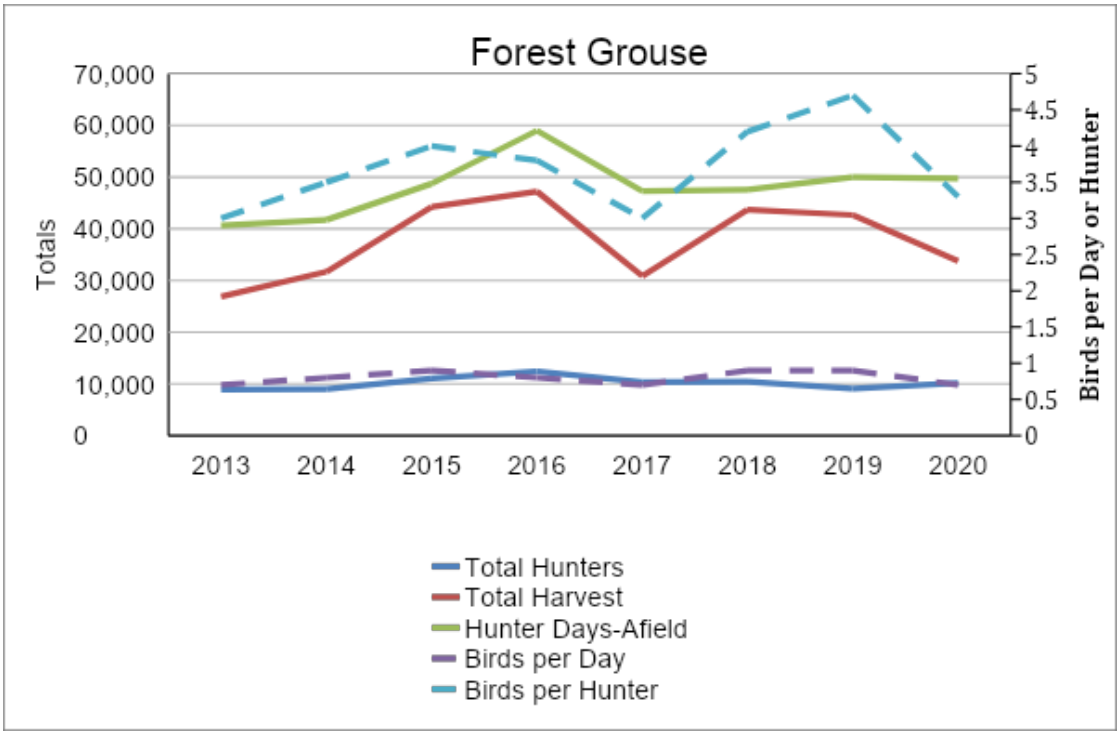

Figure 1. Forest grouse harvest and hunter participation from 2011 to 2020.

Threats

- Lack of knowledge of population changes and status, habitat needs, the effect of habitat management, seasonal movements, and vital rates.
- Declining forest health leading to large stand die offs due to beetle kill and other factors related to lack of stand diversity.
- Poor habitat quality resulting from fire suppression and other factors

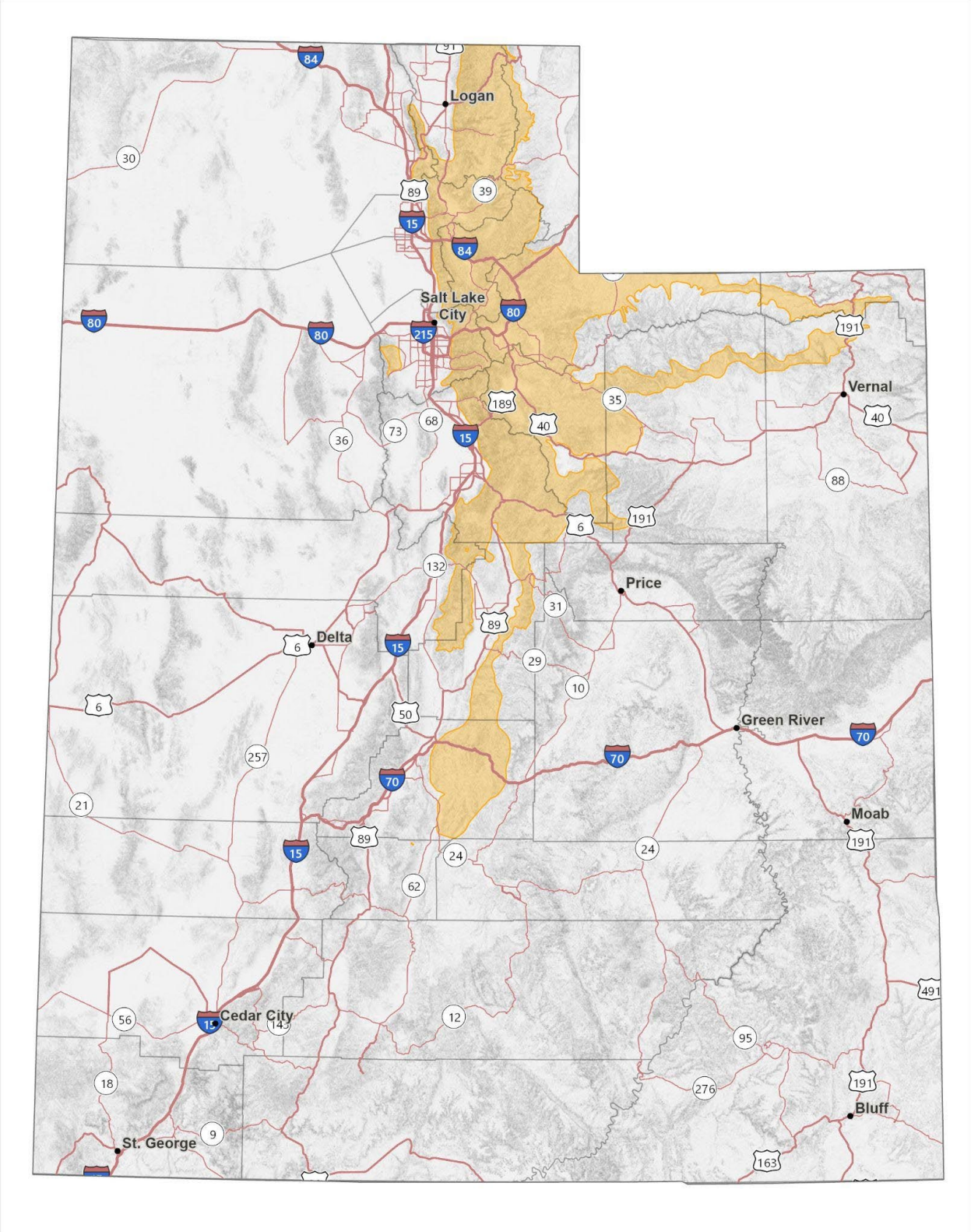

Figure 2. Occupied ruffed grouse habitat in Utah.

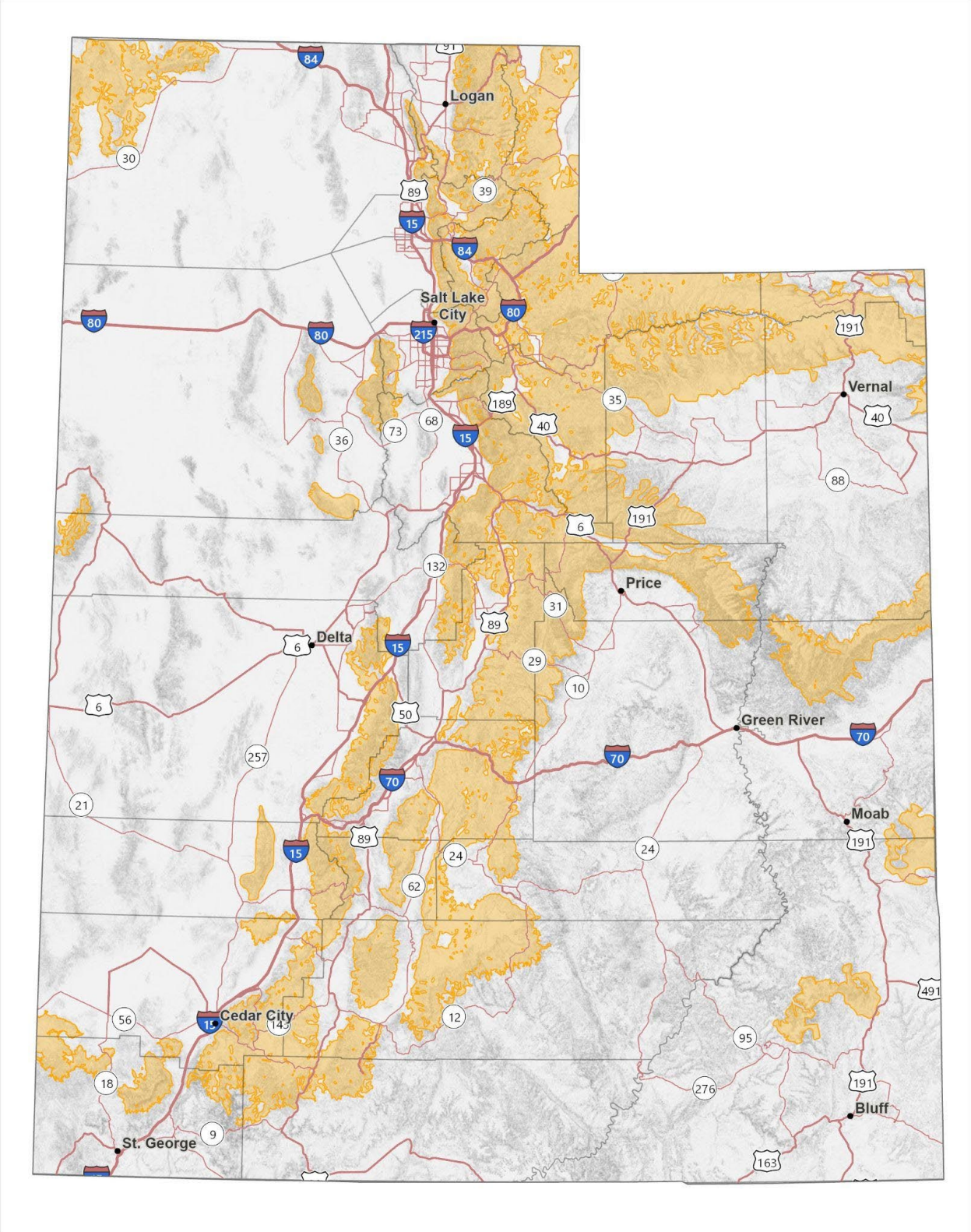

Figure 3. Occupied dusky grouse habitat in Utah.

WHITE-TAILED PTARMIGAN

The white-tailed ptarmigan (*Lagopus leucurus*) is also known as the snow quail, and is the smallest grouse (the tribe, *Tetraonini)*, weighing around one pound. This is an alpine species which permanently resides in the high mountains above timberline, and is associated with willowy drainages (Figure 6.1). They are pure white in the winter, and change in the summer to having a mottled-brown head, breast and back with white wings, abdomen and tail. Their seasonally alternating color is one of the ptarmigan's most unique adaptations, which allows for camouflage with lichens and boulders in the alpine habitats. Additionally, while all grouse have feathered tarsus, or shins, as well as feathered legs and nostrils to keep them warm in the winter months, the white-tailed ptarmigan has feathered toes. This not only assists in heat conservation, but these feathers are utilized as snowshoes for the grouse; keeping them above the surface of the snow as they walk (Robinson, 2021).

The species was introduced into the Uinta Mountains in 1976 from source populations native to Colorado. They spread from release locations and currently occupy most of the high elevation basins above timberline throughout the Uinta range. One of the most critical threats to ptarmigan is warming climate conditions and increased drought. Since ptarmigan depend on alpine habitats above tree line throughout their rangewide distribution and are not adapted for other warmer environments, some concerns include reduced winter snow cover, precipitation patterns shifting to summer rains leading to decreases in food availability, changes in plant communities, and the tree line gradually moving upward (Hoffman 2006).

Population Status/Monitoring

Currently, ptarmigan populations are not monitored. The DWR does collect information through harvest surveys sent to hunters who obtain a permit to hunt ptarmigan. However, Utah has made plans to explore other types of surveys to gain more information, such as call-back surveys to record number of ptarmigan responses to an electronic call, as well as wing collection surveys. Ptarmigan are also listed as a research priority in the Plan.

Ptarmigan are of increasing conservation concern due to the above threats — in 2010, southern white-tailed ptarmigan were petitioned for listing under the Endangered Species Act. However the USFWS determined in 2020 that the listing was not warranted, and the introduced Utah population or introduced populations were not considered in the listing decision (USFWS 2020c).

The USFWS concluded that predation, mining and related poisoning due to toxic concentrations of trace metals, hunting, recreation, livestock and native ungulate grazing did not pose a threat to extirpation of the species. The USFWS did find that changes in climate is a threat to local populations due to changes in minimum and maximum temperatures; changes in snow quantity, quality, extent, and duration; shifts in plant phenology; advancement of tree line, and expansion of willow into alpine areas; and changes in the amount and timing of seasonal precipitation. However, USFWS also concluded that range-wide there is adequate resiliency, redundancy and

representation to survive environmental changes (USFWS, 2020b). The Utah population is limited in distribution, and lacks connectivity to other populations that may be critical for maintaining genetic diversity and adaptation to variation in its environment, catastrophes, and novel biological and physical changes in its environment (USFWS, 2020b). Understanding the impacts of environmental shifts or other catastrophic events to ptarmigan in Utah is imperative for managing this species in the state.

Harvest

Hoffman (2006) describes ptarmigan as behaviorally susceptible to over-harvest as they display high site fidelity in fall habitats, despite disturbance. In recent years, Utah's ptarmigan hunting statistics have shown more than a doubling in hunter effort, while harvest per hunter day has remained below long-term averages. Early opening dates and relatively short reproductive windows may lead to increased harvest of chicks and brood hens. As a result, Utah has moved opening day to September 1st, as delaying the opener by a week may increase the probability of brood breakup before hunting begins and disperse hunting pressure amongst other upland species with similar opening dates. However, due to the remote areas that ptarmigan inhabit in Utah (Uinta Mountains), over-harvest throughout Utah's population is unlikely, but may occur in well-known or easily accessed areas. Further evaluation of season dates, bag limits, and area-specific harvest is warranted.

From 2010 to 2020, on average 102 hunters spent 303 days to harvest 66 ptarmigan annually. Hunters averaged 0.23 birds harvested/day and 0.68 birds/season, much lower harvest relative to other upland game species. Despite low harvest success, the number of ptarmigan hunters has been steadily increasing over the last three years, with an accompanying increase in hunter days. However, birds harvested per day have been trending downward overall with a slight increase in the 2020 season (Figure 6).

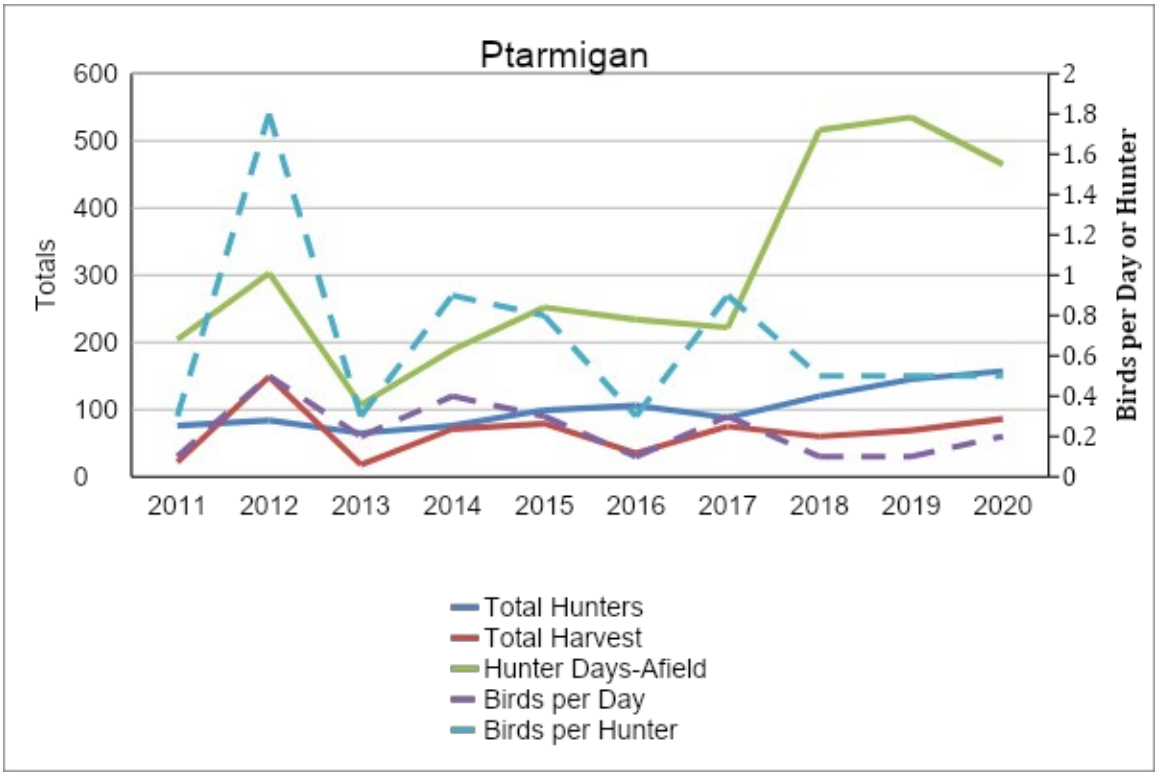

Figure 6. White-tailed ptarmigan harvest and hunter participation from 2011 to 2020.

Threats

- Decreased suitable habitat due to changes in temperature, precipitation, and other environmental factors related to a changing climate.
- Deficient fitness due to limited genetic diversity.
- Limited range and population size in Utah, possibly leading to low population resiliency.

