12. Owyhee Uplands Section

Section Description

The Owyhee Uplands Section is part of the Columbia Plateau Ecoregion. The Idaho portion, the subject of this review, comprises southwestern Idaho from the lower Payette River valley in the northwest and the Camas Prairie in the northeast, south through the Hagerman Valley and Salmon Falls Creek Drainage (Fig. 12.1, Fig. 12.2). The Owyhee Uplands spans a 1,200 to 2,561 m (4,000 to 8,402 ft) elevation range. This arid region generally receives 18 to 25 cm (7 to 10 in) of annual precipitation at lower elevations. At higher elevations, precipitation falls predominantly during the winter and often as snow.

The Owyhee Uplands has the largest human population of any region in Idaho, concentrated in a portion of the section north of the Snake River—the lower Boise and lower Payette River valleys, generally referred to as the Treasure Valley. This area is characterized by urban and suburban development as well as extensive areas devoted to agricultural production of crops for both human and livestock use. Among the conservation issues in the Owyhee Uplands include the ongoing conversion of agricultural lands to urban and suburban development, which limits wildlife habitat values. In addition, the conversion of grazing land used for ranching to development likewise threatens wildlife habitat. Accordingly, the maintenance of opportunity for economically viable ranching operations is an important consideration in protecting open space. The aridity of this region requires water management programs, including water storage, delivery, and regulation for agriculture, commercial, and residential uses. Agricultural fields are irrigated with either flood irrigation, mostly supplied by diversion from the Snake, Boise, and Payette rivers, or sprinkler irrigation supplied by groundwater pumping. Major hydroelectric and water storage reservoirs include CJ Strike and Swan Falls reservoirs on the Snake River. Reaches of the Boise and Payette rivers within the Owyhee Uplands are controlled by upstream dams.

Lower Deep Creek, Owyhee Uplands, Idaho © 2011 Will Whelan

In stark contrast, the portion of the Owyhee Uplands to the south of the Snake River is a topographically rugged, remote, and sparsely populated area. This area is high-desert sagebrush steppe. The Owyhee Mountain Range (oriented north-south in western Owyhee County) is the dominant landform with stands of quaking aspen (*Populus tremuloides* Michx.),

curl-leaf mountain mahogany (*Cercocarpus ledifolius* Nutt.), and western juniper (*Juniperus occidentalis* Hook.) in a mosaic of mountain brush, meadow, and sagebrush (*Artemisia* L.). Water discharge from higher elevations feeds many small streams that serve as the headwaters of the Owyhee, Bruneau, and Middle Snake drainages. Portions of the Bruneau and Owyhee rivers are designated Wild and Scenic Rivers. Most of this area is managed by the Bureau of Land Management (BLM), which administers 9 areas designated as wilderness, including the Owyhee Canyonlands Wilderness.

Livestock ranching and farming are major land uses in the Owyhee Uplands. This industry includes large corporate and small family operations that use a mix of private, state, and federal lands.

Historically, miners and prospectors excavated numerous gold mines in this section. Today, gold extraction supports a few commercially important business operations.

The Owyhee Uplands contains some of the most important sagebrush steppe in Idaho including the highest density of occupied Greater Sage-Grouse (hereafter Sage-Grouse, *Centrocercus urophasianus*) leks in the state. In some areas, this habitat type has been altered by the establishment of nonnative plants, particularly invasive annual grasses introduced from the Eurasian Steppe biome, including cheatgrass (*Bromus tectorum* L.) and medusahead (*Taeniatherum caput-medusae* [L.] Nevski). These species affect many aspects of sagebrush-steppe ecology, but perhaps most importantly, the presence of invasive annual grasses alters fire regimes. In some areas, increased frequency and severity of wildfires has resulted in conversion from shrub-dominated habitats to nonnative annual grasslands, which has reduced habitat value for shrubsteppe obligate species. The altered habitat has favored species that benefit from less shrub cover, including early-seral and grassland-dependent species. This has been particularly true at lower-elevation sites formerly dominated by Wyoming big sagebrush (*A. tridentata* Nutt. subsp. *wyomingensis* Beetle & Young).

Aquatic and wetland habitats in the Owyhee Uplands are a limiting resource for many species of fish and wildlife in this arid landscape. High value meadow habitats are primarily located on private land because homesteaders needed good water and forage production to make a living on their limited allotments of 160 acres. Actions proposed in the Owyhee Uplands Section that relate to upland, meadow, or riparian habitats on private land are voluntary and require consent of the landowner. In-stream habitat and riparian habitat are usually intrinsically linked in terms of their condition and value as fish and wildlife habitats. Wetlands and riparian habitats tend to have the highest vegetation productivity within the landscape and represent key habitat types for foraging herbivores. Dense vegetation cover associated with wetland and riparian habitats is also favorable for many types of wildlife. In addition, high insect populations are associated with these areas of greater primary productivity, and wetland and riparian habitats are essential for many insectivorous animals, such as bats and Neotropical migratory birds.

Most Owyhee Uplands river systems lie within steep, deeply-incised canyons. The rugged terrain and steep canyon walls provide habitats for Bighorn Sheep (*Ovis canadensis*), high concentrations of nesting raptors, and a diverse assemblage of bat species.

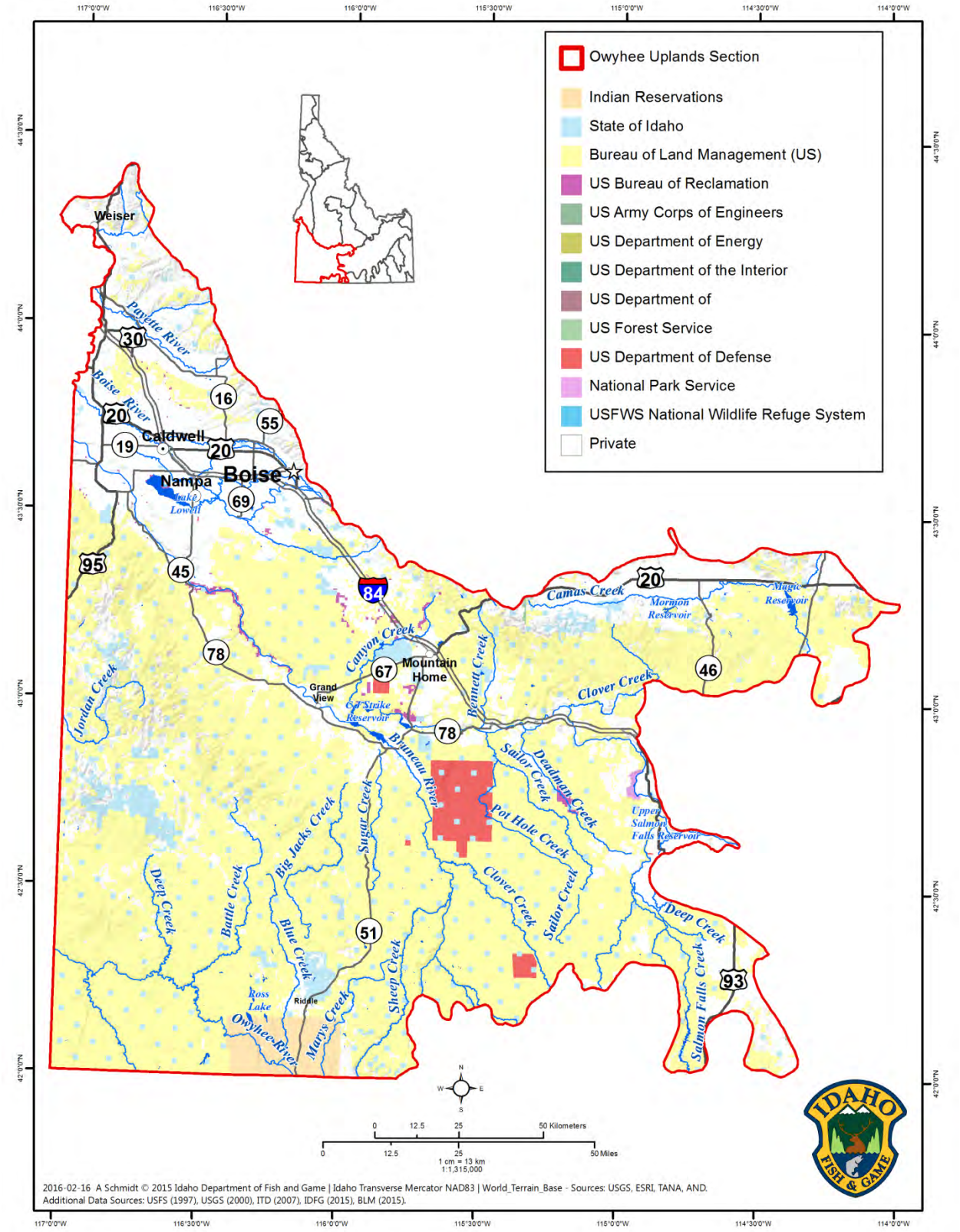


Fig. 12.1 Map of Owyhee Uplands surface management

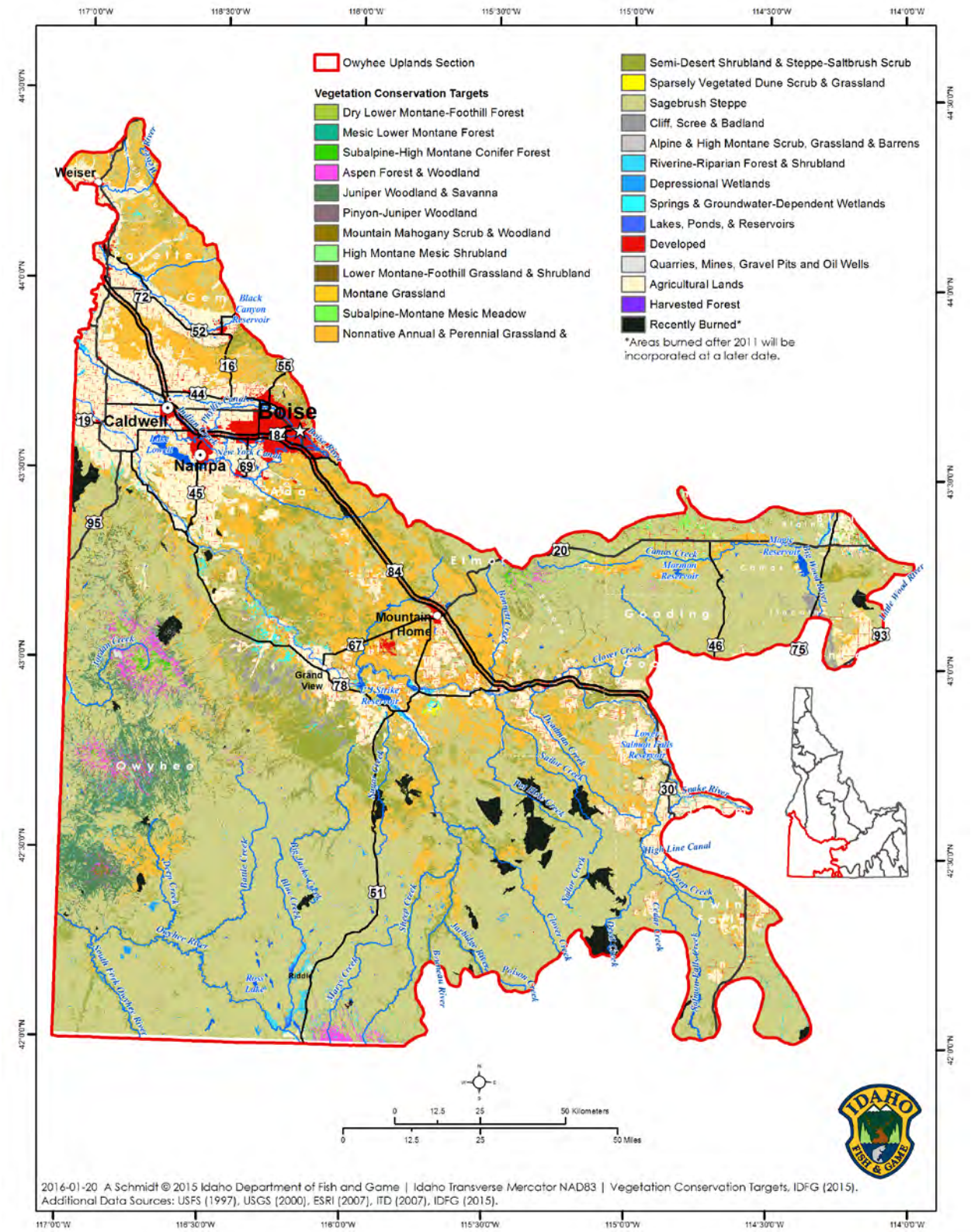


Fig. 12.2 Map of Owyhee Uplands vegetation conservation targets

Conservation Targets in the Owyhee Uplands

We selected 7 habitat targets (3 upland, 4 aquatic) that represent the highest priorities for wildlife conservation in the Owyhee Uplands as shown in Table 12.1. Species of greatest conservation need (SGCN) are associated with each habitat, i.e., "nested targets" (Table 12.2). The intent of the recommended "Objectives, Strategies, and Actions" is to direct resources toward improving the quality of these habitats for wildlife. Management of the habitat targets listed below will contribute to improving population viability for the species nested within them. Research and monitoring topics, such as species designation, ecological research, or planning, are summarized at the end of each target habitat if additional information is needed to support management programs. Such projects are often species-specific and include disease investigation and management.

Table 12.1 At-a-glance table of conservation targets in the Owyhee Uplands

Target	Target description	Target viability	Nested targets (SGCN)	
Semi-Desert Shrubland & Steppe–Saltbush Scrub	Combines "Semi-Desert Shrubland & Steppe" and "Saltbush Scrub." Xeric landscape dominated by salt desert scrub. In this section, often on ancient alkaline lacustrine deposits.	*Fair* to *Good*. In many areas, invasive weeds have affected plant diversity and created dense stands of annual grasses and forbs.	*Tier 2* *Tier 3*	Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl Common Nighthawk Townsend's Big-eared Bat Western Small-footed Myotis Great Basin Collared Lizard
Sparsely Vegetated Dune Scrub & Grassland	Bruneau Dunes, Weiser Dunes, Windmill Dunes, and other unnamed scattered dune complexes.	*Fair*. Large areas dominated by cheatgrass and other invasive annuals.	*Tier 1* *Tier 2* *Tier 3*	Bruneau Dune Tiger Beetle An Ant-like Flower Beetle (*Amblyderus owyhee*) Lined June Beetle (*Polyphylla devestiva*) A Grasshopper (*Argiacris militaris*)
Sagebrush Steppe	Sagebrush steppe systems at all elevations across the Owyhee Uplands. This target comprises a variety of sagebrush types, habitat structure, and seral stages.	*Poor* to *Very Good*. Habitat is intact in good ecological condition in some areas, but in others, dominated by invasive annual grasslands with an altered fire regime.	*Tier 1* *Tier 2* *Tier 3*	Greater Sage-Grouse Southern Idaho Ground Squirrel Morrison's Bumble Bee Ferruginous Hawk Golden Eagle Burrowing Owl Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Silver-haired Bat Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Wyoming Ground Squirrel Alpine Tiger Beetle Short-eared Owl Common Nighthawk Hunt's Bumble Bee A Miner Bee (*Hesperapis kayella*)

Target	Target description	Target viability	Nested targets (SGCN)	
Riverine–Riparian Forest & Shrubland	All rivers and streams, including aquatic habitats and their associated terrestrial riparian habitats.	*Fair*. Rivers and associated riparian habitat are predominantly affected by water management, degraded water quality, and changes in hydrology.	*Tier 1*	Columbia Spotted Frog Yellow-billed Cuckoo Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail
			Tier 2	Western Toad Woodhouse's Toad Northern Leopard Frog California Gull Silver-haired Bat Hoary Bat
			Tier 3	Ring-billed Gull Townsend's Big-eared Bat Western Small-footed Myotis Little Brown Myotis California Floater Western Ridged Mussel Snake River Pilose Crayfish A Mayfly (*Paraleptophlebia jenseni*) Duckhead Snowfly Boise Snowfly
Depressional Wetlands	Precipitation-fed systems ranging from infrequent to semipermanent or permanently flooded. Includes playas, vernal pools, shallow marshes, and deep water marshes.	*Fair*. Habitat area has been greatly reduced in many sites. Altered by invasive weeds and hydrologic disturbance.	*Tier 1*	Columbia Spotted Frog
			Tier 2	Woodhouse's Toad Northern Leopard Frog American Bittern White-faced Ibis Black Tern
			Tier 3	Sandhill Crane Raptor Fairy Shrimp
Springs & Groundwater-Dependent Wetlands	Primarily springs and seeps, geothermal springs, alkaline-saline wetlands, and wet and mesic meadows.	*Poor* to *Fair*. The current area occupied by springs and groundwater-dependent wetlands is reduced from historic extent. Numerous hydrologic alterations.	*Tier 1*	Columbia Spotted Frog Greater Sage-Grouse Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail
			Tier 2	American Bittern Silver-haired Bat Hoary Bat
			Tier 3	Sandhill Crane Common Nighthawk Townsend's Big-eared Bat Western Small-footed Myotis Little Brown Myotis
Lakes, Ponds & Reservoirs	This ecosystem includes all natural lakes and deep ponds, dam-altered naturally formed lakes, and created	*Fair*. Water level fluctuations and land bridging of nesting islands, as a result of unusually low water levels, are the main issues.	*Tier 1*	Columbia Spotted Frog
			Tier 2	Western Grebe Clark's Grebe American White Pelican California Gull Caspian Tern

Target	Target description	Target viability	Nested targets (SGCN)	
	waterbodies of all sizes that fit the lacustrine definition.		*Tier 3*	Ring-billed Gull Pondsnail (*Stagnicola*) Species Group
Bat Assemblage	The Owyhee Uplands contains the full complement of bat species found in the state (14 spp.)	*Good*. Main concerns include fatality associated with wind energy, AML closures, and potential incidence of white-nose syndrome (WNS).	*Tier 2* *Tier 3*	Silver-haired Bat Hoary Bat Townsend's Big-eared Bat Western Small-footed Myotis Little Brown Myotis

Table 12.2 Species of greatest conservation need (SGCN) and associated conservation targets in the Owyhee Uplands

Taxon	Conservation targets							
	Semi-Desert Shrubland & Steppe–Saltbush Scrub	Sparsely Vegetated Dune Scrub & Grassland	Sagebrush Steppe	Riverine–Riparian Forest & Shrubland	Depressional Wetlands	Springs & Groundwater-Dependent Wetlands	Lakes, Ponds & Reservoirs	Bat Assemblage
AMPHIBIANS								
Western Toad (*Anaxyrus boreas*)[2]				X		X		
Woodhouse's Toad (*Anaxyrus woodhousii*)[2]				X	X	X		
Northern Leopard Frog (*Lithobates pipiens*)[2]				X	X	X		
Columbia Spotted Frog (Great Basin DPS) (*Rana luteiventris*)[1]				X	X	X	X	
BIRDS								
Greater Sage-Grouse (*Centrocercus urophasianus*)[1]			X			X		
Western Grebe (*Aechmophorus occidentalis*)[2]							X	
Clark's Grebe (*Aechmophorus clarkii*)[2]							X	
American White Pelican (*Pelecanus erythrorhynchos*)[2]							X	
American Bittern (*Botaurus lentiginosus*)[2]					X	X		
White-faced Ibis (*Plegadis chihi*)[2]					X	X		
Ferruginous Hawk (*Buteo regalis*)[2]	X		X					
Golden Eagle (*Aquila chrysaetos*)[2]	X		X					
Sandhill Crane (*Grus canadensis*)[3]						X		
Long-billed Curlew (*Numenius americanus*)[2]			X					
Ring-billed Gull (breeding population) (*Larus delawarensis*)[3]				X			X	
California Gull (breeding population) (*Larus californicus*)[2]				X			X	
Caspian Tern (*Hydroprogne caspia*)[2]							X	
Black Tern (*Chlidonias niger*)[2]					X			
Yellow-billed Cuckoo (*Coccyzus americanus*)[1]				X				
Burrowing Owl (*Athene cunicularia*)[2]	X		X					
Short-eared Owl (*Asio flammeus*)[3]	X		X					
Common Nighthawk (*Chordeiles minor*)[3]	X		X			X		
Sage Thrasher (*Oreoscoptes montanus*)[2]			X					
Sagebrush Sparrow (*Artemisiospiza nevadensis*)[2]			X					
Grasshopper Sparrow (*Ammodramus savannarum*)[3]			X					
MAMMALS								
Pygmy Rabbit (*Brachylagus idahoensis*)[2]			X					
Townsend's Big-eared Bat (*Corynorhinus townsendii*)[3]			X	X	X	X		X
Silver-haired Bat (*Lasionycteris noctivagans*)[2]			X	X	X	X	X	X

Taxon	Conservation targets							
	Semi-Desert Shrubland & Steppe–Saltbush Scrub	Sparsely Vegetated Dune Scrub & Grassland	Sagebrush Steppe	Riverine–Riparian Forest & Shrubland	Depressional Wetlands	Springs & Groundwater-Dependent Wetlands	Lakes, Ponds & Reservoirs	Bat Assemblage
Hoary Bat (*Lasiurus cinereus*)[2]			X	X	X	X	X	X
Western Small-footed Myotis (*Myotis ciliolabrum*)[3]			X	X	X	X		X
Little Brown Myotis (*Myotis lucifugus*)[3]				X	X	X		X
Bighorn Sheep (*Ovis canadensis*)[2]	X		X					
Dark Kangaroo Mouse (*Microdipodops megacephalus*)[2]			X					
Columbia Plateau (syn. Merriam's) Ground Squirrel (*Urocitellus canus*)[2]			X					
Wyoming Ground Squirrel (*Urocitellus elegans nevadensis*)[2]			X					
Southern Idaho Ground Squirrel (*Urocitellus endemicus*)[1]			X					
REPTILES								
Great Basin Collared Lizard (*Crotaphytus bicinctores*)[3]	X							
BIVALVES								
California Floater (*Anodonta californiensis*)[3]				X				
Western Ridged Mussel (*Gonidea angulata*)[3]				X				
CRUSTACEANS								
Raptor Fairy Shrimp (*Branchinecta raptor*)[3]					X			
Snake River Pilose Crayfish (*Pacifastacus connectens*)[3]				X				
GASTROPODS								
Banbury Springs Limpet (*Lanx* sp. 1)[1]						X		
Pondsnail (*Stagnicola*) Species Group[3]							X	
Snake River Physa (*Physa natricina*)[1]				X				
Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*)[1]				X		X		
Bliss Rapids Snail (*Taylorconcha serpenticola*)[1]				X		X		
INSECTS								
An Ant-like Flower Beetle (*Amblyderus owyhee*)[2]		X						
Alpine Tiger Beetle (*Cicindela plutonica*)[2]			X					
Bruneau Dune Tiger Beetle (*Cicindela waynei*)[1]		X						
Lined June Beetle (*Polyphylla devestiva*)[2]		X						
A Mayfly (*Paraleptophlebia jenseni*)[3]				X				
Hunt's Bumble Bee (*Bombus huntii*)[3]			X					
Morrison's Bumble Bee (*Bombus morrisoni*)[1]			X					
A Miner Bee (*Hesperapis kayella*)[3]			X					
A Grasshopper (*Argiacris militaris*)[3]		X						

Taxon	Conservation targets							
	Semi-Desert Shrubland & Steppe–Saltbush Scrub	Sparsely Vegetated Dune Scrub & Grassland	Sagebrush Steppe	Riverine–Riparian Forest & Shrubland	Depressional Wetlands	Springs & Groundwater-Dependent Wetlands	Lakes, Ponds & Reservoirs	Bat Assemblage
Spur-throated Grasshopper (*Melanoplus*) Species Group[3]								
Duckhead Snowfly (*Capnura anas*)[3]				X				
Boise Snowfly (*Utacapnia nedia*)[3]				X				

Target: Semi-Desert Shrubland & Steppe–Saltbush Scrub

This system comprises a variety of cover types dominated by mixed xeric-adapted shrubs and native grasses. The same management strategies apply to both Semi-Desert Shrubland and Steppe, and Saltbush Scrub because they share similar traits in terms of shrub composition and structure, and occur in a similar climatic zone. This habitat type occurs where substrates include sandstone talus, fine-textured alluvium, sand, clay, loams, cinder, cobbles, or coarse gravels, often on alluvial flats and fans, plateaus, bluffs, and similar landforms. Within the Owyhee Uplands, this system is characteristic of alkaline lacustrine deposits that form low foothills in the Treasure Valley, including the Owyhee Front, the Boise Foothills, and foothills and plains along the Payette, and Snake River valleys. The system also occurs along the lower slopes and valley bottoms of the upper Owyhee drainage, albeit discontinuously and not extensively, and grading to sagebrush-steppe habitat.

Owyhee Front near Oreana, Idaho, 2010 IDFG

Vegetation is characterized by sparse shrubs ranging from 5 to 30% vegetative cover. Shrubs may include shadscale (*Atriplex confertifolia* [Torr. & Frém.] S. Watson), fourwing saltbush (*A. canescens* [Pursh] Nutt.), bud sagebrush (*Picrothamnus desertorum* Nutt.), winterfat (*Krascheninnikovia lanata* [Pursh] A. Meeuse & Smit), and greasewood (*Sarcobatus vermiculatus* [Hook.] Torr.). Characteristic grasses include Indian ricegrass (*Achnatherum hymenoides* [Roem. & Schult.] Barkworth), Thurber's needlegrass (*A. thurberianum* [Piper] Barkworth), and needle and thread (*Hesperostipa comata* [Trin. & Rupr.] Barkworth). Biological soil crusts are often an important habitat component considering that usual soil types are highly erodible (Blaisdell and Holmgren 1984). Often this system transitions to a sagebrush-dominated system, particularly along edaphic, aspect, and elevational gradients.