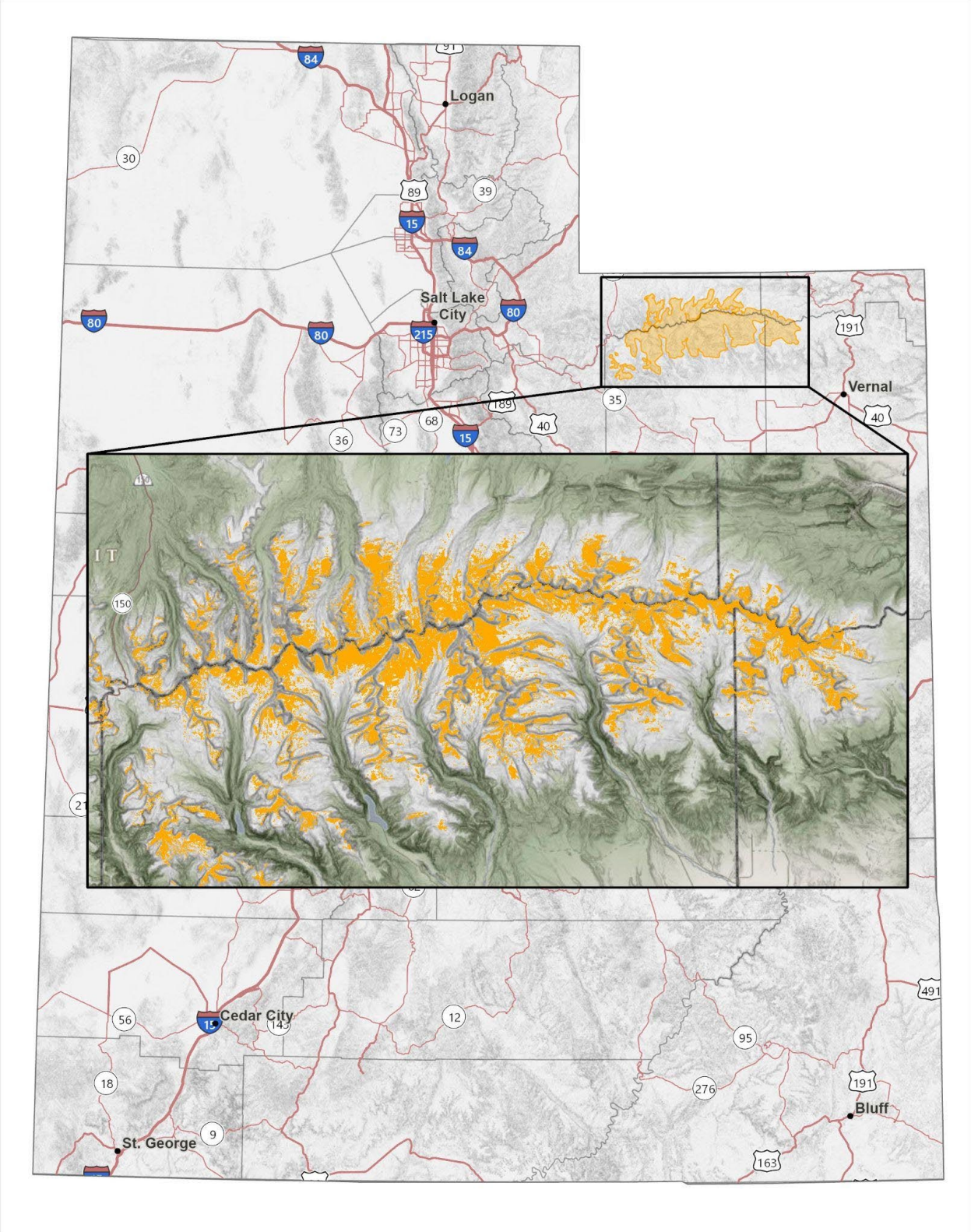

Figure 6.1. Occupied white-tailed ptarmigan habitat in Utah.

QUAIL

Three species of quail occur in Utah – California, Gambel's and scaled quail. Gambel's quail are native to Utah, and though there is debate about whether scaled quail are native to Utah, the northern range limit of scaled quail may reach extreme southern Utah. Scaled quail populations are very limited, so they are not currently hunted in Utah. California quail were translocated into Utah and have become the most abundant comprising most of the state's quail harvest. For all quail species, abundance is influenced by both habitat availability and quality, as well as timing and patterns of precipitation. Like other upland species, weather conditions (especially during the winter) can impact quail significantly, though quail are highly adapted to take advantage of periodic increases in environmental conditions. Variation in success of nesting and brood-rearing may cause wide oscillation in annual quail populations — long-term trends in abundance are generally determined by the quality of habitat and how the abundance or lack of habitat impacts survival. Multiple factors influence habitat conditions, including farming practices (e.g., removing vegetation from pivot corners and fence-lines, use of pesticides, and crop conversion from small grains), urbanization, and fire. However, winter snow conditions in Utah can result in the reduction of food sources, thereby constraining California quail distribution to lower elevations or southern regions of the state (Leopold 1977). Thick shrub vegetation is a crucial aspect of quail habitat for all seasons, including winter for thermal cover and escaping predation, and in the summer for shade to mitigate extreme heat (Leopold 1977). Quail are predominantly herbivorous — selecting green vegetation, seeds, flowers, and fruits — though insects are a staple for adult females and young chicks (Gutiérrez and Delehanty 1999, Pope et al. 2002, Zornes and Bishop 2009).

CALIFORNIA QUAIL

California quail were introduced into Utah as early as 1896 and are native to California and Oregon. They have been established in the northern portions of the state, and tend to be most abundant along the Wasatch Front, often in urban environments, and Uinta Basin but can be found in many areas throughout the state (Figure 7.1). The DWR translocates California quail from urban areas to more remote locations with suitable habitat; this is done to augment existing or to establish new populations.

California quail males have black and white faces, have black, curved feathers that protrude from their crown (which is brown), their bodies are gray in color but have intricate wavy patterns of black and white on their necks, and black scaling on the bottom portions of their bodies. Females look similar, but are more brown, have less scaling, and don't have the brown patch on their crown. Of these characteristics, the "topknot" on their crown is the most distinguishing (BNA, 1999).

Males and females exhibit mating displays; oftentimes this is presented as courtship feeding, or tidbitting, where one bird will pick up a food item, sometimes while simultaneously emitting a food-related call, and will wait for the intended receiving bird to react. This is referred to as the tidbitting display. In addition, researchers have observed a backroll, which is usually performed

by a male, though females have also displayed this behavior. The backroll is exhibited by one bird holding its back to the intended recipient, wagging its tail and shaking its feathers. Males begin mating-related vocalizations in early spring, usually peaking in May. Eggs are laid in May through early June in the Great Basin, and incubation lasts approximately 23 days. Chicks follow their parents when they are born, and are completely independent after three months (BNA, 1999).

California quail rely heavily on brushy cover for protection against predation. In some places within their range in Utah, clustered rocky formations and tall thick sagebrush also offer escape cover. They are also dependent on reliable water sources and a mosaic of open feeding areas (Zornes and Bishop 2009). Access to water and succulent vegetation is critical in the summer and fall when quail chicks are young, before the onset of winter precipitation (Leopold 1977). They feed on broad-leafed plants and seeds primarily (Leopold 1977, Zornes and Bishop 2009), though insects are also consumed depending on time of year, availability and location (Leopold 1977, Blakely et al. 1988). Quail chicks, like all gallinaceous young, are heavily dependent on invertebrates for the first few weeks of life (Leopold 1977).

Land use practices can drastically impact California quail densities. Proper land management practices, sufficient water sources, farming practices that provide cover, fire and logging management, plenty of brushy escape cover, and disking to foment the growth of preferred vegetation and to offer open habitat have been shown to bolster California quail abundance (Zornes and Bishop 2009). The range of California quail in Utah likely increased in conjunction with land-use practices such as feedlots for livestock, flood-irrigated farms, and the increase in weedy annual plants (Leopold 1977) — however, as irrigation tactics have transitioned from flood irrigation to center-pivot irrigation and farming practices have become “cleaner” with less waste and leftover fallow areas, populations of California quail have declined. California quail populations continue to thrive in urbanized areas where they are often fed during the winter.

Population Status/Monitoring

The UDWR does not currently conduct any population surveys or monitoring for California quail, other than the estimated harvest reported in the annual hunter harvest survey. In an attempt to increase occupied range and hunting opportunity, California quail are trapped and translocated in the winter months from urban areas and released in areas to initiate or augment current California quail populations. Information is documented each season and includes source sites, release sites, number of quail translocated and dates of releases. Biologists opportunistically visit release areas in an attempt to observe translocated quail. Future translocations should follow guidelines described in Appendix 2: Upland Game Translocations to better document and increase the probability of success of translocations.

Harvest

The impacts of harvest on quail populations has not been studied to a large extent, specifically species other than bobwhite quail. Fluctuations in quail numbers tend to influence harvest numbers both statewide and regionally, as laws allow liberal bag and possession limits (Guthery

et al. 2004). Therefore, minor adjustments in regulations may be biologically inconsequential (Peterson 2001, Guthery et al. 2004). One study concluded that quail harvest can be forecasted by hunters, hunter days both statewide and regionally, and quail abundance — however, some regional harvest was predicted solely by hunter effort (Tomeček et al. 2015). Since season dates and bag limits are set statewide, small or isolated populations can be at risk for overharvest (Tomeček et al. 2015).

Studies conducted on small populations that experience high harvest have found that harvest can be additive to overwinter mortality, and can significantly decrease spring breeding densities (Williams et al. 2004, Rolland et al. 2010). Harvest occurring later in the season is probably more additive than harvesting in the early part of the season (Pollock et al. 1989, Peterson 2001). In general, when quail are lower in abundance, resident hunters seem to self-regulate harvest by reducing the amount of hunter effort (Peterson and Perez 2000, Williams and Applegate 2012). However, studies have suggested that non-resident hunters do not necessarily self-regulate harvest based on quail population size (Williams and Applegate 2012). In Utah, quail harvest primarily consists of California quail, but also includes Gambel's quail. The survey results from 1971 to present are available in the Upland Game Annual Report at wildlife.utah.gov/upland-reports.

From 2010 to 2020, an average of 1,235 hunters spent 6,265 days to harvest 5,799 California quail annually. Number of birds harvested/day by hunters averaged 0.9, and hunters averaged 4.4 birds per season. The number of California quail hunters has remained fairly stable, along with harvest over the last decade.

The number of California quail hunters and harvest has generally declined since the inception of the survey in the 60's, though there have been some significant spikes in harvest of California quail in 1996 and 2006. Survey results from the 2020 season indicate a large increase in total harvest, birds per day, days afield, and birds per hunter. However, reports from hunters and biologists afield question the accuracy of this 2020 spike in harvest, which may be a result of small sample size and random variation in sampling and reporting (Figure 7).

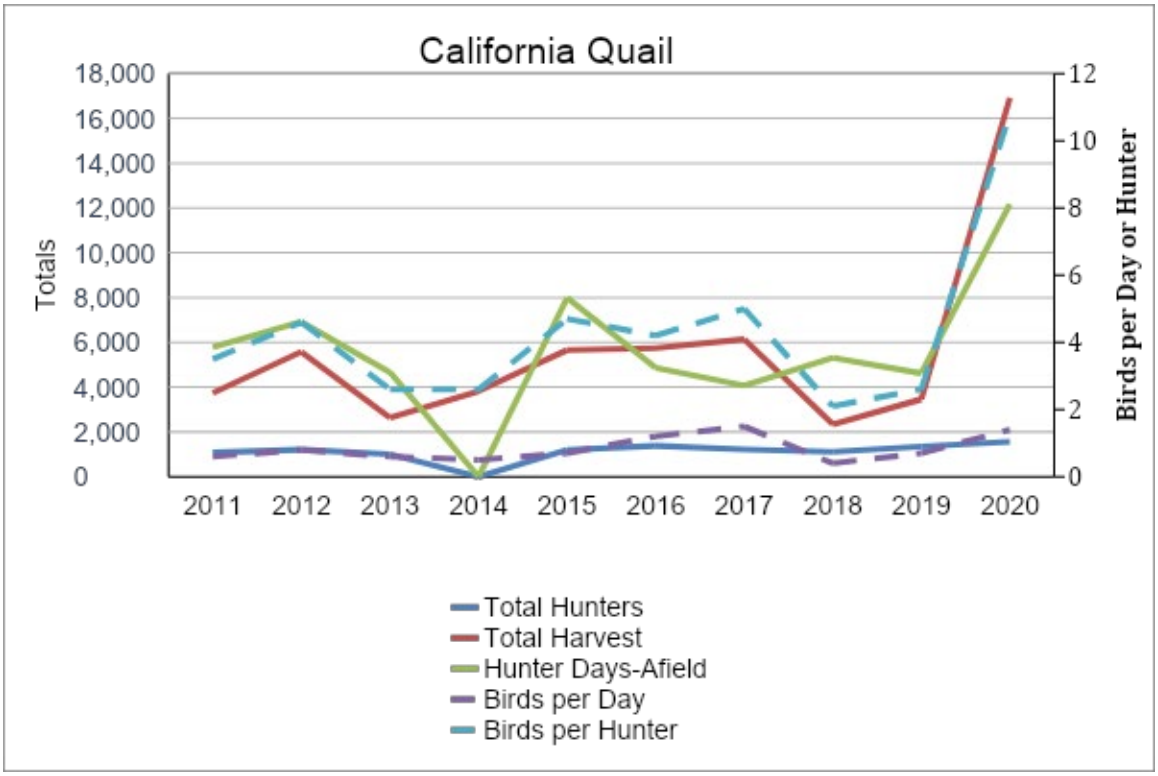

Figure 7. California quail harvest and hunter participation from 2011 to 2020.

Threats

- Loss in habitat from development, poor riparian habitat quality, and fire/invasives
- Changes in modern agricultural practices (more pivots, less ditch rows)
- Predation from avian predators and mesopredators such as raccoons, foxes, feral cats and skunks

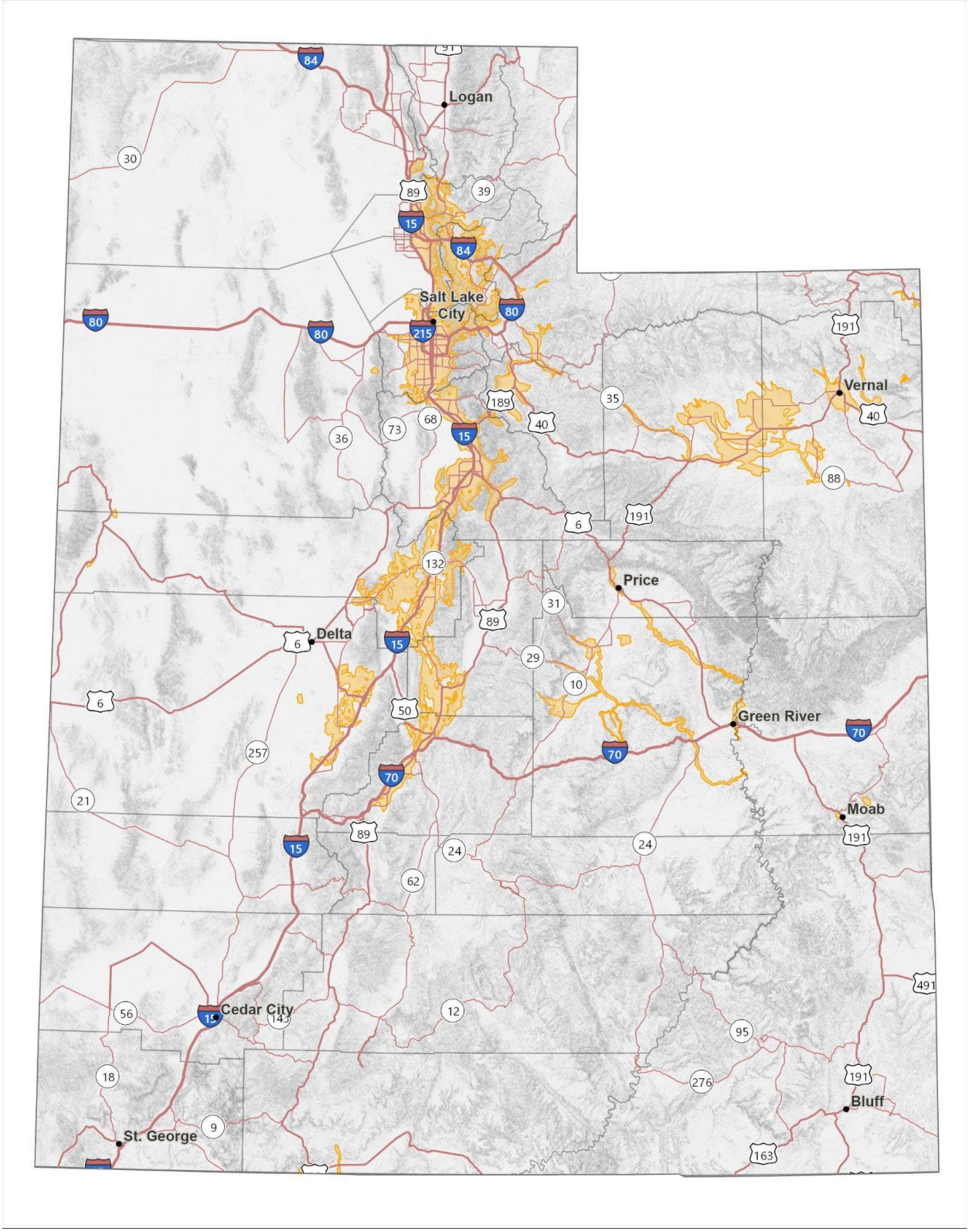

Figure 7.1. Occupied California quail habitat in Utah.

GAMBEL'S QUAIL

Gambel's quail are native to Utah — they mainly inhabit areas in southwestern Utah (Figure 8.1), and are believed to have inhabited riparian areas along the Colorado River to Moab, prior to the creation of the Glen Canyon Dam and the winter of 1949 (UT DWR 1988). Small remnant populations still occur along some of the Colorado River drainage, likely the result of translocations.

Gambel's quail resemble California quail; males have black and white faces, a cinnamon colored crown, white streaks through dark brown on the sides of their wings and legs, and the black curved plumes, or topknot protruding from the crown. Adult females resemble the males, but are more drab in color, with no distinguishing crown color, and have shorter, smaller topknots (BNA, 1998).

Gambel's quail also perform similar mating displays as California quail. Gambel's quail males will display the tidbitting behavior, offering food to a female. If the female approaches, the male will assume in a courtship stance, extending his legs, fanning his tail and lifting it, while flaring his flank feathers, with his beak near the ground. The male will also vocalize while head bobbing, causing the plume or topknot to vibrate. However, the females seem to prefer males due to tidbitting behavior, and the size of the topknot seems less important to female selection (BNA, 1998).

Gambel's quail habitat consists of brushy foothills and drainages in their native range. Gambel's quail abundance is highly correlated with nesting success, winter precipitation, and the vegetation produced during wet years (Swank and Gallizioli 1954, Zornes and Bishop 2009). Females may forgo reproduction after cold or dry winters (MacGregor and Inlay 1951). Chick survival is higher during wet years with abundant vegetation, and lower in dry years (Sowls 1960). As such, mortality and survival rates are chiefly impacted by annual variation in precipitation — Gambel's quail are less abundant during drought, and more abundant during years with higher precipitation, especially during the winter (Zornes and Bishop 2009). Gambel's quail adults, chicks, and eggs are susceptible to a myriad of predators, both mammalian and avian (Zornes and Bishop 2009). Gambel's quail regularly visit sources of open water during the spring and summer months, however, Skidmore (2016) found that excluding Gambel's quail from water sources did not impact their survival rates, but resulted in significantly larger home ranges. Impacts of free water on reproductive success are still needed.