This habitat type supports a high diversity of rodents—particularly granivores—and reptiles adapted to its sparse vegetation and sometimes specializing on unique edaphic conditions. Thus, this habitat type is often heavily used by snakes, raptors, and mesocarnivores attracted to this prey base.

In some areas large expanses have been infested with invasive annual grasses. Although semidesert habitat is typically not susceptible to intensive fires owing to the sparse vegetation, an intensified fire regime may occur at sites with dense growth of invasive plants.

Target Viability

Fair to Good. This habitat is normally characterized by sparse vegetation having an open canopy structure and an abundance of bare soil. In many areas, invasive weeds have affected plant diversity and created dense stands of annual grasses and forbs. This change in habitat structure affects suitability for reptiles, birds, and small mammals, which in turn affects higher trophic levels. Invasive annual plants also have affected fire frequency, resulting in the loss of shrubs in some areas, such as along the Owyhee Front.

Spotlight Species of Greatest Conservation Need: Burrowing Owl

The Burrowing Owl (*Athene cunicularia*) breeds in the deserts and grasslands of western North America and winters in the southern US and Mexico. Breeding habitat is characterized by low-growing grasses and shrubs (Klute et al. 2003). In the Owyhee Uplands, breeding sites are primarily in xeric, lower-elevation landscapes sparsely vegetated with grasses, shrubs, and forbs. Burrowing Owls nest in abandoned mammal burrows. In the Owyhee Uplands, burrows are predominantly abandoned American Badger (*Taxidea taxus*) burrows, especially where foraging badgers are excavating ground squirrels (e.g., Great Basin [syn. Piute] Ground Squirrel, *Urocitellus mollis* and Southern Idaho Ground Squirrel, *Urocitellus endemicus*). Thus, ground squirrel and badger population dynamics may affect Burrowing Owl nest site availability, population density, and distribution. Burrowing Owl prey comprises insects and small vertebrates. Land use and agricultural practices affect small mammal and insect prey availability, and pest control activities, in particular, may have unintended negative consequences for Burrowing Owl nest success (Klute et al. 2003). The expansion of nest predators, particularly populations of Common Raven (*Corvus corax*), is of concern for Burrowing Owl populations in some areas. For example, researchers documented visitation by ravens to scavenge cached prey items or take Burrowing Owl chicks at 66% of studied natural and artificial nests in the Owyhee Uplands (J. Belthoff pers. comm.). This increase in predation risk is likely attributable to the conversion of shrub-dominated landscapes to nonnative grasslands (i.e., cheatgrass), which makes nesting owls more visible and increases the availability of nesting structures (e.g., transmission lines) for ravens. Habitat conditions and causes of mortality outside Idaho on migration routes or particularly in wintering areas may affect population viability.

Prioritized Threats and Strategies for Semi-Desert Shrubland & Steppe–Saltbush Scrub

High rated threats to Semi-Desert Shrubland & Steppe–Saltbush Scrub in the Owyhee Uplands

Utility & service lines

Tall structures, such as utility poles and lattice towers, provide perching and nesting habitat for Common Raven and may reduce habitat use by Burrowing Owls and other species adapted to low-growing vegetation. Power lines also pose an electrocution risk to large birds, including the Golden Eagle (*Aquila chrysaetos*).

Objective	Strategy	Action(s)	Target SGCNs
Minimize population-level effects to wildlife from OHV use along maintenance roads associated with powerlines.	Manage OHV travel to avoid negative consequences for wildlife population viability.	Design OHV travel plans to avoid key areas for wildlife where viability would be affected by vehicle-caused mortality or habitat avoidance. Target weed abatement programs to minimize establishment and propagation of invasive weed stands in disturbed soils. Enforce travel regulations to minimize vehicle trespass and development of pioneered trails.	Ferruginous Hawk Golden Eagle Short-eared Owl Burrowing Owl Great Basin Collared Lizard
Minimize electrocution risk to raptors from transmission lines.	Evaluate, remediate and construct power transmission lines following Avian Power Line Interaction Committee protocols.		Ferruginous Hawk Golden Eagle Short-eared Owl

Off highway vehicle (OHV) use on undesignated routes or in undesignated areas

The Owyhee Front is close to the largest human population center in Idaho and the area is frequently used for recreation in the form of off-highway vehicle use (OHV) (IDFG 2010). OHV use has increased dramatically over recent decades, and unregulated and illegal OHV use in Bighorn Sheep habitat has also increased over the last 10–15 years (IDFG 2010). Enforcement is challenging due to the remoteness of the area (IDFG 2010). The prevalence of roads, trails, and OHV use may reduce the ability of sheep to move undisturbed between patches of habitat (IDFG 2010). In addition, OHV trail systems affect habitat use by reptiles (Munger et al. 2003), reducing the amount of habitat available to some species.

Objective	Strategy	Action(s)	Target SGCNs
Minimize population-level effects to wildlife from OHV use.	Manage OHV travel to avoid negative consequences for wildlife population viability.	Limit general recreational OHV travel to existing roads, primitive roads, and trails in areas where travel management planning has not been completed or is in progress. This action is not intended to prevent necessary administrative and/or permitted uses that include a variety of management activities such as infrastructure inspection and repair as well as use for ranch, range, and livestock management (e.g., moving livestock, repairing fences,	Ferruginous Hawk Golden Eagle Short-eared Owl Burrowing Owl Bighorn Sheep Great Basin Collared Lizard

Objective	Strategy	Action(s)	Target SGCNs
		checking water sources, distributing salt etc.). Design OHV travel plans to avoid key areas for wildlife where viability would be affected by vehicle-caused mortality or habitat avoidance. Target weed abatement programs to minimize establishment and propagation of invasive weed stands in disturbed soils. Enforce travel regulations to minimize vehicle trespass and development of pioneered trails.	

Increased frequency & severity of wildfire

Historically, the semidesert habitat was largely not susceptible to intensive fires owing to the sparse vegetation. However, an intensified fire regime may occur at sites with dense growth of invasive plants. Invasive plants affect the physical structure of sparsely-vegetated habitat when plants grow on normally bare soil patches (West 1994, Paysen et al. 2000). This increase in standing biomass increases the capacity for fire propagation through stands. Although many shrubs within this system may resprout following fire, the increased frequency and severity of wildfire may cause the loss of less resilient cover components resulting in a possible conversion to nonnative grassland (West 1994). This contributes to the ongoing fragmentation and loss of shrub-dominated habitats. Almost the entire extent of the Owyhee Uplands is rated as "very high" with respect to burn probability (DOI 2015).

Objective	Strategy	Action(s)	Target SGCNs
Reduce the number of acres of habitat lost to wildfire.	Coordinate actions with An Integrated Rangeland Fire Management Strategy (DOI 2015) and the Governor's Alternative (Otter 2012).	Request and place additional firefighting resources and establish new Incident Attack Centers (Otter 2012). Create and maintain fuel breaks in strategic locations to modify fire behavior and increase fire suppression effectiveness based on criteria outlined in the Governor's Alternative (Otter 2012) where such fuel breaks do not result in undesirable habitat loss or fragmentation.	Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl Common Nighthawk Great Basin Collared Lizard
Develop more aggressive strategies to reduce fine fuel loads (Otter 2012).	Improve targeting of fuels reduction opportunities and implementation (DOI 2015).	Explore opportunities to provide support to livestock grazing permittees and private landowners to implement fuel treatment actions as part of strategic, landscape efforts (DOI 2015). Work with livestock producers to	Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl Common Nighthawk Great Basin

Objective	Strategy	Action(s)	Target SGCNs
		implement fuels treatment on their lands and allotments (DOI 2015). Implement aggressive and targeted application of both proven techniques and the rapid investigation and implementation of new practices to control cheatgrass and mitigate habitat impacts from unwanted rangeland fire (DOI 2015).	Collared Lizard
Increase post-fire restoration success (DOI 2015).	Expand the use of native seeds and seedlings to accelerate efforts to improve and restore post-fire rangeland health (DOI 2015).	Collect native seed for use in developing commercial seed and for long-term seed banking to ensure conservation of germ plasm to promote climate resilience and long-term rangeland health (DOI 2015). Coordinate and collaborate across agencies on climate trend data as it relates to seeds (DOI 2015). Increase seed production and the grow-out of genetically appropriate native plant species for the restoration (DOI 2015). Limit the use of nonnative species (e.g., to achieve site stabilization, wildfire breaks, or invasive plant control) to transitional, noninvasive species, replaced by natives in subsequent ecological restoration or during natural successional processes (DOI 2015).	Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl Common Nighthawk Great Basin Collared Lizard
Commit to multiyear investments in restoration (DOI 2015).	Support long-term strategies for the restoration of sagebrush-steppe ecosystems, including consistent long-term monitoring protocols and adaptive management for restored areas (DOI 2015).	Map hot spots of restoration activity or investment to help identify trends and opportunities for greater efficiency and leveraging of funds (DOI 2015). Support a cross-jurisdictional consortium of agencies, organizations and partners dedicated to implementation of restoration, monitoring, and adaptive management activities (DOI 2015).	Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl Common Nighthawk Great Basin Collared Lizard

Noxious weeds & invasive annual plants

Invasive plants affect the physical structure of sparsely-vegetated habitat when plants grow on normally bare soil patches (West 1994, Paysen et al. 2000). This increase in standing biomass increases the capacity for fire propagation through stands. Invasion of nonnative annual grasses, in particular cheatgrass, is one of the primary drivers of larger, more intense rangeland fires across the Great Basin in this habitat type (West 1994). Range fires may cause changes in shrub cover composition or may result in loss of shrub diversity and/or conversion to grassland systems. New approaches to managing cheatgrass and medusahead continue to emerge,

including soil microbes (e.g., Harding and Raizada 2015) that may prove feasible for broad control programs. *The Idaho Invasive Species Strategic Plan 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012) was developed to guide the State's invasive species management.

Objective	Strategy	Action(s)	Target SGCNs
Control invasive plants and restore areas dominated by invasive, nonnative annual grasses at a rate greater than the rate of the spread.	Implement large-scale experimental activities to remove cheatgrass and other invasive annual grasses through various tools (DOI 2015).	Implement *The Idaho Invasive Species Strategic Plan 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012). Develop information to identify key areas necessary to maintain viable populations of SGCN and their prey. Prioritize key wildlife areas degraded by invasive plants for vegetation management and restoration programs. Manage anthropogenic activities to minimize the establishment and spread of invasive plants. Develop invasive species Early Detection and Rapid Response (EDRR) programs. Promote certified weed-free seeds/forage (Idaho Sage-grouse Advisory Committee 2006). Develop and evaluate restoration techniques to reduce biomass of invasive plants; for example, explore the use of MB 906®, a bacteria soil amendment for the suppression of annual grasses. Develop and build upon multiagency/organization partnerships, including Cooperative Weed Management Areas, to address weed issues across land ownership and management boundaries.	Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl Common Nighthawk Great Basin Collared Lizard

Species designation, planning & monitoring

The raptor SGCN in this habitat type (e.g., Ferruginous Hawk, Golden Eagle, Burrowing Owl, Short-eared Owl) rely on abundant prey populations, including small mammals. Maintaining abundant prey is partly achieved through habitat management programs. However, some key prey populations (e.g., populations of lagomorphs, such as Black-tailed Jackrabbit, *Lepus californicus*) may be affected by disease outbreaks or undergo enigmatic population fluctuations. For example, an epizootic plague outbreak in Great Basin (syn. Piute) Ground Squirrel populations during 2015 caused high mortality rates, which may have had consequences for prey availability and raptor breeding productivity. Investigations are needed to evaluate prey population dynamics in the context of diseases.

Objective	Strategy	Action(s)	Target SGCNs
Manage the effects of disease, including plague, on vulnerable small mammal populations.	Monitor outbreaks of plague and other diseases. Investigate the effects of small mammal diseases and disease vectors on small mammal population status.	Investigate small mammal mortality events to determine causative factors and contribute to interagency coordination of any relevant public health programs. Characterize small mammal populations and associated disease vectors. Evaluate the effects of plague and/or other small mammal diseases on population dynamics.	Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl

Target: Sparsely Vegetated Dune Scrub & Grassland

This target includes sparsely vegetated dune and grassland systems including the Bruneau Dunes, Weiser Dunes, Windmill Dunes, and other unnamed scattered dune complexes. The Bruneau River enters the Snake River at CJ Strike Reservoir (Bruneau Arm) and the landmass between the 2 rivers makes up the Bruneau Thumb, comprised of a mix of basaltic rock intermixed with aeolian sand deposits. The landscape is made up of a mix of cultivated lands and annual grass-dominated uplands. The immediate vicinity of the reservoir includes sand dunes, in particular those at Bruneau Dunes. The Eagle Cove area of the Snake River creates a unique stellate (star-shaped) dune that, due to the wind currents and shape of the cove, remains in its current location (Murphy 1973) creating habitats not found anywhere else in Idaho. The dunes are occupied by several endemic invertebrates. Proximity to productive wetlands and the presence of unique sand dune habitat make this an important biodiverse area.