Population Status/Monitoring

Surveys completed for Gambel's quail are found in our Upland Game Annual Report at wildlife.utah.gov/upland-reports. These waterhole trend counts are conducted annually in July, as observations of adults and young are recorded to gather brood and production data.

Harvest

From 2010 to 2020, an average of 628 hunters spent 2,064 days to harvest 2,178 Gambel's Quail annually. Number of birds harvested per day by hunters averaged 1.1 and hunters averaged 3.6 birds per season. The number of Gambel's quail hunters has remained fairly stable in the last decade, however there was a spike in hunters following a population high in 2016.

The number of Gambel's quail hunters and harvest has remained relatively stable overall since records of harvest began in the 1960's, however, annual harvest can vary significantly year to year (Figure 8).

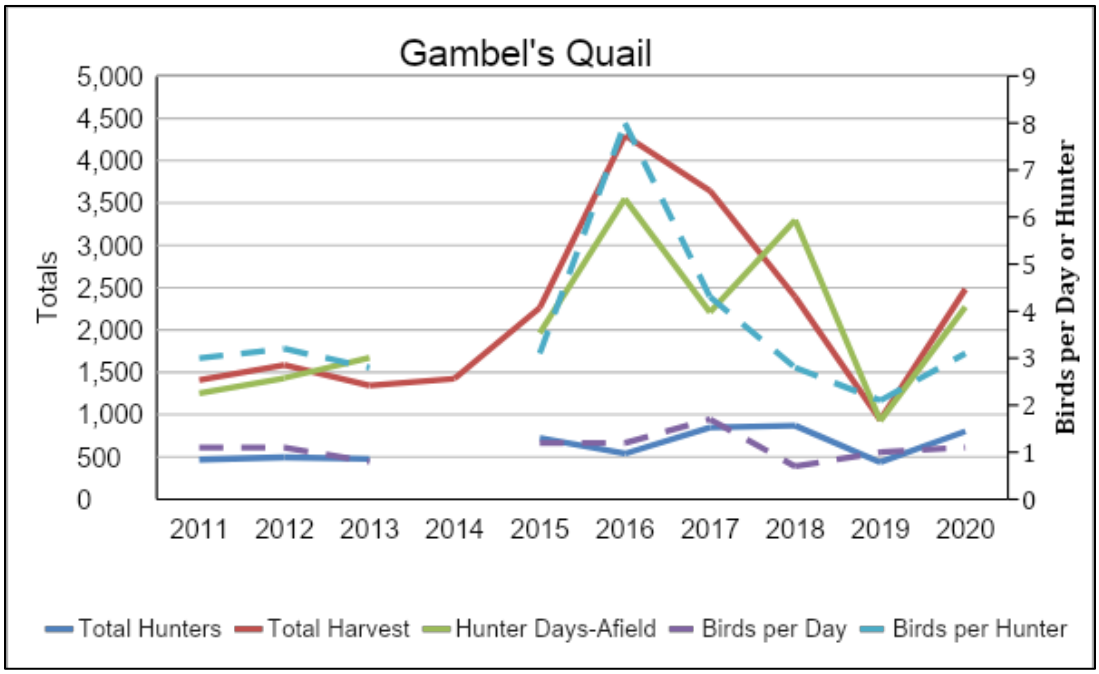

Figure 8. Gambel's quail harvest and hunter participation from 2011 to 2020.

Threats

- Habitat loss from fire and associated exotic annual grasses
- Changes in habitat caused by invasive plant species encroachment
- Overall habitat degradation impacting amount of cover, feed, and water

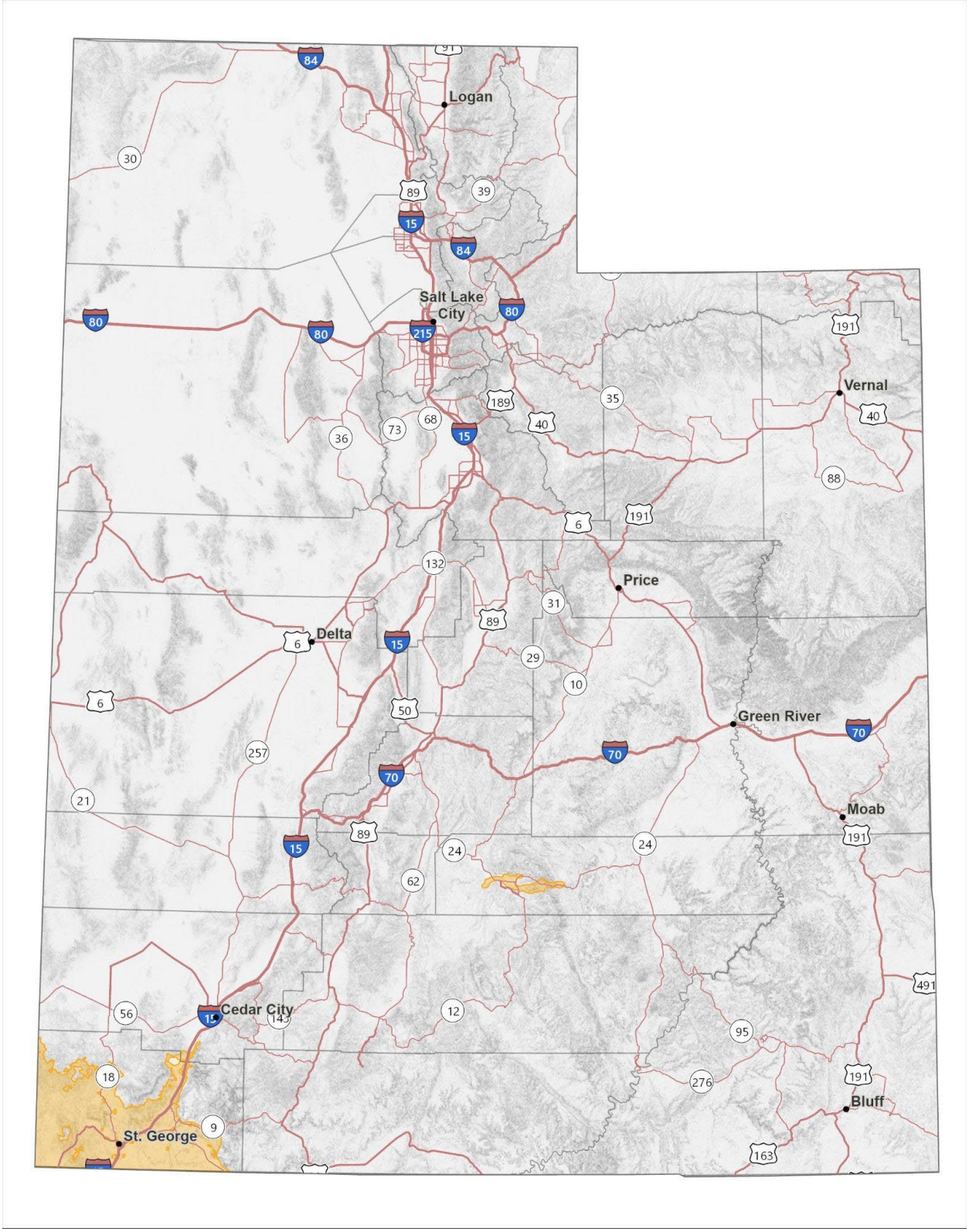

Figure 8.1. Occupied Gambel's quail habitat in Utah

SCALED QUAIL

Scaled quail, *Callipepla squamata,* are only occasionally seen in southeastern Utah, in the Four Corners area. Southern Utah is just north of this species' range. The most distinguishing feature is the scaled breast, neck and nape, and the lack of a plume on the head (as seen in other Utah quail species). The head is topped with a white-tipped crest, and there isn't a distinctive sexual dimorphism. The quail is native to the southwest desert grasslands, primarily the Chihuahuan Desert grasslands and the southern Great Plains (Schemnitz 1994).

Two areas in extreme southeastern Utah have had scaled quail sightings; Montezuma Canyon and McCracken Mesa. The likely source of these quail is New Mexico, as they experienced a high production year in 2006, which likely caused the expansion of birds in Utah, as they have been observed since 2007. Occupied range may have naturally expanded into this area of Utah due to the trending warmer temperatures, however some models do not predict suitable conditions extending into Utah (Schneider and Root 2002, Tanner et al. 2017).
In addition an effort was made from 2013 to 2015 to establish a population with 40 scaled quail released in 2013, 200 in 2014, and 205 in 2015.

Scaled quail are gregarious, inhabiting cactus and sagebrush flats, areas with shrubs (provides roosting cover, as they roost on the ground), grasslands with loafing cover such as wolfberry and mesquite. They feed primarily on forbs, shrubs and grain, while leaves and insects are consumed seasonally (Schemnitz 1994). Pairing generally begins in mid-March after males have spent time calling to attract females and defend their territories. They have a long nesting season — second broods are rare, despite commonly renesting. Like other quail species, they are short-lived, and produce a large average brood size (Schemnitz 1994).In the fall, scaled quail form coveys of 20 to 40 birds that persist through the winter . They depend on their camouflage to disguise themselves and their eggs from predation from coyotes, skunks, snakes, hawks and magpies (Project Upland, 2019).

Population Status/Monitoring

Sightings of scaled quail are opportunistically reported to the DWR. Employees report sighting to wildlife managers if they encounter scaled quail. Currently, the DWR has placed trail cameras on water sources where quail may concentrate near the McCracken Mesa. The images obtained from this exercise will better inform the DWR of scaled quail distribution and facilitate future surveys.

Harvest

While this species is not hunted in Utah currently, the DWR plans to continue translocations, improve habitat, and monitor distribution of birds to establish a viable population that may be hunted in the southeastern region. This objective is outlined in the regional priorities on page starting on page 68.

Threats

- Drought; limiting the water resources and forage production leading to degraded habitat quality

CHUKAR PARTRIDGE

Chukar partridge (*Alectoris chukar*) is a non-native, naturalized species that was initially introduced to North America in the late 1800's from their native range in east Asia, the Middle East and Southern Europe (Christensen 1970). Release efforts in Utah began in 1936 with chukar grown at the Springville Game Farm, however, introduction efforts were not successful until wild trapped chukar were translocated from Turkey in 1951 (Mitchell 2003). Current releases of pen-reared game birds are small-scale; intended for put-and-take hunting, with annual survival for pen-raised birds close to zero.

Topography plays a major role in chukar partridge habitat. These birds prefer steep, rocky slopes to provide cover and means of escape from predators. Rock and brush cover is important to chukar, as they will generally avoid water sources when the overall shrub cover is less than 11% (Larson et al. 2007). Roost sites are generally found mid-slope; associated with rock outcrops and talus that can provide cover (Knetter et al 2017).

Chukar partridge thrive in a semi-arid to arid climate, and can succeed in habitats degraded by fire and annual grasses, however, monocultures of invasive grasses can have negative effects on populations (Lindbloom et al. 2004, Knetter et al 2017). Chukar are a ground foraging species whose diet is primarily made up of green grass and forb shoots when available, and grass seeds otherwise. Insects are also an important source of protein, especially for young birds (Christensen 1996). Free water is consistently visited during hot dry periods, with water needs of juvenile birds higher with brood coveys often visiting a water source twice a day, in the morning and evening.

Chukar have been shown to consume a significant amount of lead shot — a study in Utah showed that 10.8% of harvested chukar had elevated lead levels in their liver and/or a lead pellet found in their gizzard (Walter and Reese 2003, Weiner et al. 2009, Bingham et al 2015). In a feeding trial Bingham (2011) found that a single #6 lead pellet could induce morbidity and mortality in captive chukar with the percent of population affected varying by age and diet. In the wild, even sub-lethal effects have the potential to indirectly lead to death or increase probability of predation.

Self-sustaining populations of chukar partridge currently occupy the vast majority of suitable habitat in Utah (Figure 9). However, areas remain of unoccupied suitable habitat that were newly created as a result of fire or other landscape changes, were never occupied, or no longer occupied where the population was lost. New habitat is created as the result of wildfire. However, habitat is also lost as the result of fire when healthy range loses it shrub component or becomes a monoculture of invasive annual grass (namely cheat grass and medusa head).

Population Status/Monitoring

Chukar populations vary significantly from year to year based on environmental conditions influencing survival and reproductive success. Populations generally remain at a stable baseline, with occasional and often dramatic spikes in population in response to consecutive years of high reproductive success. The population within Utah is generally stable over the long-term but can vary significantly annually.

From 1963 to 1996 the DWR conducted brood counts throughout the state. In 1996, the brood counts were replaced with a helicopter survey on the Cedar Mountains, with a second survey on the Bovine Mountains added in 2009. The DWR discontinued helicopter surveys in 2019 due to increasing cost, limited geographic scope, limited production data, and safety risks of low level flight in rough terrain. Helicopter surveys were replaced with automated game cameras placed on natural water sources or water developments to document year-to-year variation in brood production and overall population. The DWR will continue to assess this method in the future.

Harvest

The DWR conducts annual hunter harvest surveys to determine hunter participation and harvest rate. Harvest surveys act as an index of population with hunter harvest, hunter participation and harvest rate highly correlated with wild populations. From 2011 to 2020, an average of 6,590 hunters spent 34,159 days to harvest 30,478 chukars annually. Number of birds harvested/day by hunters averaged 0.9, and hunters averaged 4.6 birds/season. The number of chukar hunters fluctuates year to year, generally following the peaks and lows in chukar populations (Figure 9).

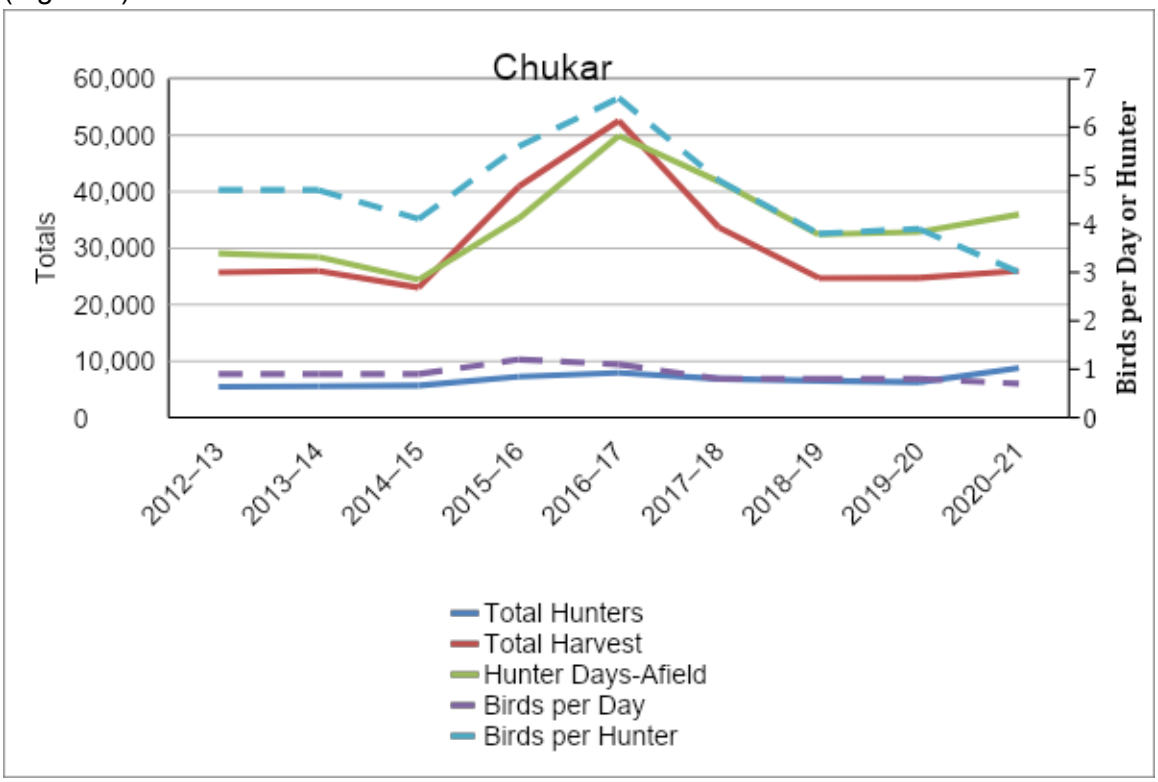

Figure 9. Chukar harvest and hunter participation from 2011 to 2020.

Threats

- Reduction in brood habitat quantity and quality
- Invasive annual grasses causing increased fire frequency and lack of habitat diversity

Translocations

Chukar have been introduced to the vast majority of suitable habitats within Utah, however, existing areas of suitable habitat remain unoccupied, or have become unoccupied due to changes in habitat conditions. When unoccupied habitat is available and has been evaluated and found suitable, the DWR may translocate wild caught chukar to the location. See Appendix 2: Translocations for detail on habitat evaluation and best practices.

Water Developments

Water developments have been a major component of chukar partridge management in Utah, with water developments being installed as early as 1967 (Shaw 1971). Since that time a considerable number of water developments have been installed throughout the state with 511 upland game-targeted water developments with 424 documented as having chukar as the target species. Anecdotally, higher densities of chukar can be found in areas with higher densities of water development. However, relatively little research has been done on the effectiveness of water developments in expanding population size and range. Early research drew contradicting conclusions that water developments both contributed to establishment and expansion of chukar populations (Messerli 1971) and did not improve productivity, survival or availability to hunters (Shaw 1971). Larson et al. 2010 showed spatial association with chukar and water sources, but also showed that high moisture content of feed in some areas may make free water unnecessary under such conditions. More recent research suggests that site level habitat is most influential in successful establishment of populations (Moulton et al 2015), including minimum shrub cover of at least 10% (Larson 2007). Research to date has not clearly demonstrated efficacy or fully explored potential negative impacts on other species (Broyles 1995, Larson 2012). Moving forward, a better understanding of water availability, water used by chukar, weather influencing water needs, constraints on use of available free water, and proper installation for target and non-target species is critical to retain support of all stakeholders (Larson et al. 2012).