Bruneau Dunes State Park, Snake River, Idaho, 2007 IDFG

Target Viability

Fair. Dune habitat condition is fair. This area has large areas dominated by cheatgrass and other invasive annuals. A substantial loss of habitat area has been documented, and remaining habitat contains extensive invasive plants. Bruneau Dune Tiger Beetle populations are in low numbers and have a fragmented distribution.

Spotlight Species of Greatest Conservation Need: Bruneau Dune Tiger Beetle

Bruneau Dune Tiger Beetle (*Cicindela waynei*) is found only within Bruneau Dunes State Park and a few adjacent sand-dominated blowouts. Habitat suitability is affected by nonnative vegetation encroachment (e.g., cheatgrass, prickly Russian thistle [*Kali tragus*] and tall tumblemustard [*Sisymbrium altissimum* L.]) (Anderson 1992, Baker et al. 1994, 1997, Bosworth et al. 2010) and changing precipitation patterns crucial to spring emergence and reproduction. This species of ground beetle is a sand-obligate species that requires healthy early-seral dune habitats with a mosaic of cobble and open sand. Cobble is required for larval survival and open dunes for breeding (both mating and oviposition) and the pursuit of prey. Currently, approximately 75% of previously occupied habitat is now unoccupied. Maintenance of core habitat identified by Bosworth et al. (2010) and potential expansion into restored areas should be a priority.

Spotlight Species of Greatest Conservation Need: Lined June Beetle (*Polyphylla devestiva*)

This endemic scarab, found only in southwestern Idaho, is closely tied to healthy early-seral dune habitats with the presence of sand-associated native perennial forbs and grasses. When originally described in 1966, it was associated with sand systems along the Snake River from Homedale to Bruneau (Young 1966), but due to habitat changes resulting from invasive species encroachment, it has recently only been observed at Celebration Park and Bruneau Dunes. This species is rhizophagous, feeding on the roots of a variety of sand-associate plants (primarily native grasses) and like many sand-associate scarabs, is physiologically and behaviorally adapted to sand-dominated habitats (Andrews and Gilbert 1992) and is often unable to survive under surrounding desert conditions (Hardy and Andrews 1987). No formal surveys have been conducted on this species and as a result, its presence at historic sites as well as population status remains unknown.

Prioritized Threats and Strategies for Sparsely Vegetated Dune Scrub & Grassland

Very High rated threats to Sparsely Vegetated Dune Scrub & Grassland in the Owyhee Uplands

Invasive plant species

Mitigating the loss of occupied habitat as a result of invasive plant species is the highest priority for Bruneau Dune Tiger Beetle, Lined June Beetle, and all sand-associated fauna; this issue has been identified by multiple authors for 2 decades.

Objective	Strategy	Action(s)	Target SGCNs
Remove invasive annual grasses and reduce spread from adjacent areas.	Test the effectiveness of best available annual-grass-mitigating actions.	Conduct trials using prescribed fire, Imazapic (a selective herbicide), and when released, annual grass biopesticides.	Bruneau Dune Tiger Beetle Lined June Beetle

Objective	Strategy	Action(s)	Target SGCNs
Determine potential impacts of herbicides on tiger beetle viability.	Where appropriate, assess the exposure to herbicides and evaluate potential impacts on beetle populations.	Conduct bioassays of intended treatment herbicides on endemic invertebrates occupying sand-dominated systems in southern Idaho.	Bruneau Dune Tiger Beetle Lined June Beetle

Species designation, planning & monitoring

We have an inadequate understanding of the population status of Bruneau Dune Tiger Beetle. Regular status assessments of occupied and recently-colonized habitats are important as the effectiveness of management actions continues to be evaluated. Likewise, the status of this population of Lined June Beetle and its life history have not been fully documented or updated. To better understand the species and its habitat needs, surveys of historic sites are needed.

Objective	Strategy	Action(s)	Target SGCNs
Assess the status of Bruneau Dune Tiger Beetle populations.	Conduct regular monitoring of occupied, historic, and potentially recent colonization sites at Bruneau Dunes, the Windmill Site and other suitable and historic localities.	Conduct a population survey of adults and larvae at all historic, current, and potential sites every 2–3 years to determine status and effectiveness of treatments. Explore the potential for translocation of gravid or recently-emerged adults from core habitat areas to locations where extirpation has occurred.	Bruneau Dune Tiger Beetle
Determine the status of historic populations of Lined June Beetle.	Conduct surveys for Lined June Beetle in Canyon, Elmore, and Owyhee counties.	Conduct light-trap surveys in July to survey for males and flighted females. Conduct night sand surface surveys for females.	Lined June Beetle

Target: Sagebrush Steppe

Sagebrush steppe is the pivotal ecological system in the Owyhee Uplands and therefore among the highest conservation priorities for this section. Sagebrush spans a wide variety of plant communities. As a habitat it is diverse, and in the Owyhee Uplands not all landscapes having sagebrush face the same management priorities or have the same conservation value or management needs. Variation in stand structural characteristics, vegetation composition, and disturbance regimes shapes the suitability and habitat value of various landscapes, which drives

Snake River Plain near Boise, Idaho, 2015 IDFG

habitat management priorities. Although resource management programs affecting wildlife habitat within sagebrush steppe are currently dominated by considerations for Sage-Grouse populations, many other species are reliant on sagebrush-steppe habitat. Disturbance regimes play an important role in determining habitat value in sagebrush steppe. Some species, including the Pygmy Rabbit (*Brachylagus idahoensis*), tend to occur in mature, undisturbed habitat. Others, such as the Long-billed Curlew (*Numenius americanus*), are associated with more disturbed habitat. Thus, some areas that have minimal to no value for Sage-Grouse are important for other high-priority species or species assemblages such as Pygmy Rabbit, Southern Idaho Ground Squirrel, and sagebrush-obligate passerine birds.

Much of the area south of the Snake River and west of the Bruneau and Jarbidge rivers is generally intact sagebrush-dominated systems. The Bruneau Escarpment, a high-elevation plateau running between the Owyhee Mountains and the Jarbidge Mountains, is dominated by little sagebrush (*Artemisia arbuscula* Nutt.) on the tabletops and both Wyoming (*Artemisia tridentata* Nutt. subsp. *wyomingensis* Beetle & Young) and mountain big sagebrush (*A. t.* Nutt. subsp. *vaseyana* [Rydb.] Beetle) below the tables. South and west of the Owyhee River, sagebrush steppe is mostly dominated by Wyoming big sagebrush, and some areas are in pristine condition. In contrast, cheatgrass has invaded the landscape along and within the canyonlands and within the eastern half of Juniper Basin. Livestock grazing is a common land-use activity within this area.

Sagebrush habitat in the Bennett and Picabo Hills, Camas Prairie, and lower Wood River Valley is mostly in good condition and comprises a variety of sagebrush types, perennial grasses, and forbs.

Most of the sagebrush steppe in the Owyhee Uplands lies within the Idaho West Owyhee Greater Sage-Grouse Conservation Area, but also extends into the Idaho Desert and Idaho Southern Conservation Areas (see Attachment 1, Fig. 2-14, Idaho and Southwestern Montana Greater Sage-Grouse Approved RMP Amendment, hereafter Idaho and Southwestern Montana GRSG ARMPA; BLM 2015). The entire area includes a mix of designated Priority (PHMA), Important (IHMA), and General (GHMA) Greater Sage-Grouse Habitat Management Areas (Fig. 12.3) as developed by the State and federal land management agencies (see Attachment 1, Fig. 2-1; BLM 2015). PHMA, IHMA, and GHMA are defined as follows:

> PHMA—BLM-administered lands identified as having the highest value to maintaining sustainable GRSG populations. Areas of PHMA largely coincide with areas identified as priority areas for conservation in the FWS's COT report. These areas include breeding, late brood-rearing, winter concentration areas, and migration or connectivity corridors.
>
> IHMA—BLM-administered lands that provide a management buffer for PHMA and connect patches of PHMA. IHMA encompass areas of generally moderate to high conservation value habitat and populations but that are not as important as PHMA. There are no IHMA designated within southwestern Montana.
>
> GHMA—BLM-administered lands where some special management will apply to sustain GRSG populations; areas of occupied seasonal or year-round habitat outside of PHMA or IHMA.

Target Viability

Poor to *Very Good*. Sagebrush Steppe condition varies across the section from poor to very good. Habitat in the basin east of the Bruneau Escarpment to the Bruneau River, which is dominated by Wyoming big sagebrush, is generally intact and in good ecological condition. With the exception of its vulnerability to wildfire, this area is somewhat resilient to disturbance. The Wyoming big sagebrush-dominated landscape south and west of the Owyhee River is likewise generally intact and geographically isolated from human disturbance. This extremely remote area is vulnerable to lightning-caused wildfire, and invasive annual grasses thrive along the canyon rims of the South Fork and Little Owyhee rivers. Historically, livestock grazing was heavy in the most xeric habitat types. Some sagebrush habitat in the Owyhee Mountains has been impacted by extensive juniper encroachment. Some areas are in poor to fair condition, and large expanses have been converted to stands of invasive annual grasses and subject to altered fire regimes, which results in the functional loss of shrubs.

Spotlight Species of Greatest Conservation Need: Greater Sage-Grouse

Although previously a candidate for listing as endangered or threatened under the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.; ESA), on October 2, 2015, the US Fish and Wildlife Service (FWS) announced a 12-month finding that listing the Greater Sage-Grouse was not warranted. However, the Greater Sage-Grouse and its habitat remains a management priority in Idaho. Its population status varies across the Owyhee Uplands. A remnant population occupies the area north and west of Mountain Home, Idaho, which is dominated by invasive annual grasses. This small population (<100 birds) is stable based on lek route counts, but fires that burned in 2012 and 2013 continue to affect Sage-Grouse habitat use in the area. The mesic meadows around Fairfield and most of the area west of the Bruneau and Jarbidge rivers in Owyhee County contain stable populations that occupy mostly intact, native sagebrush shrublands. The Owyhee County portion contains the highest density of occupied Sage-Grouse leks in the state. The population east of the Jarbidge River declined following the Murphy Complex Fire of 2007. However, lek route data show that the population is slowly increasing. Sage-Grouse that occupy the sagebrush-dominated slopes along the northern portion of the Owyhee Mountains are generally stable. However, wildfire, OHV use, energy development, and juniper encroachment are management concerns within this area.

Conservation issues and management actions are provided in the *2006 Conservation Plan for the Greater Sage-grouse in Idaho* (Idaho Sage-grouse Advisory Committee 2006). Higher-level direction for habitat management priorities is provided in the *Federal Alternative of Governor C.L. "Butch" Otter for Greater Sage-Grouse Management in Idaho* (hereafter Governor's Alternative; Otter 2012) and included in the Idaho and Southwestern Montana GRSG ARMPA (BLM 2015). Conservation actions on state endowment lands are identified in the *Idaho State Board of Land Commissioners Greater Sage-Grouse Conservation Plan* (Idaho State Board of Land Commissioners 2015). Where IDL has regulatory and assistance activities on private land, conservation measures will be voluntary Best Management Practices (BMPs) because IDL does not have the statutory authority within its regulatory programs or assistance activities to require adoption by authorized parties. Regulatory and assistance activities include Abandoned Mine Lands Projects, Dredge and Placer Mine Permits, Mine Reclamation Plan Approvals, and Oil and

Gas Permits (seismic imaging surveys, well drilling). Where appropriate, IDL will include recommended BMPs within its authorizing documents to encourage compliance. Landowners may also be eligible for technical and financial assistance to implement voluntary conservation practices through the Natural Resources Conservation Service's (NRCS) Sage-Grouse Initiative. Sage-Grouse habitat in the Owyhee Uplands is predominantly Priority (PHMA) and Important (IHMA) (see Fig. 12.3), as developed by the State and federal land management agencies and found in the *Idaho and Southwestern Montana GRSG ARMPA* (see Attachment 1, Fig. 2-1; BLM 2015).

Spotlight Species of Greatest Conservation Need: Southern Idaho Ground Squirrel

The Southern Idaho Ground Squirrel is endemic to approximately 291,500 ha (720,500 acres) in Gem, Payette, Washington, and Adams counties, Idaho (FWS 2014), concentrated in the foothills north of the Payette River from Weiser east to Squaw Butte. Investigations into the status of this species began in the 1980s (Yensen 1985). At that time, populations were suspected to be declining, but not necessarily imperiled. During the late 1990s, however, resurveys indicated a dramatic population decline (Yensen 1999, 2000), and this information led to this taxon being designated a candidate for listing under ESA in 2001 (Fed Regist. 66:54808–54832). However, on 2015 October 8, FWS announced a 12-month finding that candidate status for Southern Idaho Ground Squirrel was not warranted (FWS 2015*b*).

Southern Idaho Ground Squirrel populations occur in a mosaic of shrubland and grassland habitat. In some areas, habitat changes are driven by invasion of weedy annual grasses—particularly cheatgrass and medusahead—which displaces native plants, reduces plant diversity and nutritional resources, and alters the timing of plant productivity. These nonnative grasses tend to senesce in late spring (e.g., late May through early June), a period when Southern Idaho Ground Squirrels are completing the accumulation of energy reserves prior to entering estivation in June.

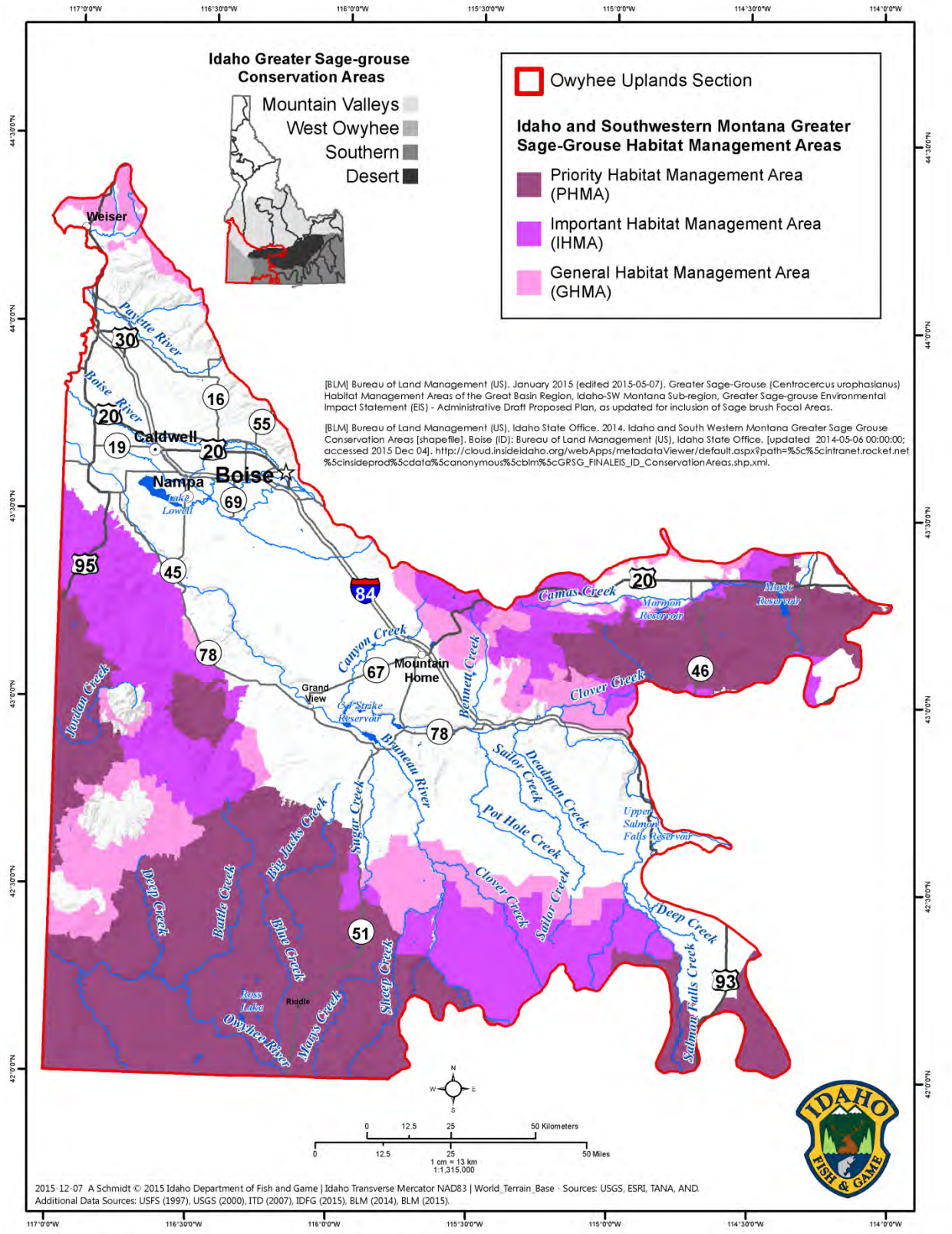


Fig. 12.3 Map of Idaho and Southwestern Montana Greater Sage-Grouse Habitat Management Areas in the Owyhee Uplands

Prioritized Threats and Strategies for Sagebrush Steppe

Very High rated threats to Sagebrush Steppe in the Owyhee Uplands

Increased frequency & severity of wildfire

The increased frequency and severity of wildfire (see Fig. 12.4) is considered a primary threat to the sagebrush-steppe ecosystem and to the many sagebrush-steppe species that depend on it, including Sage-Grouse ([FWS] US Fish and Wildlife Service 2014b; Otter 2012). In the Desert and West Owyhee Greater Sage-Grouse Conservation Areas in particular (see Fig. 2-14; BLM 2015), wildfire is a more serious issue relative to other areas of the state (Otter 2012). The accelerated invasion of nonnative annual grasses—in particular cheatgrass and medusahead—and the spread of juniper into the sagebrush-steppe ecosystem (coupled with the effects of intensified drought and climate change), create conditions that lead to larger, more intense rangeland fires across the Great Basin (DOI 2015). This contributes to the ongoing fragmentation and loss of shrubsteppe habitats. Almost the entire extent of the Owyhee Uplands is rated as "very high" with respect to burn probability (DOI 2015).

Certain remote areas of the Owyhee Uplands, e.g., the intact Wyoming big sagebrush basin between the Bruneau Escarpment and the Bruneau River and the area south and west of the Owyhee River, are especially vulnerable to lightning-caused wildfire. Protection of intact sagebrush-steppe areas and restoration management of degraded areas is a priority for this key system. In terms of fire suppression, habitat management within the Greater Sage-Grouse PHMA (BLM 2015) should be aggressive and is intended to maintain large tracts, habitat resiliency, and sustainability.

Objective	Strategy	Action(s)	Target SGCNs
Manage wildfires to minimize loss of sagebrush habitat.	Improve fire suppression protocols and resource allocations to limit habitat losses to wildfire.	Support development and implementation of Rangeland Fire Protection Associations (e.g., Idaho Code § 38-104B and Governor's Executive Order 2015-04) (Otter 2015). During high fire danger conditions, stage initial attack and secure additional resources closer to priority areas, with particular consideration of the West Owyhee, Southern, and Desert Conservation Areas to ensure quicker response times in or near Sage-Grouse habitat (BLM 2015). Create and maintain effective fuel breaks to modify fire behavior and increase fire suppression effectiveness based on criteria outlined in the Governor's Alternative (Otter 2012).	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel
Reduce the risk of wildfire impacts by managing fuel loads in a manner that can potentially reduce the rate of fire	Use cooperatively planned targeted grazing practices as a means to incrementally reduce the potential for	Recognize sustainable animal agricultural use as a means to incrementally reduce fuel accumulation, continuity of fuels, and wildfire impacts under moderate and advantageous climatic conditions (Strand et al. 2014).	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's)

Objective	Strategy	Action(s)	Target SGCNs
travel, lower intensity, increase burn patchiness, and reduce total fuel consumption.	catastrophic wildfire (Launchbaugh et al. 2008).		Ground Squirrel Southern Idaho Ground Squirrel
Increase post-fire restoration success (DOI 2015)	Expand the use of native seeds and seedlings to accelerate efforts to improve and restore post-fire rangeland health (DOI 2015).	Reallocate use of native seed from emergency stabilization and rehabilitation (ESR) projects outside of PHMA or IHMA (or ESA-listed species habitat) to those inside it in years when preferred native seed is in short supply (BLM 2015). Collect native seed from across the distribution of the species for use in developing commercial seed and for long-term seed banking to ensure conservation of germ plasm to promote climate resilience and long-term rangeland health (DOI 2015). Coordinate and collaborate across agencies on climate trend data as it relates to seeds (DOI 2015). Increase seed production and the grow-out of genetically appropriate native plant species for the restoration of the sagebrush steppe, which will provide necessary structure and habitat, as well as dietary and other benefits for Sage-Grouse (DOI 2015). Limit the use of nonnative species (e.g., to achieve site stabilization, fuel breaks, or invasive plant control) to transitional, noninvasive species, replaced by natives in subsequent ecological restoration or during natural successional processes (DOI 2015).	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel
Restore degraded habitat.	Support long-term strategies for the restoration of sagebrush-steppe ecosystems, including consistent long-term monitoring protocols and adaptive management for restored areas (DOI 2015).	Map hot spots of restoration activity to help identify trends and opportunities for greater efficiency and leveraging of funds (DOI 2015). Support a cross-jurisdictional consortium of agencies, organizations and partners dedicated to restoration, monitoring, and adaptive management activities leading to a healthy sagebrush-steppe ecosystem (DOI 2015).	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel
Maintain intact	Protect Wyoming big	Suppress wildfires in Sage-Grouse habitat, commensurate with threatened and endangered	Greater Sage-Grouse

Objective	Strategy	Action(s)	Target SGCNs
sagebrush stands to limit fragmentation and minimize direct habitat loss.	sagebrush from destruction by wildfire.	species habitat or other critical habitats to be protected (BLM 2015). Develop fuel breaks in areas dominated by invasive annual grasses adjacent to Wyoming big sagebrush stands.	Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel

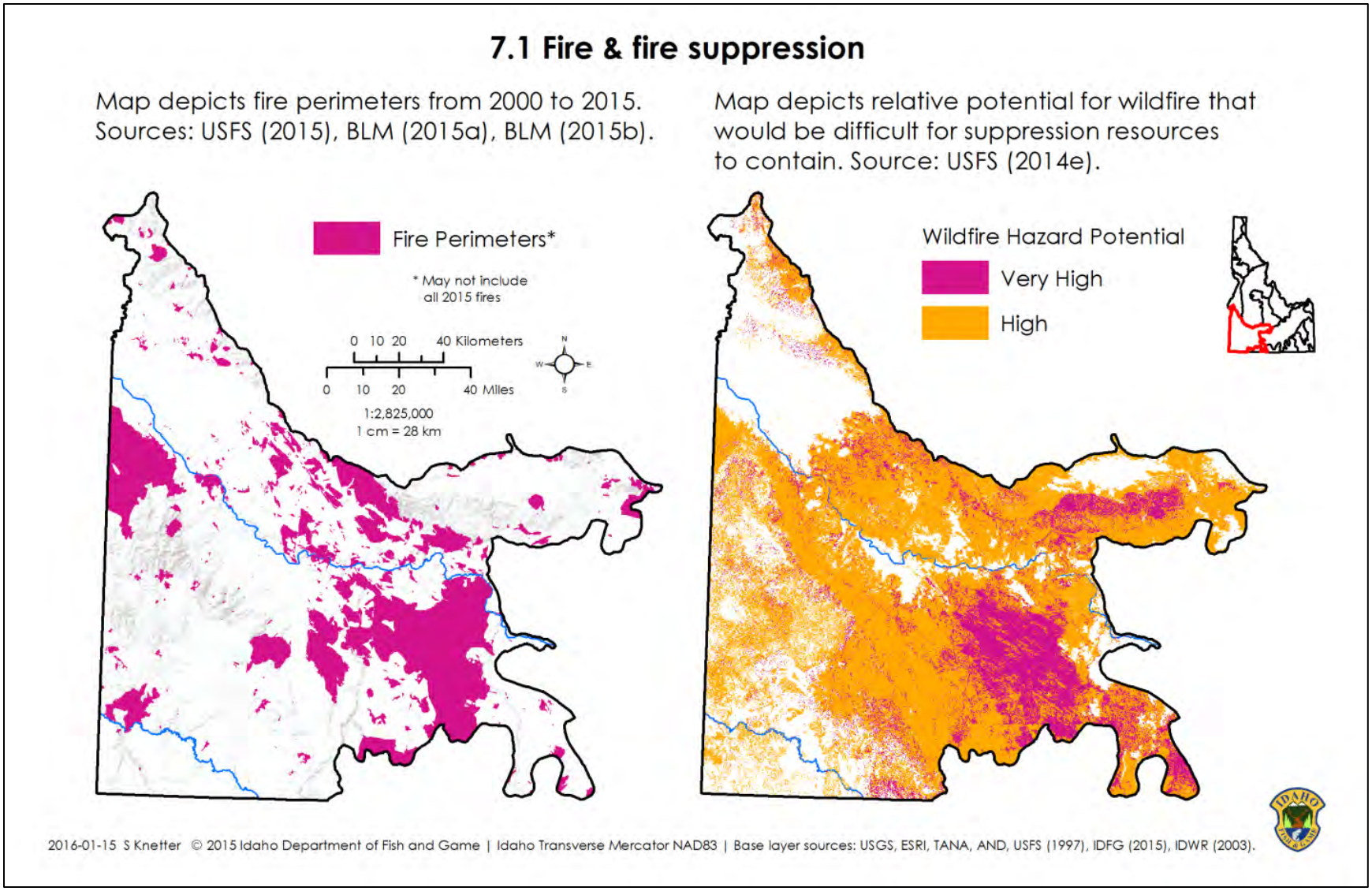


Fig. 12.4 Map of fire perimeters and relative potential for wildfire in the Owyhee Uplands

Noxious weeds & invasive annual grasses

Invasive species (see Fig. 12.5) are considered a primary threat to Sage-Grouse in Idaho in the Governor's Alternative (Otter 2012) and a primary threat to shrubsteppe habitats by the FWS (2014b). The State of Idaho has developed *The Idaho Invasive Species Strategic Plan 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012). In the Owyhee Uplands, noxious weeds (e.g., rush skeletonweed [*Chondrilla juncea* L.]) and invasive annual grasses have colonized many sagebrush habitat types and replaced native herbaceous vegetation, particularly at lower-elevation sites. The accelerated invasion of nonnative annual grasses is one of the primary drivers of larger, more intense rangeland fires across the Great Basin (DOI 2015).