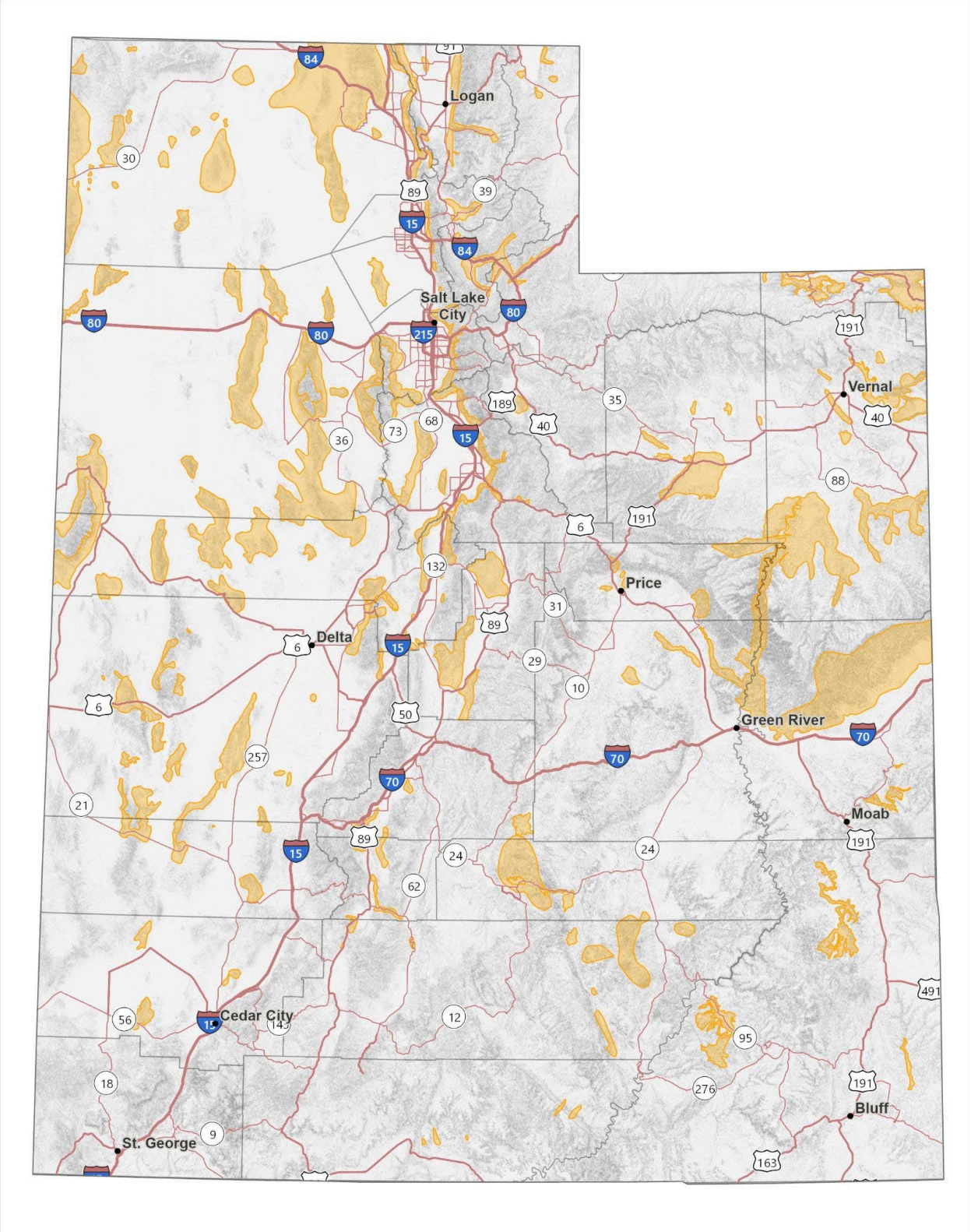

Figure 9.1 Occupied chukar habitat in Utah.

GREY (HUNGARIAN) PARTRIDGE

The grey partridge (*Perdix perdix*) is also known as the Hungarian partridge or Huns. This is a medium-sized bird from Europe, introduced to multiple areas in North America. A translocation of 120 grey partridge on November 11, 1911 is most likely the first introduction to Utah, though translocation efforts were decidedly unsuccessful by 1940. The current populations in Utah are likely from the Snake River drainage of Idaho and from Nevada, as reported sightings in Utah in areas that border Idaho and Nevada began being documented in 1948 (Porter, 1955). Across the species range worldwide grey partridge tend to be tied to northern latitudes with Utah as part of the southernmost distribution of the species in North America (Figure 10.1). Even when the birds were first documented in Utah, low densities were reported (Porter, 1955).

Grey partridge are a gray to brown color, with short wings and tails. Adults have unique shades or orange or tan on the face and throat, which is typically brighter in males (Carroll, 1993). Grey partridge are typically found in areas with grasslands or mixed sagebrush and grass, and often adjacent to cultivated lands. They can occupy open rangeland with no associated agriculture, and concentrate in areas with a combination of cereal grains and herbaceous cover such as weedy vegetation, grasses, and fields of hay which provide desired habitat (Carroll 1993). The water requirements of grey partridge are relatively unknown in the western United States (Knetter et al. 2017). While Yeatter (1934) ascertained grey partridge attained plenty of water from dew and succulent foods in the Great Lakes region, Porter (1955) maintained that grey partridge in western Utah necessitated free water in dry desert areas.

These birds are monogamous and pairs typically occur between separate coveys, however, intra-covey pairings do form between previously paired adults (Jenkins 1961, Weigand 1977). A formal mating display has not been documented; though both sexes show aggressive behavior. Females select males that chase other females away from the area, and males that show vigilance are the first to become paired (Carroll, 1993). The incubation period is 21–26 days (McCabe and Hawkins 1946).

Grey partridge will continue renesting efforts if a nest is damaged before hatching, and may create up to four nests in a single season. However, each subsequent nest contains fewer eggs (Jenkins 1961, Birkan et al. 1990). Annual precipitation and predation are critical factors of annual mortality; generally during nesting, brood-rearing, and winter (Potts 1980, Carroll et al. 1990, Church and Porter 1990, Carroll 1993). Grey partridge are vulnerable to predation from mammals and predatory birds. However, Porter (1955) indicates that mowing vegetation as a result of farming operations was the greatest factor of the initial decline of the species.

Population Status/Monitoring

There are not currently any population surveys done on grey partridge, though annual hunter harvest surveys are collected. Grey partridge are listed in the priorities indicated under the goal

to expand base knowledge within this plan. Huns are also mentioned in the research priorities, as well as the northern and central region goals.

Harvest

Published research by Vander Zouwen (1990) and Carroll (1992) addresses impacts of harvest on grey partridge populations in North America. They suggest hunting is likely not additive for most populations because of little interest or hunting pressure. In Utah, these birds are only available in the northern region of the state, primarily on private lands.

From 2011 to 2020, an average of 812 hunters spent 4,287 days to harvest 2,547 grey partridge annually. Number of birds harvested/day by hunters averaged 0.6, and hunters averaged 3.0 birds/season. The number of grey partridge hunters has decreased over the long term, but has remained relatively stable for the last decade. Harvest has fluctuated significantly, with large spikes in harvested numbers in 1999-2000, 2005-06, and 2016-17.

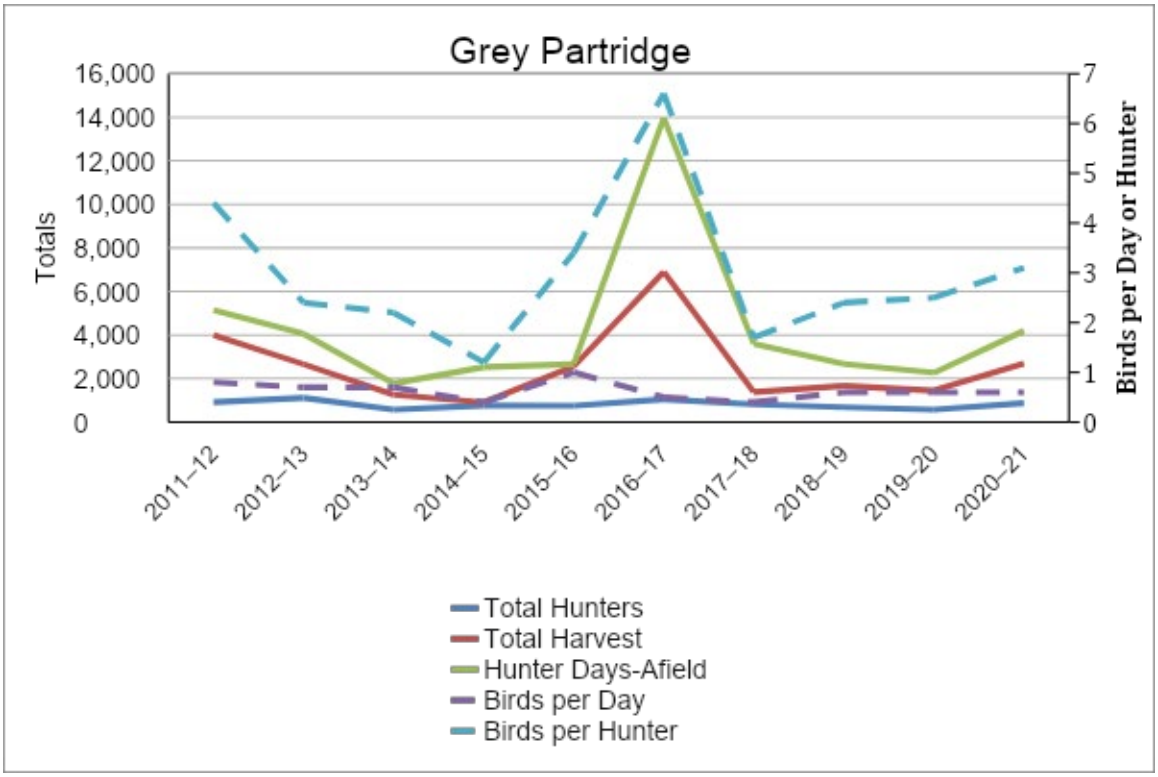

Figure 10. Grey partridge harvest and hunter participation from 2011 to 2020.

Threats

- Lack of information regarding population dynamics and habitat associations
- Changes in climate may lead to northward range shifts. With Utah on the Southern extent of range, higher temperatures and less water availability may create negative impacts.
- Predation by mesopredators and avian predators

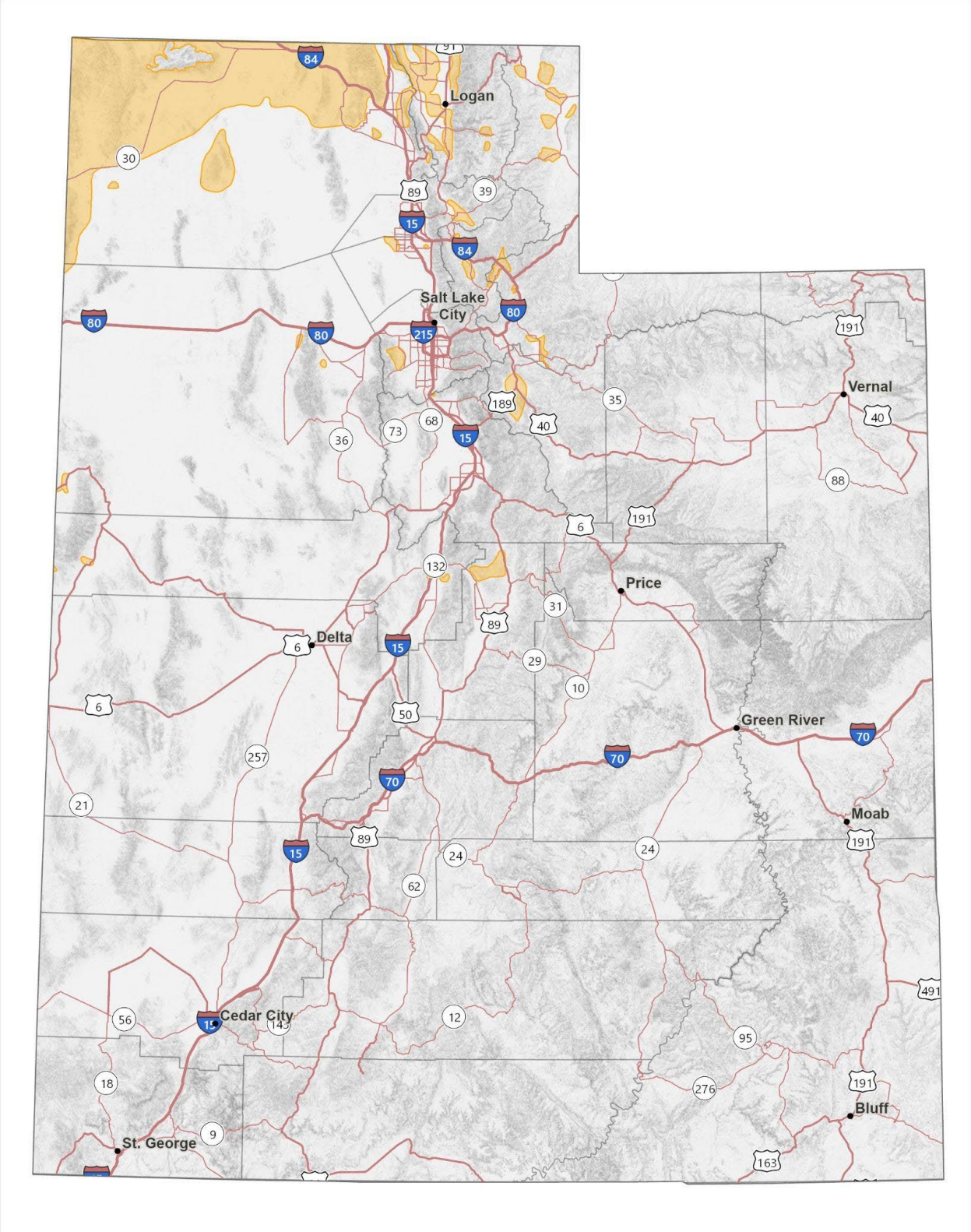

Figure 10.1 Occupied grey partridge habitat in Utah.

RING-NECKED PHEASANT

Pheasants (*Phasianus colchicus*), whose native range stretched across Asia, were first introduced into Utah in the late 1800s and early 1900s, and now occupy suitable habitats in 27 of 29 counties (Figure 11.1), although declines in habitat availability in many counties limits population range and size.

Pheasants are connected to agriculture and exist at varying densities on or near farmland and riparian corridors throughout Utah. Factors integral for pheasant survival include brushy or woody winter cover, nesting and/or brood rearing cover often associated with grasslands near agriculture, winter food, and the proximity of these habitats to one another (Hubbard 1991). Studies indicate that pheasants favor non-row crop herbaceous vegetation, especially grasslands, are generally associated with small grains crops, and hay to raise broods in (Drake et al. 2009). Nesting cover also provides early brood-rearing cover, as broods tend to remain near the nest for three weeks after hatching (Warner 1979).

The factors associated with declines in pheasant populations nationwide are also a concern in Utah: the development of clean farming practices, declines in crop diversity, conversion of native grass and scrubland habitats to cropland, and increasing urban development (NWPTC 2021). Utah is party to the National Wild Pheasant Conservation Plan (NWPTC 2021) that outlines broad objectives for conservation priorities and populations nation-wide:

Objective I. Maximize the resources available to federal and state agencies, NGOs, and other partners to improve pheasant abundance, access to quality hunting opportunities, and other amenities necessary to improve pheasant hunter participation and the relevance of pheasant management.

Objective II. Maximize the efficiency with which federal and state agencies, NGOs and other partners use their collective resources to improve pheasant abundance, hunter participation, and management relevance.

Objective III. Strengthen the body of scientific evidence (a) describing the factors affecting pheasant abundance and hunter participation, and the methods with which those factors can be most efficiently influenced; and (b) quantifying the broader societal benefits of pheasants, their hunters, and habitats, and how best to communicate the relevance of those benefits to a diversity of stakeholders.

The National Wild Pheasant Conservation Plan measures habitat in “CRP Acre Equivalents” based on habitat value of many cover types relative to Conservation Reserve Program acres. The stated goal for Utah is to simply maintain current habitat and prevent additional habitat loss.

Population Status/Monitoring

Pheasant populations in Utah are not currently monitored, but a postseason hunter harvest survey is completed annually. Historically pheasant populations had also been monitored using spring crow counts, winter sex-ratio counts, brood route surveys, and hunter bag checks. These

data provided information to the public about the current hunting season's outlook and helped monitor long-term population trends. However, low densities and loss of habitat in survey areas reduced the effectiveness of field surveys and they were removed from work plans in 2001.

Stocking Program

With reduced populations of wild pheasants, but lingering popularity of pheasant hunting, the DWR stocks pheasants in release areas akin to community fishing ponds in order to provide additional pheasant hunting opportunity. Utah's pheasant stocking program is operated as a 'put and take' operation, and is not utilized to restore or maintain wild pheasant populations. The DWR stocks game farm pheasants, purchased from private contractors, on many wildlife management areas and walk-in-access areas throughout the state in areas with hiding cover available to pheasant, but not exclusively on properties with habitat that will support wild pheasant populations.

Alternative stocking methods have been tried, however none have been shown to be effective in increasing populations or cost effectively getting birds into hunters' bags. For example, Thacker et al. 2016 found that only 5.5% of pheasant and 7.2% of bobwhite were returned to bag using an artificial brooder (i.e., surrogator). Thackston et al. 2012 found that the mean cost of a bird returned to bag using artificial brooders was $489 to $821 per bird.

Harvest

Male and female pheasants have distinct plumage, making identification of sex by a hunter possible upon flushing. This distinction allows sex specific hunting regulations to be put in place targeting only male birds leaving female pheasants. Since pheasants are polygamous, with males forming territories and being able to fertilize 10 or more females, harvest of only males has little to no potential to impact breeding populations.

Pheasant populations peaked in Utah during the 1950s and 1960s, with harvest remaining high through the early 1970s when populations began a long term decline. During the years of peak pheasant harvest in Utah, the DWR operated multiple game farms and released a considerable quantity of pen-reared birds each year. An average of 85,000 hunters harvested 255,000 pheasants annually in the 1960's. In the last decade, an average of 18,100 hunters spent 44,000 days to harvest 71,300 pheasants annually or 2.4 per hunter. Estimated harvest ranged from 29,704 to 60,104 birds. Average pheasant harvested per day per hunter has remained stable over the last decade at about 0.65, but decreased substantially from 1.17 in the 1960's. (See Upland Game Annual Harvest Survey).

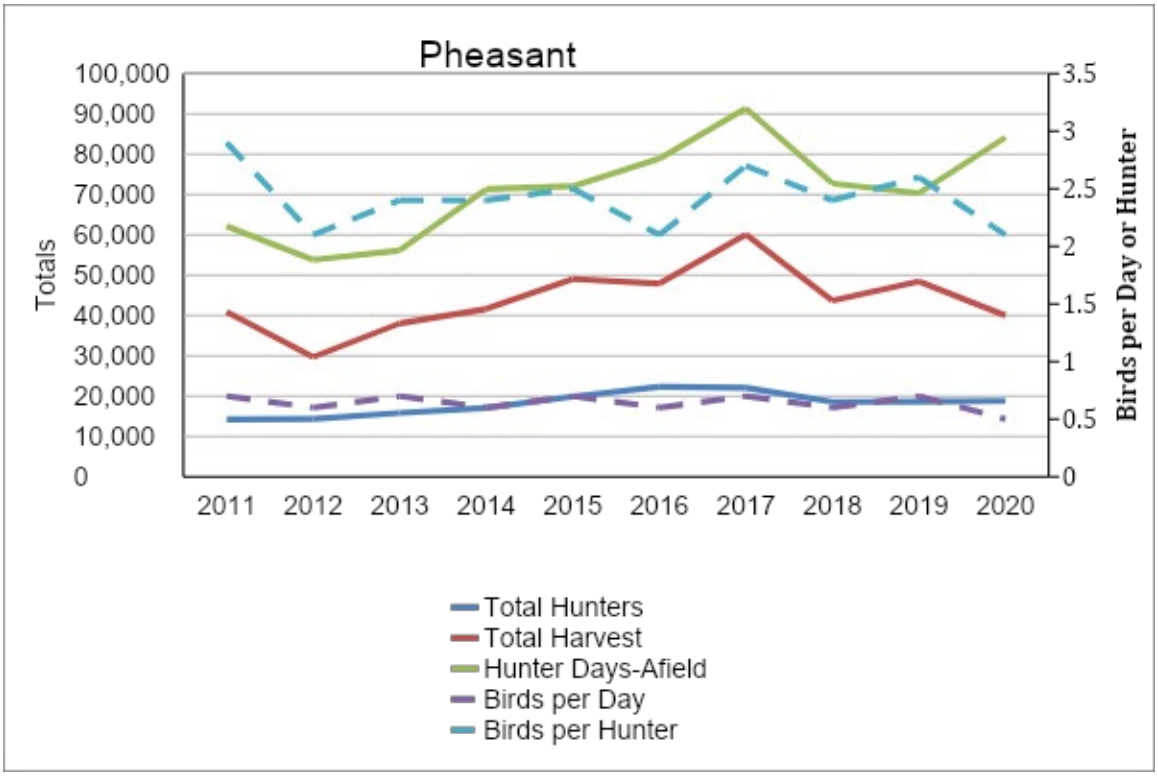

Figure 11. Pheasant harvest and hunter participation from 2011 to 2020.

Pheasants continue to be one of the most popular upland game birds in the state, even as participation and harvest numbers are much lower than past decades (Figure 11.1). Pheasant hunting seasons are relatively liberal and provide considerable recreation for the public. Pheasants are concentrated on limited public land and private land associated with wetlands and agriculture.

Threats

- Habitat Loss; urbanization and clean farming practices and conversion of grasslands to croplands
- Climate; drought leading to reductions in wetland habitat and accelerating agricultural conversion.

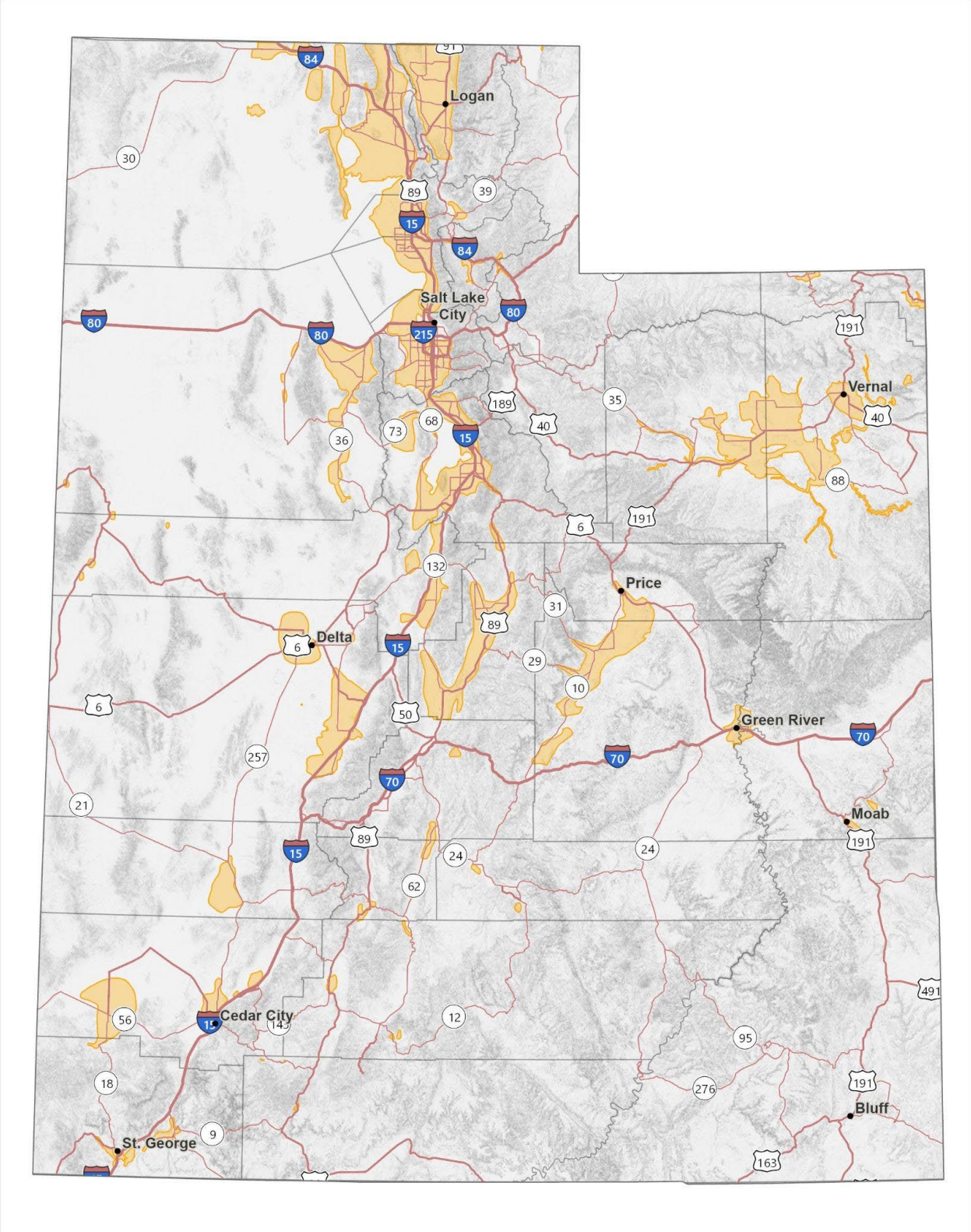

Figure 11.1 Occupied pheasant habitat in Utah.

RABBITS AND HARES

Rabbits and hares (i.e., lagomorphs) are mammalian upland game and are found worldwide. Lagomorphs are commonly harvested for both sport and commercial use. Rabbits and hares are largely distinguished by the condition in which their young are born. Rabbits have altricial young, meaning they are born with no hair and are blind, thus completely dependent on parental care (Feldhamer et al. 2015). In contrast, hares produce precocial young, which are born with fur, open eyes, and can move shortly after birth (Feldhamer et al. 2015). Utah has three species of rabbits and three species of hares. Desert and Mountain cottontails (*Sylvilagus audubonii* and *Sylvilagus nuttallii)*, respectively, pygmy rabbits (*Brachylagus utahensis*), black-tailed and white-tailed jackrabbits (*Lepus californicus* and *Lepus townsendii*, respectively) and snowshoe hares (*Lepus americanus*) are classified as upland game animals in Utah. Harvest for both species of jackrabbits is not regulated and is not controlled — they may be hunted without a license and have a year- round season with no bag or possession limits. Pygmy rabbits have been classified as a Species of Greatest Conservation Need (SGCN) in Utah since 2005, and are not considered a huntable upland game species. Further information on pygmy rabbits in Utah, including management issues and concerns can be found in Utah's State Wildlife Action Plan (wildlife.utah.gov/wap) on the DWR website.

Rabbits and hares may exhibit high rates of annual reproduction. Annual production for most species of hare is typically 10 young per female (Flux 1981). However, cottontails' annual production varies between approximately 10 to 35 young per female and has been shown to be correlated with other upland bird species (Chapman and Ceballos 1990). Snowshoe hare reproduction rates fluctuate more than most hare species (Keith 1981), reproducing up to four times a year, with litter sizes varying from one to 14 young (Hodges 1999, Ellsworth and Reynold 2006).

As with most species with high reproductive potential, lagomorphs can also experience high rates of annual mortality. Environmental extremes and the depletion of plant resources can result in predation and disease, which are the main contributors for rabbit and hare mortality. While lagomorphs are biologically flexible and adapted to diverse habitats and ecological surroundings, their annual mortality rates can reach 90% in some populations. Rabbits and hares are the foundation of many predator-prey interactions. Their intermediate size and abundance facilitates a food source for a community of small to medium-sized predators. Some hare populations can impact the reproductive success of their predators, such as coyotes (Cypher et al. 1994, Bartel et al. 2008), bobcats (Knick 1990), and golden eagles (Steenhof et al. 1997).

Desert and mountain cottontail rabbits range throughout Utah (Figure 12). Cottontails can occupy a diverse range of habitats including disturbed areas and transitional habitat zones. In Utah, desert cottontails can survive in many habitats and standing water is not necessary for their survival. They are found in the desert areas and lower slopes of the mountains, usually staying below 6,000 feet. Mountain cottontails prefer habitats above 6,000 feet, and they are

considered sagebrush specialists, depending on sagebrush as a major food source. Both species can be found in riparian areas (such as creek bottoms and washes) with sagebrush and willow trees, and near rocky outcroppings, or areas that transition between sagebrush and agriculture fields. Both cottontail and pygmy rabbits utilize burrows throughout the year for protection and parturition.

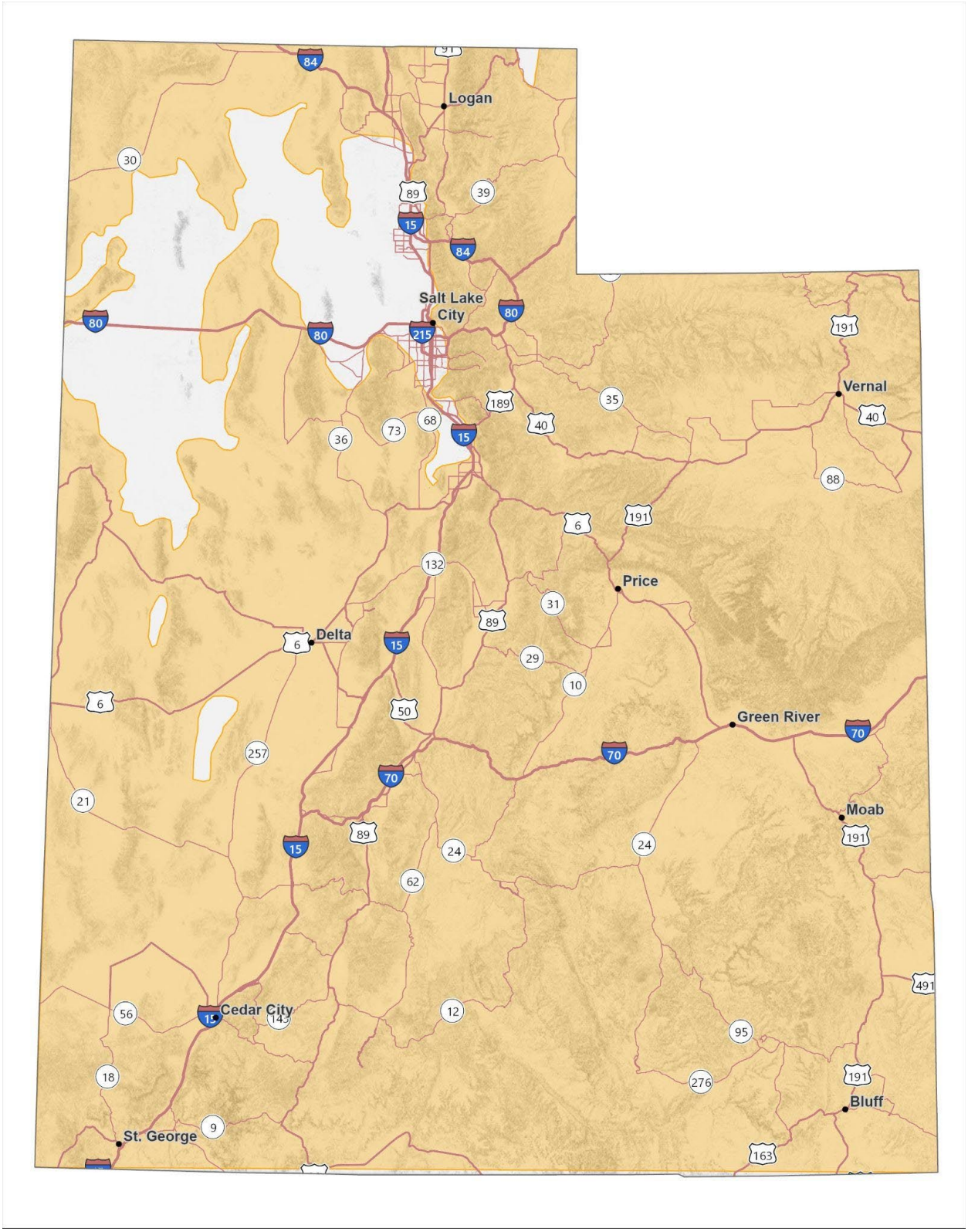

Figure 12. Occupied cottontail rabbit habitat in Utah.

Snowshoe hares occupy the center portion of northern and central Utah, as well as the northeastern region (Figure 13). They are closely tied to Engelmann spruce, Douglas-fir, subalpine fir, and lodge pole pine forests that provide adequate escape cover and buds, twigs, bark, forbs and conifer as food sources. Like desert cottontails, open water is not necessary for snowshoe hares, and they are also coprophagic, meaning they eat their own fecal matter after its first pass. Snowshoe hares have white pelage (fur) during the winter, and shift to brown pelage during the summer in most situations (Chapman and Ceballos 1990, Ellsworth and Reynolds 2006). There is recent evidence that the impacts of drought — the decreased snowfall and earlier melting of snow — could potentially alter the winter coat in polymorphic species such as snowshoe hares (Mills et al. 2018).

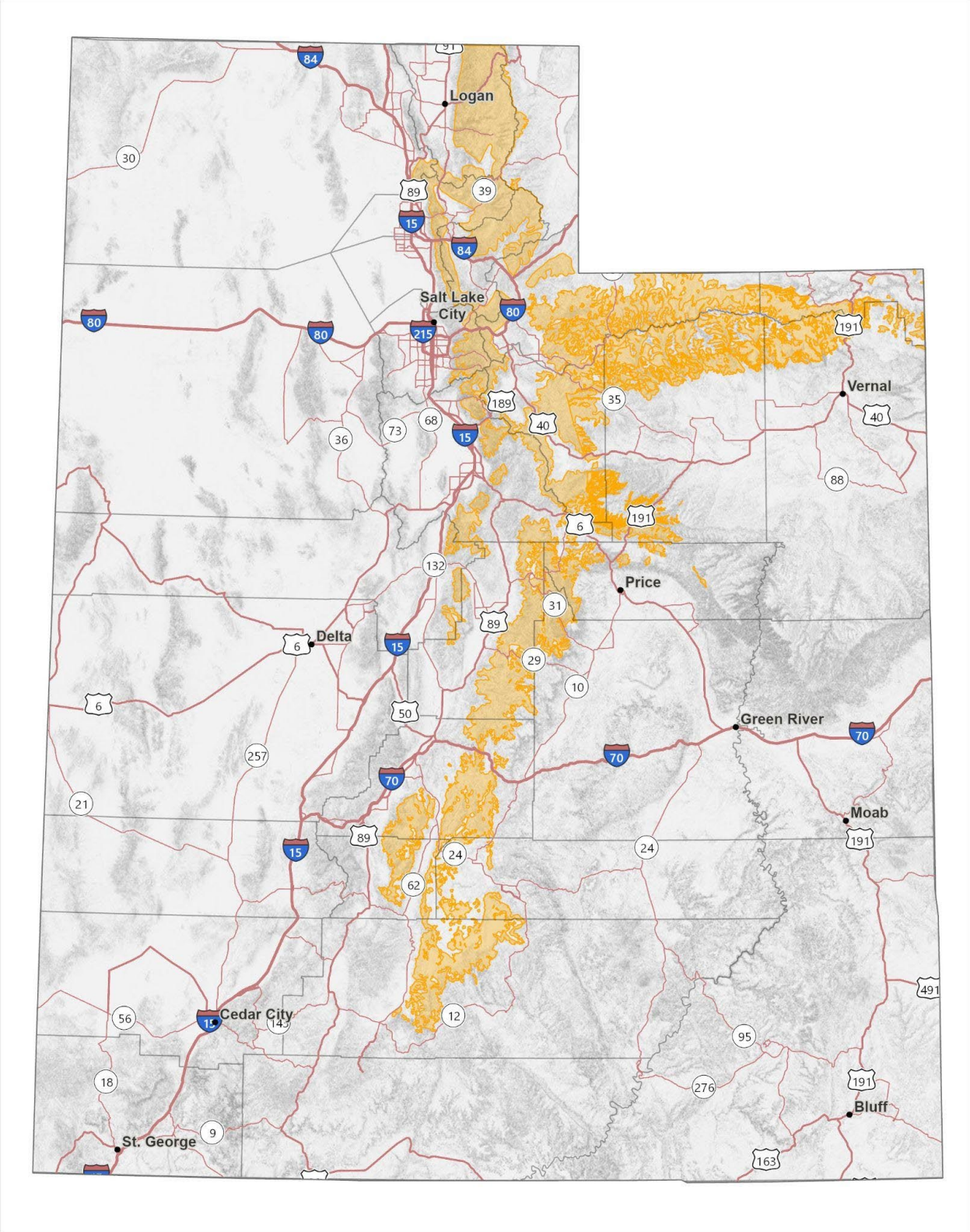

Figure 13. Occupied snowshoe hare habitat in Utah.

Harvest

In general, rabbits and hares have short lifespans with high mortality rates. Their populations can fluctuate and exhibit large annual variations. Lagomorphs are hunted in many areas of North America and Europe, and both climatic conditions and predation can influence population change (Boland and Litvaitis 2008). However, recent drought conditions in Utah have likely contributed to the substantial population decline. Cottontail rabbits can be hunted in Utah from September 1 to February 28, and snowshoe hares from September 1 to March 15, with a liberal daily bag limit of 10 rabbits and five hares. Estimates for cottontails and hares have been separated since 2003. Cottontails are harvested more often than that of snowshoe hares, likely due to greater numbers of cottontails and convenience of hunting in most cottontail habitats.

Over the past 10 years, approximately 8,200 hunters harvested 47,000 cottontails per year, while 750 hunters harvested 1,300 snowshoe hares per year. The number of cottontail rabbits and snowshoe hares harvested per day by hunters has averaged 1.97 and 0.45, respectively from 2010-2020 (Figures 12.1 and 13.1). Cottontail rabbits are often found in open areas, while in contrast, snowshoe hares are relatively difficult to access in dense forest and deep snow during much of the hunting season.