Objective	Strategy	Action(s)	Target SGCNs
Limit introduction of new weeds into areas where they do not occur.	Improve weed management tools and techniques. Aggressively manage nonnative undesirable plant species.	Implement *The Idaho Invasive Species Strategic Plan 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012). Develop integrated weed management programs that include chemical, mechanical, biological, newly registered biocides, and subsequent restoration practices (DOI 2015). Develop large-scale application of integrated weed management programs that include chemical, mechanical, biological, newly registered biocides, and subsequent restoration practices (DOI 2015). Support the use of Plateau® herbicide in controlling cheatgrass. However, because Plateau® has been documented to also impact some native forb species (see DeGraff and Johns 2013, BSU study); this herbicide should be used with caution in areas outside of cheatgrass monocultures. Exercise caution with respect to herbicide and/or pesticide use to avoid negative impacts on SGCN and ESA-listed species. Promote certified weed-free seeds/forage (Idaho Sage-grouse Advisory Committee 2006). Target areas that contain cheatgrass and other invasive or noxious species to minimize competition and favor establishment of desired species (BLM 2015). Support the development of a framework for a national invasive species EDRR program (DOI 2015).	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Townsend's Big-eared Bat Western Small-footed Myotis Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel

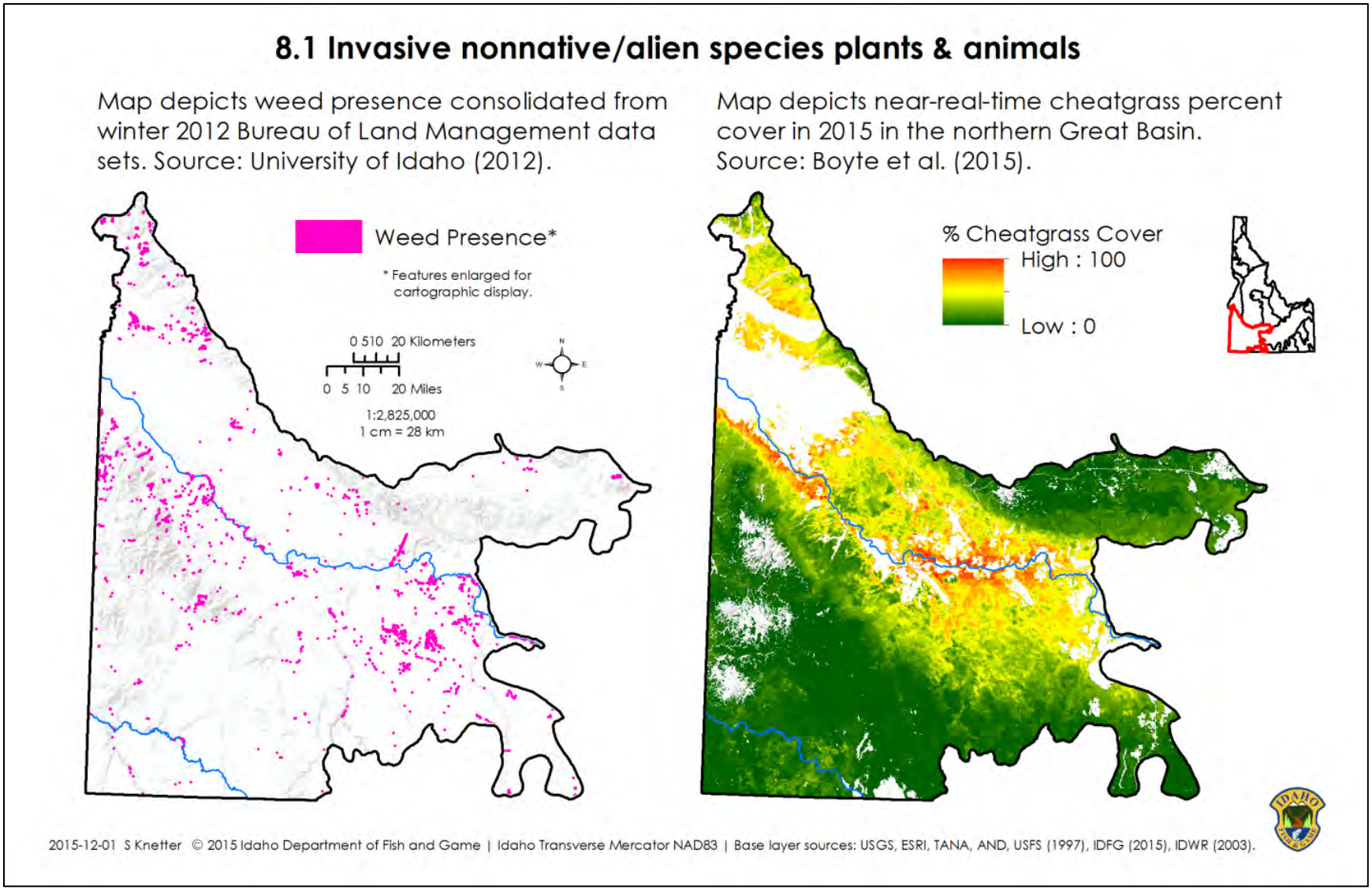


Fig. 12.5 Map of weed presence and cheatgrass percent cover in the Owyhee Uplands

High rated threats to Sagebrush Steppe in the Owyhee Uplands

Energy development & related infrastructure

Energy development and related infrastructure (e.g., oil and gas development, mines, geothermal wells, commercial wind projects) (Governor's Executive Order No. 2015-04; Otter 2015) are identified as a primary threat and contribute to the fragmentation and loss of shrubsteppe habitats ([FWS] US Fish and Wildlife Service 2014b; Otter 2012). Wind turbines can increase mortality rates for Golden Eagle (*Aquila chrysaetos*) (Tack and Fedy 2015), and Hoary (*Lasiurus cinereus*) and Silver-haired (*Lasionycteris noctivagans*) bats, and these tall structures have the potential to displace wildlife averse to the moving turbine blades (e.g., Sage-Grouse). In addition, the Owyhee Uplands has potential for geothermal and solar energy development.

Objective	Strategy	Action(s)	Target SGCNs
Minimize the effects of energy development and related infrastructure.	Manage energy infrastructure siting.	Work with key agencies and stakeholders to develop voluntary recommended criteria to consider when siting infrastructure to be compatible with wildlife. Infrastructure related to energy development must follow recommendations outlined in the Governor's Executive Order No. 2015-04 (Otter 2015) as it pertains to PHMA (Core), IHMA, and GHMA. Where IDL has regulatory and assistance activities on private land, conservation measures will be voluntary BMPs because IDL does not have the statutory authority within its regulatory programs or assistance activities to require adoption by authorized parties. Regulatory and assistance activities include Abandoned Mine Lands Projects, Dredge and Placer Mine Permits, Mine Reclamation Plan Approvals, and Oil and Gas Permits (seismic imaging surveys, well drilling). Where appropriate, IDL will include recommended BMPs within its authorizing documents to encourage compliance (see Idaho State Board of Land Commissioners 2015; Otter 2015). Develop Idaho Decision Support Tool to assist developers with appropriately siting projects. Develop information to identify priority wildlife habitat and migration routes. Support development of avian and bat protection plans and negotiate siting and operational mitigation to minimize effects on wildlife populations.	Greater Sage-Grouse Golden Eagle Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Silver-haired Bat Hoary Bat Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel

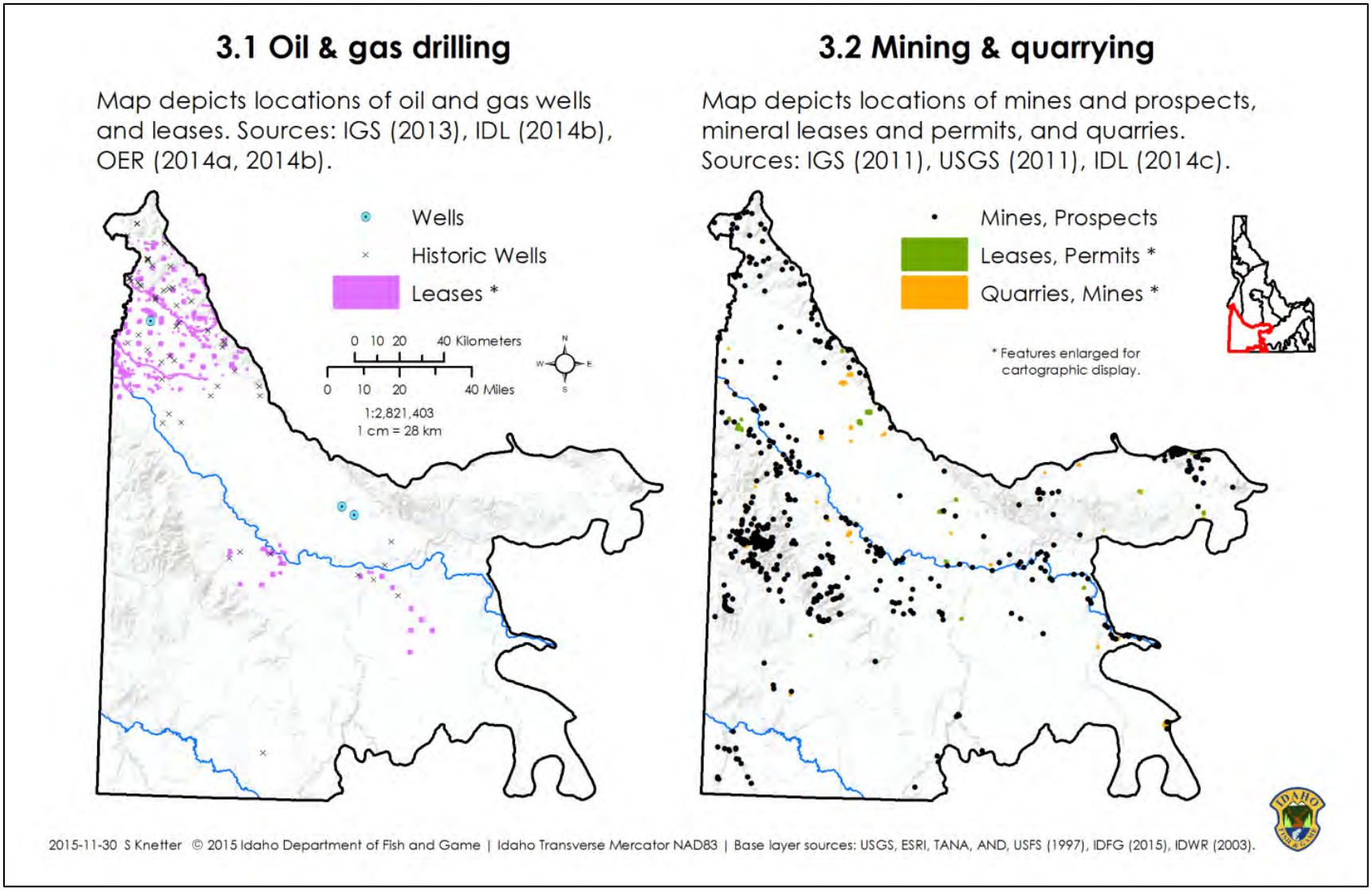


Fig. 12.6 Map of oil and gas wells and leases, and mines and prospects, mineral leases and permits, and quarries in the Owyhee Uplands