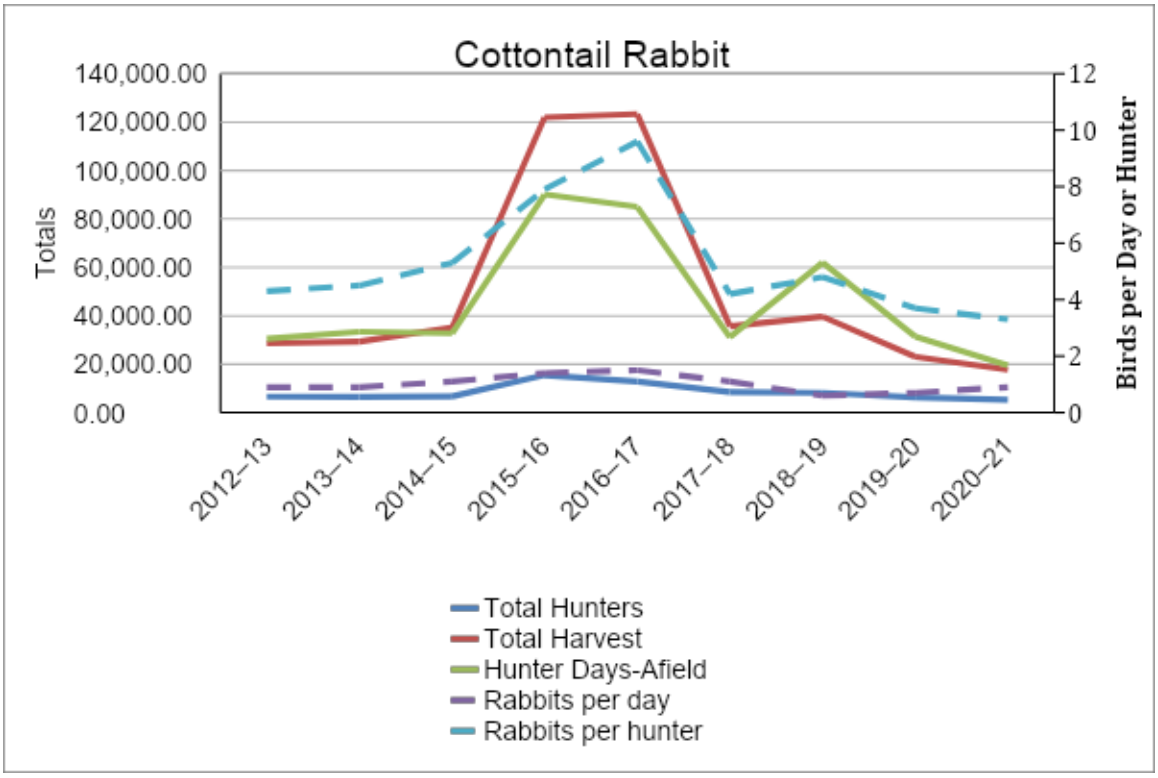

Figure 12.1 Cottontail rabbit harvest and hunter participation from 2011 to 2020.

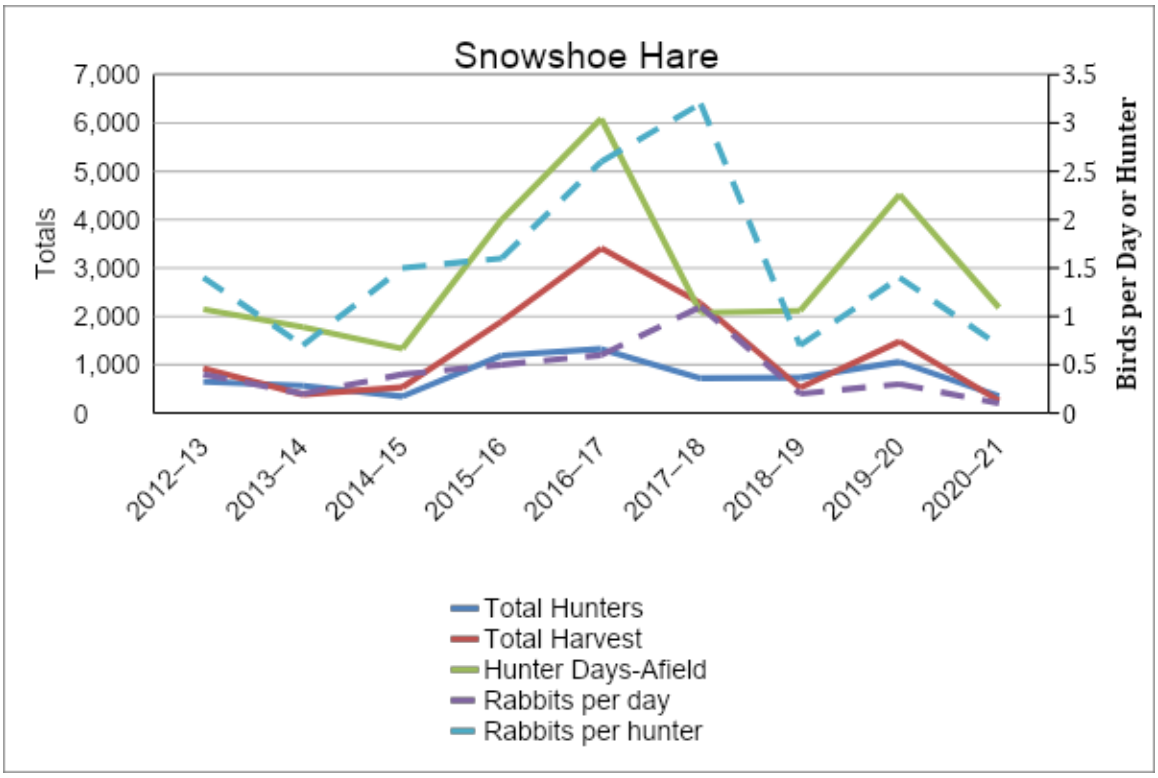

Figure 13.1 Snowshoe hare harvest and hunter participation from 2011 to 2020.

Population Status/Monitoring

Cottontail rabbit roadside count routes were established shortly after the species was declared a protected game animal in 1966. Routes were discontinued in 2001, and later restarted in 2010. In 2020, routes were reduced from 3 repeated counts per route to a single count per route while also conducting pellet surveys for monitoring rabbit populations. Beginning in 2012, jackrabbits have also been recorded during cottontail surveys. Counts are conducted during the annual survey period July 22 – August 20 when cloud cover is less than 75% and when wind velocity is under seven miles per hour. Routes are 30 miles long and driven at 20 miles per hour or less and start at local official sunrise.

The DWR also partners with HawkWatch to conduct walking transects. These surveys are conducted along permanent, square, 1.6-kilometer long transects (0.4 kilometers per side). Walking transects are carried out between 8:30 a.m. and 6:30 p.m. in May (or first week of June). Transects are walked by a single observer navigating to all 4 corners of the transect and recording the perpendicular flushing distance relative to the transect of all jackrabbits and cottontails detected, as well as identifying pellets found within the transect. We encourage transect surveyors to photograph the habitat along the transect from each corner point and facing toward the subsequent point during each spring survey effort to document gross habitat changes that occur over time. Photographs should also be taken immediately following obvious habitat changes that occur between survey efforts.

Utah is currently experiencing a decline in rabbits, though an increase is anticipated when drought conditions subside. The Utah Department of Agriculture and Food has been collaborating with the DWR to report occurrences of rabbit hemorrhagic disease serotype 2 (RHDV-2). First identified in domestic rabbits in Europe, the disease has been detected in multiple southwestern states and northern Mexico in early 2020. On June 22, 2020, the Utah Department of Agriculture and Food confirmed that a private farm with domestic rabbits in Sanpete County had rabbits test positive for the disease. To date, this virus has been confirmed in Iron, San Juan, Sanpete, Uintah, and Wayne counties. We have not had any confirmations of the virus in 2021 (DWR, 2020): https://wildlife.utah.gov/rabbit-hemorrhagic-disease.html).

Threats

- Drought; reduction of food source as desired vegetation is less available
- Predation; avian predators, bobcats, coyotes, other mammals
- Disease such as RHDV-2, tularemia, etc.

UPLAND GAME MANAGEMENT DIRECTION

Statewide upland game management goals will be achieved through quantifiable objectives and strategies. This tiered structure was created to provide guidance for each upland species, considering the stakeholder opinions, agency resource allocations, and opportunities and challenges of each resource. These objectives and strategies form the foundation for future annual work plans, research council proposals, and budget requests.

POPULATION AND HARVEST MONITORING

Management Goal: Expand baseline knowledge of factors that are limiting upland game population size and distribution.	
Objectives	**Strategies**
Identify top priority information necessary for managing upland game	Collaborate with regional wildlife managers, NGO partners, and universities to identify needs for upland game species. Priority species include forest grouse, chukar, scaled quail, ptarmigan, rabbits and grey partridge
Apply for funding through WRI and apply through Research Council to facilitate university student research	See Research Priorities section
Improve and update range maps	Develop habitat suitability models
	Meet with regional biologists to edit maps
	Incorporate crowd sourced locations

Utilize emerging technologies to conduct surveys	Infrared technology or other night vision, sound amplifiers, etc.

Management Goal: Improve population monitoring upland game species to better inform management decisions	
Objectives	**Strategies**
Improve current methods to monitor annual upland game productivity	Standardize and expand the wing collection program to attain a more extensive index of annual upland game bird productivity and promote a research project for the compilation of old wing data
	Implement or increase efforts of utilizing dogs for upland surveys; brood surveys for dusky and ruffed grouse, develop survey methods for sharp-tailed grouse, ptarmigan, and scaled quail
	Utilize cameras to collect data on species where applicable
	Work with a graduate student (as funding allows) to analyze relationships between weather patterns, annual productivity, and estimated harvest of upland game species to construct a predictive tool to forecast upland game bird populations
	Promote use of eBird for upland game sightings, until DWR implements a different platform
	Increase or establish new rabbit routes
Establish scientifically defensible population trends independent of hunter harvest surveys sufficient to justify continuation of upland harvest into the future	Evaluate current survey methods used by DWR and survey methods in the literature and used by other states
	For each species, rank the need for a population index
	For each species, estimate the time needed to conduct surveys or to manage volunteers if feasible
	Provide updated range maps for each species
Create databases for storing upland game data	Create multi-species band database
	Create multi-species radio database (Wildlife Tracker)
Rabbit Routes	Increase rabbit route effort and/or establish new rabbit routes for highest survey efficacy

Management Goal: Improve efficiency of upland game species translocations	
Objectives	**Strategies**
Evaluate previous translocation efforts	Work with research staff and regional wildlife managers to analyze data and evaluate success or failure of prior translocation efforts
Develop translocation guidelines to be consistent with WAFWA translocation standards for translocation of upland game from, into or within Utah	Work with regional wildlife managers to develop guidelines in response to requests for in-state and out-of-state translocations of resident upland species
Evaluate translocation success and outcomes, and explore updated methodology	Develop a single database of all known upland game translocations and pen-reared releases
	Establish a true need before undertaking translocation efforts
	Evaluate habitats before release
	Monitor populations after release
	Create distribution models for species to expand possible release sites
	Finish California quail habitat evaluation guidelines and prioritized release sites; complete this for other quail species
	Document release effort and lessons learned
Increase distribution of chukar partridge	Identify areas of suitable habitat without extant populations
	Identify limiting factors (i.e. water distribution)
	Translocate wild birds

HABITAT IMPROVEMENT AND MANAGEMENT

Management Goal: Preserve and enhance available habitat for upland game species.	
Objectives	**Strategies**
Work with regional staff and other partners to apply for at least 5 WRI projects per region per year	Partner with NRCS and utilize the WRI program to create and maintain or increase acres of upland game habitat per year

	Maintain four Farm Bill biologists in Natural Resources Conservation Service offices to encourage landowners to participate in Federal Farm Bill programs and design conservation projects to benefit upland game
	Identify priorities within each region that will focus on region-specific needs, including a ranking of highest priority WMAs for upland benefit
	Recommend pollinator seed mixes with z-dike structures
	Combine upland projects with other game projects such as fawning, and partner with Mule Deer Foundation and other non-government organizations for additional funding
	Seek funding for a Habitat Specialist position (in conjunction with Pheasants Forever and Sportsmen for Fish and Wildlife as shared stewardship); this position will entail directing, and implementing habitat management work on public wildlife areas; and other duties as assigned to benefit/survey upland game, waterfowl, and WMAs. Will start with this position covering the northern and central regions; goal is to expand for one position per region as funding allows
	Identify priorities within each region of Utah where DWR staff will strategically focus habitat improvement efforts that benefit species unique to those regions, or to establish species in those regions, including utilizing Farm Bill biologists' knowledge to best identify private resources, and collaborate with BLM, USFS, STILA and other agencies to address public lands
Preserve or increase upland game populations and hunting opportunities through habitat management on Waterfowl Management Areas and Wildlife Management Areas (WMAs) managed by the DWR	Rank WMAs for focus on upland benefit, and continue to support submission of WRI projects on WMAs for upland game
Establish water sources in areas needed to expand upland game species range and abundance, while establishing a protocol for artificial water source placement to maintain and improve available habitat for upland game species in Utah	Evaluate chukar partridge use of water sources
	Evaluate raven, fox, and other mesopredator use of water developments within sage-grouse range
	Conduct chukar study as proposed by Brigham Young University and continue to increase trail camera surveys at water sources.
	Evaluate water source impacts on population vital rates for

	target species
	Extrapolate and analyze data from camera surveys, upland report, telemetry data, etc. to evaluate impacts
	Complete an Upland Game Guzzler Plan — determine needed density and distribution of guzzlers to formulate an end goal and maintenance plan and address maintenance of guzzlers in plan
Forest grouse habitat treatments	Maintain forest grouse habitat projects (ensure leaving enough old forest stands for dusky winter habitat)
	Conduct surveys to check for utilization in habitat project areas
	More aspen for ruffed grouse winter habitat
Continue to seek land acquisitions and conservation easements	Work with regional staff and other agencies to identify land acquisitions and conservation easements that will benefit upland game

HUNTER OPPORTUNITY

Management Goal: Increase participation in hunting and appreciation for upland game species.	
Objective	**Strategies**
Maintain current marketing efforts for upland game hunting and viewing opportunities	Continue to work with outreach staff to develop news releases, conduct interviews, submit WildFind ideas, regional hunting clinics and seminars, increase knowledge of benefits of upland game (i.e. potential benefits of wild turkey to agriculture)
Maintain up-to-date methods used to inform hunters of upland game population trends	Continue social media presence
	Continue youth and beginner upland hunts (i.e. pheasant hunts) to recruit new hunters
	Continue to publicize the factors that influence upland game populations
	Develop education and outreach materials that describe the factors that influence upland game populations
	Present information annually to upland groups
	Increase involvement with NGOs to promote upland programs
Increase engagement	Provide information about banding

Evaluate effectiveness of outreach activities	Determine if events are effective in reaching new hunters
	Determine if events are effective in recruiting, retaining, or reactivating hunters
	Determine return-on-investment of events and pen-reared releases

Management Goal: Maintain or increase hunting access opportunities for upland game.	
Objectives	**Strategies**
Increase or maintain programs to establish access to private lands, seek avenues to access landlocked public land, or acquire more land for upland game hunting	Continue to seize opportunities for land acquisition/easements for long-term access to and increase large tracts of continuous acreage
	Pursue agreements that secure perpetual access to public land, and continue to support the access agreement established with the SITLA
	Inspire ethical practices on private lands through hunter education, guidebooks, and other outreach exercises
	Continue to advertise and maintain funding for the Walk-In Access program to improve access for upland game hunters

REGIONAL SPECIES PRIORITIES

Each of the five regions in Utah have unique geographical and climatic attributes — therefore, each region provides specific resources to enhance or expand upon. This emphasis does not preclude the improvement of habitat or management for other species, but prioritizes each region's unique qualities.

NORTHERN REGION

Management Goal: Northern Region Priorities	
Objectives	**Strategies**
Increase winter habitat for all upland game	Utilize WRI to propose habitat projects; use Farm Bill programs for upland species that utilize private lands. Habitat projects will be focused in White's Valley, Howell Valley, Hansel Valley, and the Bear River Valley north of Tremonton.
Year-round habitat development for pheasant, quail, rabbits, gray partridge, and on WMAs	Utilize WRI to propose projects on Richmond, Hardware Ranch, Henefer-Echo, East Canyon, Coldwater, Brigham Face, Cinnamon Creek and Middle Fork WMAs

Increase access to private lands for, gray partridge, pheasant, quail and (WIA)	Work with the wildlife recreation specialist to contact landowners with upland species on properties in Eastern Box Elder County and Northern Cache County. Work with landowners via Farm Bill programs to create habitat for upland species

CENTRAL REGION

Management Goal: Central Region Priorities	
Objectives	**Strategies**
Dusky and ruffed Grouse	Early successional aspen habitat work. Specific mountain ranges include: Deep Creek Mountains, Stansbury Mountains, Oquirrh Mountains, and Sheeprock Mountains
	Improvement (more and younger) of aspen stands in each of those mountain ranges where aspens occur. The promotion of limber and Douglas fir tree stands through logging and fire management
Ruffed grouse in Stansbury Mtns	Translocations, habitat projects. There are currently no ruffed grouse in the Stansbury Mountains. This would be an introduction of ruffed grouse in novel habitat, although they occur extensively along the Wasatch Front, and possibly in the Oquirrh Mountains
	There is available habitat in the Stansbury Mountains, specifically aspen stands and riparian drainages on the eastern slope (East Hickman, Box Elder, South Willow, North Willow canyons)
Chukar and California quail	Water developments; guzzlers. There is extensive chukar habitat throughout Tooele and Juab counties. Often the limiting factor is availability of water, especially in the summer and fall
	Water developments, guzzlers, increase chukar numbers and distribution. Adding more guzzlers throughout the West Desert will increase chukar densities and distribution, adding increased hunting opportunities.
	months Example areas include: Deep Creek Mountains, Silver Island Mountains, Grassy Mtns, Lakeside Mtns, Stansbury Mtns, Central and southern Cedar Mtns, Simpson Mtn, Sheeprock Mtns, Desert and Keg Mtns
Grey partridge - Ibapah area	Translocations, habitat projects. Huns existed in the Ibapah Valley along the Nevada border as recently as the 1990s. There are some indications that a small remnant population may still be there (J.Robinson Personal Observation).