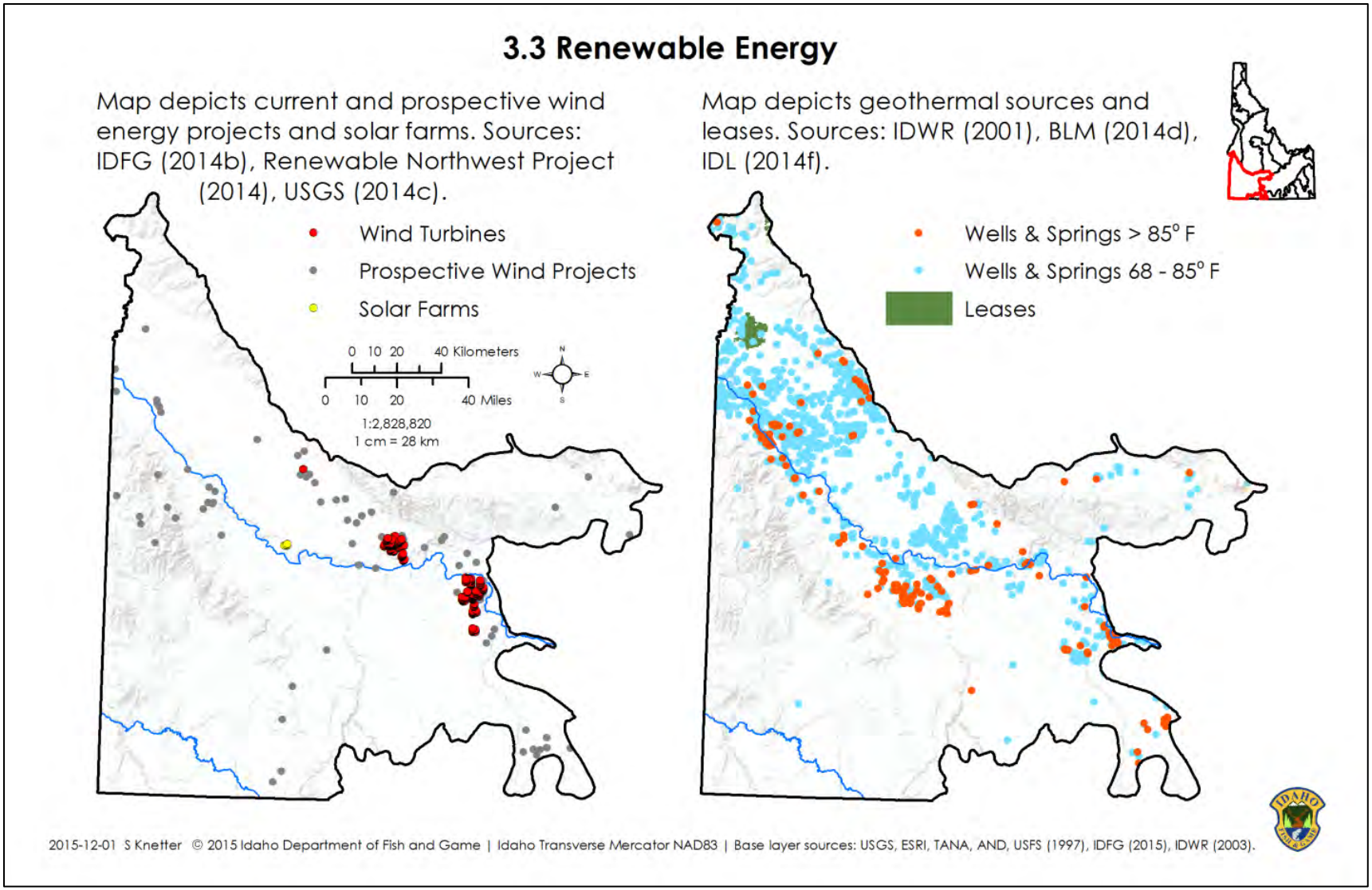


Fig. 12.7 Map of current and prospective wind energy projects and solar farms, and geothermal sources and leases in the Owyhee Uplands

Transportation & service corridors

Infrastructure such as roads, highways, high-voltage transmission lines, and cell phone towers (Governor's Executive Order No. 2015-04; Otter 2015) is identified as a primary threat (Otter 2012) and causes fragmentation and direct loss of shrubsteppe habitats FWS (2014b). Electrocution and collision with power lines is an important source of mortality for large birds, including the Golden Eagle. Idaho Power Company has a program for retrofitting poles and constructing new lines to minimize wildlife mortality and follows Avian Power Line Interaction Committee (APLIC) protocols for reducing electrocution risk.

Objective	Strategy	Action(s)	Target SGCNs
Reduce road & utility line construction in key habitats.	Coordinate development and location of new roads and transmission lines.	Develop recommended criteria to consider when siting and constructing new power lines and associated features in "designated" habitat (see [APLIC] Avian Power Line Interaction Committee 2015). Follow management actions outlined in the Governor's Executive Order No. 2015-04 (Otter 2015) as it pertains to PHMA (Core), IHMA, and GHMA when proposing to develop transportation and service corridors. Work with key agencies and stakeholders to route roads, transmission lines, and other linear infrastructure based on recommended criteria to avoid sensitive habitat areas. Develop Idaho Decision Support Tool to assist developers with appropriately siting projects.	Greater Sage-Grouse Golden Eagle Short-eared Owl Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel
Minimize bird electrocutions and collisions with transmission lines.	Modify existing power lines that pose collision or electrocution hazards.	Mark those sections of distribution lines where evidence is collected that Sage-Grouse or raptor mortality occurs due to collisions.	Greater Sage-Grouse Golden Eagle Short-eared Owl
Minimize the potential for bird collisions with fences.	Work with landowners and land management agencies to identify fences (including new fences) that may pose risk for collision mortality.	Work with local utilities, landowners, and land management agencies to identify and mark problem fences. Apply wildlife-friendly fencing standards when constructing or modifying fences (e.g., Paige 2012). Identify and remove unnecessary fences or other structures ([BLM] Bureau of Land Management (US) 2015; Otter 2012). When placing new fences or other structural range improvements (such as corrals, loading facilities, water tanks, and windmills), consider their impact on Sage-Grouse (Otter 2012).	Greater Sage-Grouse Ferruginous Hawk Golden Eagle Short-eared Owl
Reduce the number of tall structures in this habitat.	Site new structures in areas where key wildlife populations	Place new, taller structures (e.g., corrals, loading facilities, water storage tanks, windmills) at least 1 km from occupied leks (Otter 2012) and within existing disturbance corridors or in unsuitable habitat (BLM 2015).	Greater Sage-Grouse

Objective	Strategy	Action(s)	Target SGCNs
	would not be affected.		

Off highway vehicle (OHV) use on undesignated routes and in undesignated areas

Recreation in the form of OHV use is considered a secondary threat to Sage-Grouse in the Governor's Alternative (Otter 2012). Increasing OHV use in southwestern Idaho has been implicated in the decline of Golden Eagle occupancy, success, and productivity of territories in close proximity to recreational trails and parking areas (Steenhof et al. 2014; K. Steenhof and J. Heath, pers. comm. citing R. Spaul, unpubl. manuscript).

Objective	Strategy	Action(s)	Target SGCNs
Minimize unrestricted cross-country travel (Otter 2012) in sensitive habitat—Priority (Core) and Important habitat areas for Sage-Grouse.	Develop and enact travel management plans and regulations to manage impacts to wildlife populations.	Limit general recreational OHV travel to existing roads, primitive roads, and trails in areas where travel management planning has not been completed or is in progress. This action is not intended to prevent necessary administrative and/or permitted uses that include a variety of management activities such as infrastructure inspection and repair as well as use for ranch, range, and livestock management (e.g., moving livestock, repairing fences, checking water sources, distributing salt etc.). Locate areas and trails to minimize disturbance to Sage-Grouse and other species sensitive to OHV disturbance; use route upgrade, closure of existing routes, timing restrictions, seasonal closures, and creation of new routes to help protect habitat and reduce the potential for pioneering new unauthorized routes (BLM 2015). Conduct road upgrades and maintenance outside the Sage-Grouse breeding season to avoid disturbance on leks (BLM 2015). Implement seasonal trail closures, buffer zones around Golden Eagle nests, and suitable location of staging areas to minimize OHV effects (Steenhof et al. 2014). On federal and state lands, permits govern the use of these lands by private entities and therefore the above actions include an exemption for permitted activities.	Greater Sage-Grouse Ferruginous Hawk Golden Eagle Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel

Residential & commercial development

Urbanization causes the direct loss and fragmentation of shrubsteppe habitats FWS (2014b). Infrastructure that includes discrete, large-scale anthropogenic features such as airports, landfills, and residential and commercial subdivisions, etc. is a primary threat to Sage-Grouse (Otter 2012). Reduced profitability of ranching and agriculture combined with increased land values

can lead to the conversion of rural properties of agricultural value to exurban and suburban developments.

Objective	Strategy	Action(s)	Target SGCNs
Manage residential and commercial development to minimize negative consequences for wildlife populations.	Maintain land uses that do not generate the infrastructure, disturbance, and/or habitat conversion associated with exurban and urban development. Develop partnerships that help keep sustainable grazing the prevailing land use (Krausman et al. 2009).	Use subsidies, funding, and cost-sharing programs to support profitability of agricultural land uses beneficial to or compatible with wildlife and minimize development potential. Assist private landowners with programs like the Sage Grouse Initiative or other NRCS programs. Work with land trusts and other NGOs to develop conservation easements and acquisitions where appropriate and feasible. Work with county and local Planning and Zoning to support their decision-making process and avoid unnecessary losses of intact habitat. Avoid implementing competing objectives, strategies, and actions in a manner that may diminish economically sustainable animal agricultural use of private lands.	Greater Sage-Grouse Ferruginous Hawk Golden Eagle Burrowing Owl Short-eared Owl Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Columbia Plateau (syn. Merriam's) Ground Squirrel Wyoming Ground Squirrel Southern Idaho Ground Squirrel

Juniper encroachment

The expansion of native western juniper into sagebrush-steppe habitats has degraded this ecosystem, reducing habitat suitability for sagebrush obligates. Although the scope of western juniper encroachment into the sagebrush-steppe ecosystem in the Owyhee Uplands is isolated (primarily in the Owyhee Mountains), its existing impact and potential future impact on sagebrush-steppe habitats is significant. Factors contributing to juniper expansion are complex and include fire regimes, climate, soil moisture, and atmospheric carbon dioxide (e.g., Knapp et al. 2001). From a climate change perspective, southern Idaho is predicted to have less sagebrush and more woodland cover types (e.g., juniper) in the future.

Objective	Strategy	Action(s)	Target SGCNs
Reduce juniper encroachment into sagebrush steppe.	Remove phase 1 and phase 2 juniper stands to reduce juniper expansion into sagebrush steppe.	Prioritize treatments near occupied Sage-Grouse leks and other seasonal Sage-Grouse habitats. Use site-specific analysis to refine the location for specific areas to be treated. Juniper removal in wilderness areas should be a last resort management action. Loss of habitat due to juniper encroachment should be met with increases in the amount of priority or important habitat in other areas to maintain or increase overall habitat availability.	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit

Medium rated threats to Sagebrush Steppe in the Owyhee Uplands

Improper livestock grazing management & associated infrastructure

In the context of this plan, "improper" is defined as grazing beyond the capacity of the resource in either direction (e.g., overuse such as along riparian areas that need protection). Improper grazing management that results in persistent heavy grazing may lead to negative outcomes whereas proper grazing management does not. In the Governor's Alternative (Otter 2012), improper livestock grazing management is considered a secondary threat with monitoring and management actions tailored accordingly.

When improperly managed, livestock grazing can affect wildlife habitat in many ways (Krausman et al. 2009). For example, livestock grazing can change habitat features that directly influence birds by reducing plant species diversity and biomass (Reynolds and Trost 1981, Bock and Webb 1984, Saab et al. 1995). Alternatively, changes in water and nutrient cycling caused by grazing can promote the spread of invasive species, which then degrade native bird habitats by altering fire and disturbance regimes (Knick et al. 2003; Rotenberry 1998). Livestock grazing tends to be somewhat monocultural, and especially in recent years, the conversion from sheep to cattle has resulted in cattle being nearly the sole herbivore. Historically, the Owyhee Uplands were grazed by wild horses (*Equus caballus*), deer (*Odocoileus* spp.), Elk (*Cervus canadensis*), and Pronghorn (*Antilocapra americana*).

Livestock grazing infrastructure (e.g., fences, corrals, loading facilities, water tanks and windmills) can impact Sage-Grouse (Otter 2012) as well as other rangeland-associated wildlife. For example, an Idaho study documented a high risk of Sage-Grouse colliding with fences, particularly around leks (Stevens et al. 2012a, b). Other structures can provide artificial nesting sites for nest predators. Activities associated with livestock production, such as feedlots, can facilitate nest predators or parasitism by Brown-headed Cowbird (*Molothrus ater*) (Vander Haegen and Walker 1999, Goguen and Matthews 2000). Finally, water developments that were not fitted with escape ramps have been implicated in wildlife drownings.