	Wild grey partridge, supplemented with pen-raised grey partridge, could be released in appropriate habitat in Ibapah valley
	There are several drainages with grass, forbs and shrubs as suitable habitat. The new population could add additional hunting opportunities for all upland game hunters

NORTHEASTERN REGION

Management Goal: Northeastern Region Priorities	
Objectives	**Strategies**
Standardize and facilitate regular ptarmigan surveys	Learn "callback" technique from Colorado to expand current survey methods via electronic calls, or whichever method proves to acquire the best data
Ptarmigan research project	Work with university partners to get a student to conduct research. Until a formal research project is implemented, regular ptarmigan surveys will be conducted
Forest grouse project	Ashley National Forest plans to complete aspen restoration projects, want to capture the response of forest grouse. Additional aspen restoration work may occur on the Currant Creek WMA. If it occurs, monitoring of forest grouse response will follow
Habitat projects and telemetry research	Continue to facilitate upland game habitat projects in the region; utilize GPS transmitters to monitor habitat use as funding allows

SOUTHEASTERN REGION

Management Goal: Southeastern Region Priorities	
Objectives	**Strategies**
California quail	Continue to explore opportunities to protect and expand occupied habitat of California quail through habitat improvements such as BDA's, cooperation with private landowners, and transplants of wild birds, and utilize translocation protocol and habitat evaluation document
Chukar range expansion	Continued habitat improvement and guzzler construction for range expansion of wild chukars
	Promote habitat improvement projects that promote more wild chukars available for harvest in more accessible areas near population centers in Carbon and Emery counties
	Continue to utilize transplants of wild chukars to augment existing populations and provide for opportunities for range

	expansion
	Monitor effectiveness of guzzler construction projects by tracking use by chukars with trail cameras
Scaled quail project	Continued range expansion and monitoring of scaled quail through water developments and transplants of wild birds
	Historical observations of scaled quail have been noted in the Bluff Bench, Lime Ridge, and Montezuma Canyon areas. Continue to monitor these areas and check for occupancy
	Pursue agreements with neighboring states to transplant birds to these areas to augment populations and expand range
Forest grouse	Consider forest grouse habitat requirements and potential benefits when proposing vegetative treatments on summer ranges
	Consider habitat improvement projects in mixed coniferous-deciduous forests that create multiple small openings that maximize edge, promotes understory development and high forb abundance
	Incorporate these attributes in to habitat projects proposed for big game species in forest grouse habitat
R3	Continue to host organized youth pheasant and youth chukar hunts on DWR owned lands. These experiences recruit young hunters and generate enthusiasm for upland game hunting
Rabbit routes	Increase rabbit route efforts due to low populations, likely due to drought and possibly RHDV-2
	Look for additional methods to quantify rabbit abundance such as trail cameras at water sources or winter track surveys that correspond with other ongoing efforts
	Continue to work with HawkWatch to share our data with them and receive the transect data they collect
	Carefully monitor disease outbreaks by picking up and submitting rabbit mortalities to the State Vet Lab

SOUTHERN REGION

Management Goal: Southern Region Priorities	
Objectives	**Strategies**
Increase distribution of chukar partridge	Identify areas of suitable habitat without extant populations
	Identify limiting factors (i.e. water distribution)

	Translocate wild birds; utilize current chukar trapping efforts to augment populations
Forest grouse habitat treatments	Maintain forest grouse habitat projects (ensure leaving enough old forest stands for dusky winter habitat) many projects have removed conifer; ensure there is enough remaining conifer
	Conduct surveys to check for utilization in habitat project areas. May conduct scat transects, drumming surveys, etc.
	Ensure aspen stands are healthy for ruffed grouse winter habitat; continue to apply for funding through WRI
Increase knowledge of rabbits	Studies with GPS units, analyze current data
	Increase rabbit route surveys to check for utilization in treated areas; compare current rabbit route data to encroachment of cheatgrass, other climatic events, other species' trends, study avian predation
Continue pen-reared pheasant program	Maintain current funding and evaluate R3 impacts in final report for the grant; continue organized pheasant hunts.

APPENDICES

Appendix 1: Species Specific Management Plans

a. WT Ptarmigan
    i. Biological Unit Management Plan: White-tailed Ptarmigan (UDWR 1975)
b. Snowshoe Hare
    i. Strategic Management Plan for Cottontail Rabbits and Snowshoe Hares (UDWR 1989)
c. Cottontail Rabbit
    i. Strategic Management Plan for Cottontail Rabbits and Snowshoe Hares (UDWR 1989)
d. Greater Sage-grouse
    i. Utah Conservation Plan for Greater Sage-grouse (PLPCO 2019)
    ii. Conservation Plan for Greater Sage-grouse in Utah (PLPCO 2013)
    iii. Utah Greater Sage-grouse Management Plan (UDWR 2009)
    iv. Strategic Management Plan for Sage-grouse (UDWR 2002b)
e. Gunnison Sage-grouse
    i. Gunnison Sage-grouse Rangewide Conservation Plan (Gunnison 2005)
    ii. Final Recovery Plan for Gunnison Sage-grouse (USFWS 2020)
f. Sharp-Tailed Grouse
    i. Guidelines for the Management of Columbian Sharp-tailed Grouse Populations and their Habitat (Hoffman 2015)

ii. Strategic Management Plan for Columbian Sharp-tailed Grouse (UDWR 2002)

g. Chukar
    i. Strategic Management Plan for Chukar Partridge (UDWR 2003)
    ii. Western States Chukar and grey Partridge Management Guidelines (Knetter et al. 2017)
h. Grey Partridge
    i. Western States Chukar and Grey Partridge Management Guidelines (Knetter et al. 2017)
    ii. Strategic Management Plan for Hungarian Partridge (UDWR 1987)
i. Ring-necked Pheasant
    i. National Wild Pheasant Conservation Plan (NWPTC 2021)
    ii. National Wild Pheasant Conservation Plan (Midwest 2013)
j. California Quail
    i. Strategic Plan for Quail Management (UDWR 1987)
k. Gambel's Quail
    i. Strategic Plan for Quail Management (UDWR 1987)
l. Wild Turkey
    i. Utah Wild Turkey Management Plan (UDWR 2014)
    ii. Strategic Management Plan for Wild Turkey (UDWR 2000)
    iii. Strategic Management Plan for Wild Turkey (UDWR 1998)

Appendix 2: Upland Game Translocations

Translocation may be necessary in limited circumstances when populations have reached low levels, lack genetic diversity, have been extrapolated, or to introduce new populations. There have been many translocation attempts, many of which have been successful, but more that have failed or were performed without adequate planning or monitoring to even determine if they were successful. If a translocation is deemed necessary it is critical to document the need for a translocation, evaluate the habitat in the release site to ensure there is sufficient quality and quantity of habitat for successful establishment, follow best practices for capture, transport and release, monitor the introduced population to evaluate success, and document the project so that successful methods can be repeated and unsuccessful methods can be avoided in the future.

Each translocation project proposal should have the following:

1. Purpose of the release and project goal. Clearly define what success is
2. Habitat evaluation or Habitat Suitability Index of proposed release site
3. Historical and current densities
    a. Identified and remediated limiting factors in the case of augmentations or reintroductions
4. Release site description – including size of property or project area, historic habitat conditions, current habitat conditions, ownership, long-term management plans, connectivity, etc.

5. Translocation methods – trapping, handling, and release
6. Disease/parasite testing, response procedures, and disease risk analysis
7. Proximity of release to large domestic poultry or gamebird operations
8. Proposed source location/ownership. Justification that source population will not be jeopardized
9. Expected timeline. Number of releases over what time period
10. Target number of birds per year and total, including age and sex ratios
11. Any previous translocation efforts/experience
12. Habitat management/maintenance efforts to date, monitoring, and plans to ensure long-term success
13. Monitoring protocols

Annually and at the conclusion of the project it is critical to future management that the efforts be documented:

1. Numbers/age ratio/sex ratio and location(s) of birds captured and released
2. Capture and transport mortality, carcass disposition
3. Disease monitoring results
4. Site fidelity of translocated birds (if available)
5. Survival rates of translocated birds (if available)
6. Production rates of translocated birds (if available)
7. Modifications from original proposal
8. Evaluation of trap, transport and release methods
9. Results of release site disease screening (first annual report)
10. Harvest information (if applicable)
11. Overall evaluation of the translocation effort
12. Other lessons learned

Appendix 3: Upland Game Water Developments

To be completed by 7/1/2024.

Appendix 4: Upland Opinion and Harvest Survey Methodology

To address upland game opinion surveys or management surveys, we have compiled excellent lists from the last 5-10 years of hunters who hunted upland game. We can pull the list of all hunter customer IDs from the harvest surveys over many years to get a more-than-adequate population base from which to survey. Generally, survey sample sizes of ~400 allows for statistically significant results when questions are simple (for example, yes/no, multiple choice, ranking/rating scale questions). Of course, we also have complete lists of hunters interested in sage-grouse, turkey, sharp-tailed grouse, white-tailed ptarmigan, band-tailed pigeon, and sandhill crane (those who drew permits as well as those who applied), so any of those hunters' names that don't show up in the general harvest surveys lists will be added because of these special permits.

Harvest surveys are conducted differently — the pool of potential upland game hunters in a single year is vast and complex and includes: anyone with a valid hunting or combination license (resident and nonresidents, youth, adult, senior, disabled veteran, etc.), lifetime license holders, hunter education completion certificates, three-day nonresident hunting licenses, etc. We have developed a multi-faceted sampling strategy to analyze these differing permit types separately (this is called stratification: for example, nonresident youth hunting licenses will have much different activity and harvest than adult resident combination licenses so they need to be analyzed separately). The first wave is an online harvest survey sent to a sample of each license type. We send 60-80k emails per year with roughly 9-14k responses received. The majority of hunters in this list have hunting/combination licenses to apply for or hunt big game exclusively. We need this large sample size in order to get a valid sample size of hunters who did hunt upland game, per species. Fortunately, for the size of this survey, cost is minimal.

The email invitation/online survey has potential for bias because hunters who respond are more likely to have hunted upland game, or more likely to have harvested. To correct for this response-bias, we conduct a second survey by telephone (costly but necessary). We pull a randomized, stratified sample from those who did not respond to the online survey, and contact these hunters by telephone, making several attempts to fill as much of the sample as possible. Then the 2 datasets are combined using a statistical method outlined in "Wildlife Demography" by Skalski, Ryding, and Millspaugh.

Appendix 5: Upland Opinion Survey Summary

METHODS

A survey was created based on stakeholder input and historical records; there were two sample populations — convenience sample on social media, and a random sample of individuals from our aforementioned hunter harvest survey. This survey was sent to individuals and available online in January and February of 2022.

The DWR received 1,476 total survey responses. The email sample resulted in 573 responses (a 42% response rate; sent to 1,353 hunters from the harvest survey,). The web-link sample resulted in 903 responses (533 clicks and 17,040 people saw the ad at least once).

The average age of respondents was 44.4 years old, 94% were male and 6% were female. Four percent of new hunters responded (0-3 years of hunting), 35% were seasoned hunters (4-25 years of hunting) and 61% were veteran hunters (over 25 years of hunting).

KEY FINDINGS

Over 50% of non-upland game hunters would be more likely to hunt if they knew where to go. Overall, hunters do not describe their hunting experiences as good —new hunters are more likely to describe their experiences as good, and the majority of hunters that ranked their experiences as less than good, indicate that a lack of game is the issue. Most hunters utilize

public lands for hunting, and express crowding as a problem. Hunters perceive habitat loss as an important factor impacting upland game populations, and our hunters strongly support installing guzzlers.

Research Priorities

Species	Info/research needs for harvest	Info/research needs for conservation and management	Current Justification of Harvest
Dusky Grouse	Baseline population monitoring (breeding surveys, production indices, fall pop estimation),	Breeding populations surveys/monitoring statewide	Very low band returns in Cache County, Farnsworth et al. study (USU)
	Breeding surveys most important	Relationship of brooding habitat and fawning/calving habitat	
	Harvest rate (Farnsworth - already low)	Nesting habitat	
	Population relationships with precipitation	Response to management (aspen, Doug fir, fire, riparian, etc.)	
	Adult hen harvest	Genetics - isolated vs. contiguous populations	
	Aggregate bag with Ruffed Grouse issues		
Ruffed Grouse	Harvest rate	Habitat selection	Low survival, high reproduction grouse spp. higher probability of compensation
	Population estimates (breeding & fall)	Response to habitat management (low priority)	
	Population relationships with precipitation	Genetics - isolated populations	
		Translocations (CO, NV)	

Species	**Info/research needs for harvest**	**Info/research needs for conservation and management**	**Current Justification of Harvest**
Chukar Partridge	Harvest rate (some info from R. Larsen available)	Habitat relationships with fire/PJ loss/etc.	Unsure of band returns on BYU studies? Low survival, high reproduction spp. limited/difficult access
	Breeding/fall population estimations/status/trend (some info - camera/helicopter)	Spatial ecology of water use	
	Population Relationships with Precipitation		
Grey Partridge	Harvest rate	Habitat selection and availability in Utah	Low survival, high reproduction spp., overall harvest is low statewide
	Public vs. private land issues (population available for harvest)	Habitat relationships with fire/PJ loss/etc.	
	Population relationships with precipitation		
White-tailed Ptarmigan	Harvest rate and risk	genetics (already evidence of bottlenecking), hunter harvest wings	Inaccessibility and low hunter success have kept them safe, however, things hunter harvest dynamics have changed in the last several years
	Adult hen harvest risk (associated with broods in the early season)	Translocations - increase genetic diversity, boost population levels, and establish new populations	
	Hunter characteristics (success)		
	Population levels (breeding and fall)		

Species	**Info/research needs for harvest**	**Info/research needs for conservation and management**	**Current Justification of Harvest**
Pheasant	Harvest rate of planted birds (return on investment)		Polygynous spp. and only males are harvested
California Quail	Harvest rate	Assessment of urban trapping and translocation efforts	Very low survival, very high reproduction species, lots of room for compensation, and limited hunting areas in the state
	Harvest impacts (urban vs. WMA)	Establishing populations	
	Understanding the relationship with precipitation	Habitat selection	
	Breeding and fall population trends	Habitat management	
Gambel's Quail	Harvest rate (what info do we already have from Brigham Young University?)	Effects of fire/cheatgrass in Mojave Desert	Very low survival, very high reproduction species, lots of room for compensation, and limited hunting areas in the state
	Hunter characteristics (Southwest UT)	What about translocated populations (Montezuma Creek, Torrey-Teasdale, etc.)	
	Breeding/fall population		
	Production indices		
	Relationship with precipitation		

Scaled Quail	Not currently hunted	Translocation success - continued monitoring (Butte)	Not hunted
		More translocations with wider distribution	
		Learn from the Gambel's in Montezuma Creek	
Lagomorphs	Address declines	Evidence of decline; population decreases over time as depicted in rabbit routes	
		Increase rabbit routes	
		Increase rabbit habitat projects	
		Develop surveys for snowshoe hares	

Literature Cited

Bartel, R. A., F. F. Knowlton, and L. C. Stoddart. 2008. Long-term patterns in mammalian abundance in northern portions of the Great Basin. Journal of Mammalogy 89:1170–1183.

Bartel, R. A., and M. W. Brunson. 2003. Effects of Utah's Coyote Bounty Program on Harvester Behavior. Wildlife Society Bulletin 31(3):736–743.

Bennitt, R. 1948. The coyote bounty system in Missouri, 1936-1947. Pages 314-322 in E. M. Quee, editor. Transactions of the Thirteenth North American Wildlife Conference. Missouri Cooperative Wildlife Research Unit Columbia, USA. March 8-10, 1948, St. Louis, Missouri

Bingham, R. J. 2011. Causes, extent, and consequences of lead-pellet ingestion by chukars (*Alectoris chukar*) in western Utah: examining habitat, search images, and toxicology. Thesis, Utah State University, Logan, USA.

Bingham, R. J., R. T. Larsen, J. A. Bissonette, and J. O. Hall. 2015. Widespread ingestion of lead pellets by wild chukars in northwestern Utah. Wildlife Society Bulletin 39:94–102.

Birkan, M., D. Serre, E. Pelard, and S. Skibnienski. 1990. Effects of irrigation on adult mortality and reproduction of grey partridge in a wheat farming system. Pages 257–271 in Perdix V: grey partridge and ring-necked pheasant workshop. Kansas Department of Wildlife and Parks, Emporia, USA.

Blakely, K. L., J. A. Crawford, R. M. Oates, and K. M. Kilbride. 1988. Invertebrate matter in the diet of California quail in western Oregon. Murrelet 69:75–78.

Boland, K.M., and J.A. Litvaitis. 2008. Role of predation and hunting on eastern cottontail mortality at Cape Cod National Seashore, Massachusetts. Canadian Journal of Zoology 86:918–927.

Broyles, B., 1995. Desert wildlife water developments: questioning use in the Southwest. Wildlife Society Bulletin, 23(4):663-675.

Bui, T. D., J. M. Marzluff, and B. Bedrosian. 2010. Common raven activity in relation to land use in western Wyoming: implications for greater sage-grouse reproductive success. Condor 112:65–78.

Carroll, John P. 1993. The American Ornithologists' Union. *The Birds of North America, No. 58.* Gray Partridge.

Carroll, J. P. 1992. A model of grey partridge (Perdix perdix) population dynamics in North Dakota. Gibier Faune Sauvage 9:337–349.

Carroll, J. P. 1993. Grey partridge. Account 58 in A. Poole and F. Gill, editors. The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C., USA.

Carroll, J. P., R. D. Crawford, and J. W. Schulz. 1990. Nesting and brood-rearing ecology of grey partridge in North Dakota. In *Perdix V: grey partridge and ring-necked pheasant workshop. Kansas Dept. of Wildlife and Parks, Emporia* (pp. 272-294)

Center for Biological Diversity. 2010. Petition to List the White-tailed Ptarmigan (*Lagopus leucura*) as a Threatened Species Under the Endangered Species Act. https://www.biologicaldiversity.org/species/birds/white-tailed_ptarmigan/pdfs/WTP_Petition.pdf

Chapman, J. A., and G. Ceballos. 1990. The cottontails. Pages 95–110 in J. A. Chapman and J. E. C. Flux, editors.

Christensen, G. C. 1970. The chukar partridge: its introduction, life history, and management. Biological Bulletin Number 4, Nevada Department of Wildlife, Reno, USA.

Christensen, G. C. 1996. Chukar (Alectoris chukar). Account 258 in A. Poole and F. Gill, editors. The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C., USA.

Church, K. E., and W. F. Porter. 1990. Winter and spring habitat use by grey partridge in New York. The Journal of Wildlife Management 54:653–657.

Coates, P.S., B.E. Brussee, K.B. Howe, K. B. Gustafson, M.L. Casazza, and D. J. Delehanty. 2016. Landscape characteristics and livestock presence influence common ravens: relevance to greater sage-grouse conservation. Ecosph ere 7:1–20.

Connelly, J. W., J. H. Gammonley, and T. W. Keegan. 2012. Harvest management. Pages 202–231 in N. J. Silvy, editor. The wildlife techniques manual: volume 2. Johns Hopkins University Press, Baltimore, Maryland, USA.

Conover, M. R., and A. J. Roberts. 2017. Predators, predator removal, and sage-grouse: a review. Journal of Wildlife Management 81:7–15.

Cook A. A., P. A. Deibert, S. P. Espinosa, A. Moser, L. Schreiber, M. A. Schroeder. 2021. Greater Sage-grouse Range-wide Population Monitoring Guidelines Part A: Standards for Collection and Reporting of Greater Sage-grouse Lek Count Data. WAFWA Sage- and Columbian Sharp-tailed Grouse Technical Team, Boise, Idaho.

Cornell Laboratory of Ornithology and The Academy of Natural Sciences.1992. Birds of North America, No. 15. Blue Grouse.

Cornell Laboratory of Ornithology and The Academy of Natural Sciences. 1998. The Birds of North America, No. 321. Gambel's Quail.

Cornell Laboratory of Ornithology and The Academy of Natural Sciences. 1999. Birds of North America, No. 473. California Quail.

Cornell Laboratory of Ornithology and The Academy of Natural Sciences. 2000. The Birds of North America, No. 515. Ruffed Grouse.

Côté, I. M., and W. J. Sutherland. 1997. The effectiveness of removing predators to protect bird populations. Conservation Biology 11:395–405.

Cypher, B. L., K. A. Spencer, and J. H. Scrivner. 1994. Food-item use by coyotes at the Naval Petroleum Reserves in California. Southwestern Naturalist 39:91–95.

Dahlgren, R. B. 1988. Distribution and abundance of the ring-necked pheasant in North America. Pages 29–43 in D.L. Hallett, W. R. Edwards, and G.V. Burger, editors. Pheasants: symptoms of wildlife problems on agricultural lands. North-central Section of the Wildlife Society, Bloomington, Indiana, USA.

Dahlgren, D. K., E.J. Blomberg, C.A. Hagen, and R.D. Elmore. 2021. Upland game bird harvest management. Pages 307-325 in K. L. Pope and L. A. Powell, editors. Harvest of Fish and Wildlife. CRC Press, Boca Raton, USA.

Dinkins, J.B., M. R. Conover, C. P. Kirol, J. L. Beck, and S. N. Frey. 2016. Effects of common raven and coyote removal and temporal variation in climate on greater sage-grouse nesting success. Biological Conservation 202:50–58.

Douglas, D. W. and A. M. Stebler. 1946. Bounties don’t work out as they are supposed to. Michigan Conservation. 15(2): 6..:i7' 10 0

Drake, J. F., R. O. Kimmel, J. D. Smith, and G. Oehlert. 2009. Conservation Reserve Program grasslands and ring-necked pheasant abundance in Minnesota. National Quail Symposium Proceedings 6:302–314.

DWR, 2020. https://wildlife.utah.gov/rabbit-hemorrhagic-disease.html.

Ellsworth, E., and T. D. Reynolds. 2006. Snowshoe hare (Lepus americanus): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. <https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5210225.pdf>. Accessed 5 July 2018.

Farnsworth, S. Y. 2020. Forest grouse ecology and management in the Bear River Range, northern Utah. 2020. Thesis, University of Utah, Logan, Utah, USA.

Feldhamer, G. A., L. C. Drickamer, S. H. Vessey, J. F. Merritt, and C. Krajewski. 2015. Mammalogy: adaptation, diversity, ecology. Fourth Edition. Johns Hopkins University Press, Baltimore, Maryland, USA.

Flux, J. E. C. 1981. Reproductive strategies in the genus Lepus. Pages 155–174 in Proceedings of the World Lagomorph Conference. K. Myers and C. D. MacInnes, editors. University of Guelph, Ontario, Canada.

Frey, S.N., S. Majors, M. R. Conover, T. A. Messmer, D. L. Mitchell. 2003. Effect of predator control on ring-necked pheasant populations. Wildlife Society Bulletin 31(3):727-735.

Gunnison Sage-grouse Rangewide Steering Committee. 2005. Gunnison sage-grouse rangewide conservation plan. Colorado Division of Wildlife, Denver, Colorado, USA.

Guthery, F. S., M. J. Peterson, J. J. Lusk, M. J. Rabe, S. J. DeMaso, M. Sams, R. D. Applegate, and T. V. Dailey. 2004. Multistate analysis of fixed, liberal regulations in quail harvest management. Journal of Wildlife Management 68:1104–1113.

Guthery, F. S., N. D. Forrester, K. R. Nolte, W. E. Cohen, and W. P. Kuvlesky Jr. 2000. Potential effects of global warming on quail populations. In National quail symposium proceedings, Vol. 4, No. 1, p. 48.

Gutierrez, R. J., and D. J. Delehanty. 1999. Mountain quail (*Oreortyx pictus*). Account 457 in A. Poole and F. Gill, editors. The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C., USA.

Hiller, T. L., L. A. Powell, T. D. McCoy, and J. J. Lusk. 2009. Long-term agricultural land-use trends in Nebraska, 1866–2007. Great Plains Research 19:225–237.

Hodges, K. E. 1999. Ecology of snowshoe hares in southern boreal and montane forests. Pages 163–206 in L. F.

Hoffman, R. W. 1985. Effects of changes in hunting regulations on blue grouse populations. Pages 327–334 in S. L. Beasom and S. F. Roberson, editors. Game harvest management, proceedings of the third international symposium. Caesar Kleberg Wildlife Research Institute, Kingsville, Texas, USA.

Hoffman, R. W. 2006. White-tailed Ptarmigan (*Lagopus leucura*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region, Fort Collins, Colorado, USA.

Hoffman, R. W., K. A. Griffin, J. M. Knetter, M. A. Schroeder, A. D. Apa, J. D. Robinson, S. P. Espinosa, T. J. Christiansen, R. D. Northrup, D. A. Budeau, and M. J. Chutter. 2015. Guidelines for the management of Columbian sharp-tailed grouse populations and their habitats. Sage and Columbian Sharp-tailed Grouse Technical Committee, Western Association of Fish and Wildlife Agencies, Cheyenne, Wyoming, USA.

Hubbard, M. W. 1991. Habitat changes in central Iowa and their relationship to ring-necked pheasant populations, 1981–1990. Thesis, Iowa State University, Ames, USA.

Jenkins, D. 1961. Social behaviour in the partridge Perdix perdix. Ibis 103:155–188.

Joselyn, G. B., and J. E. Warnock. 1964. Value of Federal Feed Grain Program to production of pheasants in Illinois. Journal of Wildlife Management 28:547–551.

Keith, L. B. 1981. Population dynamics of hares. Pages 395–440 in K. Myers and C. D. MacInnes, editors. Proceedings of the World Lagomorph Conference. University of Guelph, Ontario, Canada.

Knetter, J. M., D. A. Budeau, and S. P. Espinosa. 2017. Western states chukar and grey partridge management guidelines. Western States Partridge Working Group, Western Association of Fish and Wildlife Agencies, Cheyenne, Wyoming, USA.

Knick, S. T. 1990. Ecology of bobcats relative to exploitation and a prey decline in southeastern Idaho. Wildlife Monographs 108:3–42.

Larsen, R. T., J. A. Bissonette, J. T. Flinders, M. B. Hooten, and T. L. Wilson. 2010. Summer spatial patterning of chukars in relation to free water in western Utah. Landscape Ecology 25:135–145.

Larsen, R. T., J. A. Bissonette, J. T .Flinders, and J. C. Whiting. 2012. Framework for understanding the influences of wildlife water developments in the western United States. California Fish and Game, 98(3):148-163.

Larsen, R. T., J. T. Flinders, D. L. Mitchell, E. R. Perkins, and D. G. Whiting. 2007. Chukar watering patterns and water site selection. Rangeland Ecology and Management 60:559–565.

Leopold, A. S. 1977. The California quail. University California Press, Berkeley, California. USA.

Lindbloom, A. J., K. P. Reese, and P. Zager. 2004. Seasonal habitat use and selection of chukars in west central Idaho. Western North American Naturalist 64:338–345.

McCabe, R. A., and A. S. Hawkins. 1946. The Hungarian partridge in Wisconsin. American Midland Naturalist 36:1–75.

Midwest Pheasant Study Group. 2013. National wild pheasant conservation plan. N.B. Veverka (ed.). Association of Fish and Wildlife Agencies. 111 pp.

Mitchell, D., R. Lee, E. Perkins, and J. Staley. 2003. Strategic management plan for chukar partridge (*Alectoris chukar*). Utah Division of Wildlife Resources, Salt Lake City, Utah, USA.

MacGregor, W., Jr., and M. Inlay. 1951. Observations on the failure of Gambel's quail to breed. California Fish and Game 37:218–219.

Messerli, J.R. 1971. Water in relation to the establishment of chukar partridge in Utah deserts. Thesis, Utah State University, Logan, Utah, USA.

Mills, L. S., et al. 2018. Winter color polymorphisms identify global hot spots for evolutionary rescue from climate change. Science 359:1033–1036.

Moulton, M. P., W. P. Cropper Jr, and A. J. Broz. 2015. Inconsistencies among secondary sources of Chukar Partridge (Alectoris chukar) introductions to the United States. Peer J, 3:1447.

Mussehl, T.W. 1960. Blue grouse production, movements, and populations in the Bridger Mountains, Montana. Journal of Wildlife Management 24:60–68.

National Wild Pheasant Technical Committee (NWPTC). 2021. National wild pheasant conservation plan. Second edition. J. S. Taylor (ed.). Agencies of the National Wild Pheasant Conservation Plan and Partnerships

Newsome, T. M., G. Ballard, P. J. S. Fleming, R. van de Ven, G. L. Story, and C. R. Dickman. 2014. Human-resource subsidies alter the dietary preferences of a mammalian top predator. Oecologia 175:139–150.

Peterson, M. J. 2001. Northern bobwhite and scaled quail abundance and hunting regulation: a Texas example. Journal of Wildlife Management 65:828–837.

Peterson, M. J., and R. M. Perez. 2000. Is quail hunting self-regulatory? Northern bobwhite and scaled quail abundance and quail hunting in Texas. National Quail Symposium Proceedings. 4:85–91.

Pollock, K. H., C. T. Moore, W. R. Davidson, F. E. Kellogg, and G. L. Doster. 1989. Survival rates of bobwhite quail based on band recovery analyses. Journal of Wildlife Management 53:1–6.

Pope, M. D. 2002. The ecology of mountain quail in Oregon. Dissertation, Oregon State University, Corvallis, Oregon, USA.

Porter, R. D. 1955. The Hungarian partridge in Utah. Journal of Wildlife Management 19:93–10

Potts, G. R. 1980. The effects of modern agriculture, nest predation and game management on the population ecology of partridges (Perdix perdix and Alectoris rufa). Advances in Ecological Research 11:1–79.

Project Upland Magazine. 2019. Scaled Quail (*Callipepla squamata*) - Life History of the Blue Quail.

Public Land Policy Coordination Office (PLPCO). 2013. Conservation plan for sage-grouse in Utah. Utah Public Land Policy Coordination Office, Salt Lake City, Utah, USA.

Public Land Policy Coordination Office (PLPCO). 2019. Utah conservation plan for greater sage-grouse. Utah Public Land Policy Coordination Office, Salt Lake City, Utah, USA.

Robinson, Jason D. White-tailed Ptarmigan Hunting. Grantsville, Strutting Grouse Bird Dogs, 2021.

Rodgers, R. D. 1999. Why haven't pheasant populations in western Kansas increased with CRP? Wildlife Society Bulletin 27:654–665.

Rolland, V., J. A. Hostetler, T. C. Hines, H. F. Percival, and M. K. Oli. 2010. Impact of harvest on survival of a heavily hunted game bird population. Wildlife Research 37:392–400.

Schemnitz, S.D. 1994. Scaled Quail (Callipepla squamata). In The Birds of North America, No. 106 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Schneider, S.H. and T. L. Root. 2002. Climate Change: Overview and Implications for Wildlife. North American Case Studies, Washington D.C.: Island Press, 437 pp.

Schroeder, M. A., and R. K. Baydack. 2001. Predation and the management of prairie grouse. Wildlife Society Bulletin 29:24–32.

Shaw, W. W. 1971. The effects of available water upon populations of chukar partridge on desert mountains of Utah. Thesis, Utah State University, Logan, USA.

Skidmore, W. R. 2016. Ecology of Gambel's quail (*Callipepla gambelii*) in relation to water and fire in Utah's Mojave desert. Thesis, Brigham Young University, Provo, Utah, USA.

Small, R. J., J. C. Holzwart, and D. H. Rusch. 1991. Predation and hunting mortality of ruffed grouse in central Wisconsin. Journal of Wildlife Management 55:512–520.

Southwick Associates. Quantifying the Economic Contributions of Wildlife-Related Recreation on BLM Land. September, 2018.

Steenhof, K., M. N. Kochert, and T. L. McDonald. 1997. Interactive effects of prey and weather on golden eagle reproduction. Journal of Animal Ecology 66:350–362.

Swank, W. G. and S. Gallizioli. 1954. The influence of hunting and rainfall on Gambel's quail populations. Transactions North American Wildlife and Natural Resources Conference 19:283–296.

Tanner E. P., M. Papeş, R. D. Elmore, S. D. Fuhlendorf. 2017. Incorporating abundance information and guiding variable selection for climate-based ensemble forecasting of species' distributional shifts. PLOS ONE 12(9): e0184316. https://doi.org/10.1371/journal.pone.0184316

Taylor, J. S., T. R. Bogenschutz, and W. R. Clark. 2018. Pheasant responses to U.S. cropland conversion programs: a review and recommendations. Wildlife Society Bulletin 42:184–194.

Tomeček, J. M., B. L. Pierce, and M. J. Peterson. 2015. Quail abundance, hunter effort, and harvest of two Texas quail species: implications for hunting management. Wildlife Biology 21:303–311.

Thackston, Reggie E.; Sisson, D. Clay; Crouch, Tyson L.; Baxley, Danna L.; and Robinson, Ben A. (2012) "Hunter Harvest of Pen-Reared Northern Bobwhites Released From the Surrogator," National Quail Symposium Proceedings: Vol. 7 , Article 63.

Thacker, E. T., Hamm, R. L., Hagen, J., Davis, C. A. and Guthery, F. (2016), Evaluation of the Surrogator® system to increase pheasant and quail abundance. Wild. Soc. Bull., 40: 310-315. doi:10.1002/wsb.648

U.S. Fish and Wildlife Service (USFWS). 2020a. Final recovery plan for Gunnison sage-grouse (Centrocercus minimus). October 2020. U.S. Fish and Wildlife Service, Upper Colorado River Region, Lakewood, Colorado. 32 pages.

U.S. Fish and Wildlife Service (USFWS). 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Revised October 2018.

U.S. Fish and Wildlife Service (USFWS). 2020b. Endangered and Threatened Species: Eleven Species Not Warranted for Listing. Federal Register Number 2020-26139

U.S. Fish and Wildlife Service (USFWS). 2020c. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment for Southern White-tailed Ptarmigan. Document ID FWS-R6-ES-2012-0023-0010.

Utah Division of Wildlife Resources (UDWR). 1975. Biological Unit Management Plan: White-tailed Ptarmigan. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 1987. Strategic Management Plan for Hungarian Partridge. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 1988. Strategic Management Plan for Quail. Division of Wildlife Resources, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 1989. Strategic Management Plan for Cottontail Rabbits and Snowshoe Hares. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 1998. Strategic Management Plan for Wild Turkey. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 2000. Strategic Management Plan for Wild Turkey. Publication 00-25. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 2002. Strategic Management Plan for Columbian Sharp-tailed Grouse. Utah Department of Natural Resources, Division of Wildlife Resources, Publication 02-19, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 2002b. Strategic management plan for sage-grouse. Utah Department of Natural Resources, Division of Wildlife Resources, Publication 02-20, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 2003. Strategic Management Plan for Columbian Chukar Partridge. Utah Department of Natural Resources, Division of Wildlife Resources, Publication 03-20, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 2009. Utah Greater Sage-grouse Management Plan. Utah Department of Natural Resources, Division of Wildlife Resources, Publication 09-17, Salt Lake City, Utah, USA.

Utah Division of Wildlife Resources (UDWR). 2014. Strategic Management Plan for Wild Turkey. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah, USA.

Vander Haegen, W. M., M. A. Schroeder, and R. M. DeGraaf. 2002. Predation on real and artificial nests in shrubsteppe landscapes fragmented by agriculture. Condor 104:496–506.

Walter, H., and K. P. Reese. 2003. Fall diet of chukars (Alectoris chukar) in eastern Oregon and discovery of ingested lead pellets. Western North American Naturalist 63:402–405.

Warner, R. E. 1979. Use of cover by pheasant broods in east-central Illinois. Journal of Wildlife Management 43:334–346.

Warner, R. E. 1988. Habitat management: how well do we recognize the pheasant facts of life? Pages 129–146 in D. L. Hallett, W. R. Edwards, and G. V. Burger, editors. Pheasants:

symptoms of wildlife problems on agricultural lands. Northcentral Section of the Wildlife Society, Bloomington, Indiana, USA.

Weigand, J. P. 1977. The biology and ecology of Hungarian (European grey) partridge (Perdix perdix L.) in northcentral Montana. Dissertation, Montana State University, Bozeman, USA.

Weiner, E., B. D. Dugger, and D. Budeau. 2009. Incidence of ingested lead shot in chukar (Alectoris chukar) gizzards from Eastern Oregon. Unpublished report, Oregon Department of Fish and Wildlife, Salem, USA.

Williams, C. K., and R. D. Applegate. 2012. Do resident and non-resident northern bobwhite hunters self-regulate harvest based on population size? National Quail Symposium Proceedings 7:148–154.

Williams, C. K., R. S. Lutz, and R. D. Applegate. 2004. Winter survival and additive harvest in northern bobwhite coveys in Kansas. Journal of Wildlife Management 68:94–100.

Yeatter, R. E. 1934. The Hungarian partridge in the Great Lakes region. School of Forestry and Conservation Bulletin Number 5. University of Michigan Press, Ann Arbor, USA.

Zornes, M., and R. A. Bishop. 2009. Western quail management plan. Association of Fish and Wildlife Agencies. Washington, D.C., USA.

Vander Zouwen, W. J. 1990. Recent status of gray partridge in North America. Pages 21–40 in K.E. Church, R. E. Warner, and S. J. Brady, editors. Perdix V: gray partridge and ring-necked pheasant workshop. Kansas Department of Wildlife and Parks, Emporia, USA.

Zwickel, F. C. 1992. Blue grouse. Account 15 in A. Poole and F. Gill, editors. The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C., USA.

Zwickel, F. C., and Bendell, J. F. 2004. Blue grouse: their biology and natural history. NRC Research Press, Ottawa, Ontario, Canada.