Objective	Strategy	Action(s)	Target SGCNs
Identify and implement proper grazing management to maintain or enhance the ecological integrity of the landscape and/or otherwise initiate progress toward management objectives.	Manage the timing, intensity, duration, and frequency of grazing practices to manipulate vegetative condition (Otter 2012).	Prioritize permit renewals and land health assessments for allotments with declining Sage-Grouse populations (Otter 2012). Inform affected permittees and landowners regarding Sage-Grouse habitat needs and conservation measures (Idaho Sage-grouse Advisory Committee 2006). Increase the cooperative coordinated development of Allotment Management Plans to best meet wildlife objectives over the broadest landscape. Incorporate GRSG Seasonal Habitat Objectives (Table 2-2 in BLM 2015) into relevant resource management plans and projects while considering the potential conflicts with habitat parameters for other species.	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Bighorn Sheep Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel

Objective	Strategy	Action(s)	Target SGCNs
		Use the Sage-Grouse Habitat Assessment Framework (Stiver et al. 2015) with an appropriate sampling design to conduct fine-scale habitat assessments to inform grazing management. Undertake adaptive management changes related to existing grazing permits when improper grazing is determined to be the causal factor in not meeting habitat objectives (Otter 2012).	
	Maintain and promote the rangeland monitoring Memorandum of Understanding (MOU) between Idaho State Department of Agriculture (ISDA) and BLM, which provides a collaborative framework for photo monitoring and review of rangeland photo data on BLM-managed lands across Idaho.	Involve permittees in providing monitoring information, the interpretation of monitoring data, and providing input into grazing management adjustments to meet the goals and objectives of federal land management agencies and the permittees (Sanders 2006).	
Assess the impacts (both negative and, potentially, positive) of livestock grazing on sagebrush-steppe obligate songbirds (Rotenberry 1998).	Design experiments involving a variety of alternative grazing treatments (including no grazing at all) across the spectrum of major shrubsteppe habitat (Rotenberry 1998).	Implement grazing alternatives based on project outcome. Conduct experiments over multiple years (Rotenberry 1998). Work with the University of Idaho to consider adding a sagebrush-obligate passerine component to its long-term study of the impacts of spring grazing on Sage-Grouse.	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel
To the extent practicable, reduce the impacts of fences and livestock management facilities on	Implement grazing management programs that take into account wildlife habitats and needs (e.g., Otter	Mark fences to reduce wildlife collisions (Stevens et al. 2012a, b). Identify and remove unnecessary fences or other structures ([BLM] Bureau of Land Management (US) 2015; Otter 2012). When placing new fences or other structural	Greater Sage-Grouse Ferruginous Hawk Sage Thrasher Sagebrush Sparrow Pygmy Rabbit

Objective	Strategy	Action(s)	Target SGCNs
wildlife populations.	2012).	range improvements (such as corrals, loading facilities, water tanks, and windmills), consider their impact on Sage-Grouse (Otter 2012) and other wildlife. Place new structures (e.g., corrals, loading facilities, water storage tanks, windmills) in accordance with guidance documents (e.g., Otter 2012 for Sage-Grouse leks) and within existing disturbance corridors or in unsuitable habitat (BLM 2015). Develop water sources for livestock to allow access to water by wildlife, including bats and birds that drink while in flight. Discourage management activities (such as water development or fencing) that may focus interspecific competition in important seasonal Bighorn Sheep habitats (IDFG 2010)	Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis Bighorn Sheep Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel
Expand availability of water sources where needed.	Develop livestock water sources (e.g., troughs) so they are compatible with local wildlife populations.	Retrofit tanks with escape ladders. Design tanks to be wildlife friendly. Consider unintended consequences of water development, including range expansion of water-dependent predators or competitors into previously unsuitable areas.	Greater Sage-Grouse Ferruginous Hawk Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis Bighorn Sheep Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel

Changes in precipitation & broad-scale hydrologic regimes

Much of the Owyhee Uplands Section is transitioning from a snow-dominated system to one more rain-dominated (Klos et al. 2014), decreasing the length of the snow season by nearly a month (Nayak et al. 2010). Increasing temperatures and decreasing snowpack, especially at

warmer low to mid-elevations, equates to more drought stress to native plants and increasing conditions for drought-adapted invasive species to establish. Intensified drought also drives conditions that lead to larger, more intense rangeland fires across the entire Great Basin (DOI 2015). The amount and timing of precipitation also affects sagebrush growth and recruitment and may seriously hinder restoration efforts. Generally, the most reliable strategies for mitigating these climate change impacts in sagebrush steppe are those that promote ecosystem resiliency by preserving areas of high ecological integrity. Juniper reduction also has the hypothetical potential to mitigate the effects of drought.

Objective	Strategy	Action(s)	Target SGCNs
Increase landscape resilience.	Manage for diverse, healthy plant communities able to resist stresses including drought and drought-mediated impacts such as invasion by nonnative plants and wildfire.	Research options for managing this habitat under forecasted climate models. Work with other agencies, organizations and user groups across the Owyhee Uplands to address climate change impacts across landscapes, and refine land management planning options and alternatives down to local level implementable projects where possible. Engage in microclimate monitoring to better identify and understand local pockets of environmental opportunity to enhance habitat resistance to climate induced stressors. Engage in research to identify plants useful for habitat restoration or enhancement from current climate regimes that are forecast to be local future climate regimes. Support efforts to increase public and political awareness of climate change impacts to local landscapes and wildlife dependent on them. Research options for managing livestock grazing in this habitat under forecasted climate models (i.e., drought conditions). Work with agencies, organizations, and livestock operators to use this information to both be proactive and refine land management planning options and alternatives down to local level implementable projects.	Greater Sage-Grouse Sage Thrasher Sagebrush Sparrow Pygmy Rabbit Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Southern Idaho Ground Squirrel
	Manage vegetation to improve groundwater recharge and soil moisture.	Evaluate the effects of juniper removal and other vegetation treatments on soil moisture and groundwater levels.	

Species designation, planning & monitoring

In addition to conservation actions to address specific threats, some species require inventory and monitoring to assess their current status and distribution in Idaho. As such, we identify needs for 6 species in the section below and identify appropriate actions.

Greater Sage-Grouse

West Nile virus (WNV) is considered a secondary threat in the Governor's Alternative (Otter 2012), and was first detected in Sage-Grouse in Idaho in 2006. Sage-Grouse are highly susceptible to the virus with close to 100% mortality rate in infected birds (Clark et al. 2006). The disease can reduce population growth by 6% to 9% per year (Clark et al. 2006). WNV was detected in Sage-Grouse in Owyhee County in 2006. Trend counts based on lek surveys showed a 25% overall decline in Sage-Grouse between 2006 and 2007 in Owyhee County. Early detection of WNV in Sage-Grouse can help managers better assess risk and determine further actions (e.g., alert the public, restrict seasons, and increase monitoring). WNV also affects other avian species and has the potential to cause population declines in some raptors, waterbirds, and other birds.

Objective	Strategy	Action(s)	Target SGCNs
Reduce impacts of WNV on wildlife populations.	Continue to cooperate with regional and state-level WNV monitoring and surveillance efforts (Idaho; Idaho Sage-grouse Advisory Committee 2006). Develop information for and implement land management activities that reduce risk of transmission.	Increase public awareness and education of the impacts of WNV on Sage-Grouse and encourage them to report observations of dead Sage-Grouse. Consider closing Sage-Grouse hunting seasons in areas affected by WNV. Test all captured Sage-Grouse for presence of WNV antibodies. Monitor and assess mortality events in bird populations, including corvids and raptors, to detect WNV outbreaks. Assess mosquito ecology and status in areas where SGCNs are vulnerable to West Nile virus. See the Governor's Alternative (Otter 2012) and BLM (2015; App C, p. C-11 to C-12) for additional actions with respect to WNV and Sage-Grouse.	Greater Sage-Grouse American White Pelican Ferruginous Hawk Golden Eagle Ring-billed Gull Yellow-billed Cuckoo Common Nighthawk

Bighorn Sheep

Bighorn Sheep are vulnerable to respiratory disease caused by pathogenic organisms. Respiratory disease (pneumonia) causes increased adult and lamb mortality and has been characterized as "a significant factor in the historic decline of bighorn sheep" and a "key factor limiting recovery throughout Idaho" (IDFG 2010). Pathogenic organisms can be transmitted to uninfected Bighorn Sheep herds by healthy domestic sheep and goats, and no effective treatment has been developed to treat the disease once it is established in a herd.

Bighorn Sheep rams in the E. Fork Owyhee River, Idaho © 2012 Jake Powell

The Idaho Bighorn Sheep Management Plan states "the most important management direction to reduce the impact of disease on Bighorn Sheep populations is to minimize or eliminate contacts between Bighorn Sheep and domestic sheep and goats that could result in disease transmission" (IDFG 2010).

Objective	Strategy	Action(s)	Target SGCNs
Reduce effects of disease on Bighorn Sheep populations.	Advocate and work toward maintaining spatial and temporal separation between Bighorn Sheep and domestic sheep and goats.	Work with willing domestic sheep permittees, FS, and BLM to identify and implement BMPs (e.g., limit estrus ewes near wild sheep populations, develop effective grazing patterns, track and report missing livestock) to maintain separation between Bighorn Sheep and domestic sheep and goats. Work with FS, BLM, and other land management agencies to identify appropriate alternative management options. Capture or euthanize wild sheep and stray domestic sheep or goats if found in an area (removal zone) where contact is likely (IDFG 2010). Work with ranchers to seasonally coordinate grazing patterns (WAFWA 2007, IDFG and ISDA 2008).	Bighorn Sheep

Objective	Strategy	Action(s)	Target SGCNs
		Collaborate with others to develop vaccines and treatments for pathogens to prevent transmission of disease among domestic sheep and Bighorn Sheep (IDFG 2010)	
	Improve education and outreach efforts regarding risks associated with contact between Bighorn Sheep and domestic sheep and goats.	Collaborate with ISDA and Idaho Wool Growers Association to develop education and outreach strategies.	Bighorn Sheep
	Monitor PMUs for pathogen incidence and disease outbreaks.	Obtain biological samples to determine exposure to pathogens and develop individual herd health histories (IDFG 2010).	Bighorn Sheep

Dark Kangaroo Mouse

The Idaho population of the Dark Kangaroo Mouse (*Microdipodops megacephalus*) is restricted to an area in the extreme southwest corner of Idaho that comprises <64 km^2 (25 mi^2) in the Little Owyhee River drainage. Currently this population is taxonomically identified as a subspecies, *M. megacephalus atrirelictus*. Preliminary analysis of molecular data has suggested that the Idaho population and a population in north-central Nevada represent a distinct species (Hafner et al 2008, Hafner and Upham 2011, Hafner 2013, unpublished data).

Dark Kangaroo Mouse individuals are infrequently captured with standard live-trapping techniques, so additional work may be needed to develop approaches for monitoring the status of this population. No monitoring programs exist to evaluate population status relative to habitat conditions and management needs, including responses to any habitat management or restoration.

Columbia Plateau (syn. Merriam's) Ground Squirrel

Columbia Plateau (syn. Merriam's) Ground Squirrel (*Urocitellus canus*) occurs south of the Snake River and west of Reynolds Creek. Range disjunction between *U. canus* and Great Basin (syn. Piute) Ground Squirrel (*U. mollis*) is not well demonstrated; contact zones could result in hybrids, but this topic has not been investigated. Current distribution and status is uncertain, complicated by the difficulty in differentiating *U. canus* and *U. mollis*; as of January 2014, extirpation from Idaho remains a possibility, but extant colonies have been reported in the Owyhee foothills in the Reynolds Creek vicinity. Efforts are needed to determine the identity of ground squirrel populations in northwest Owyhee County, to characterize distribution, contact zones between Columbia Plateau (syn. Merriam's) Ground Squirrel and Great Basin (syn. Piute) ground squirrel populations, and reevaluate the taxonomic positions of the nominal taxa.

Wyoming Ground Squirrel

The distribution of Wyoming Ground Squirrel (*Urocitellus elegans nevadensis*) is poorly-documented in southwest Idaho. These populations are widely disjunct from the range of *U. e*.

aureus in the mountains of central Idaho. Southwest populations are members of the subspecies *nevadensis*, which is otherwise restricted to northern Nevada. This species occupies sagebrush steppe at the disturbed end of the spectrum.

Southern Idaho Ground Squirrel

Populations of this locally endemic ground squirrel have undergone enigmatic fluctuations. These fluctuations may be related to habitat conditions, but populations may also be affected by disease outbreaks. Plague invaded Idaho during eastward expansion of the pathogenic bacteria, *Yersinia pestis*, since its introduction in California during the 1800s, reaching Idaho around 1940. Ground squirrels are among species most susceptible to mortality from plague, and extreme population declines could follow epizootic outbreaks. Also, survival rates may be depressed by enzootic occurrence of disease, which has the potential to mediate competitive interactions with other small mammals less susceptible to plague. New efforts elsewhere are underway to develop oral vaccines against plague for at-risk mammal populations. At this time, additional information is needed to evaluate the effects of plague on Idaho small mammal populations.

Objective	Strategy	Action(s)	Target SGCNs
Monitor population viability relative to habitat conditions and management needs.	Establish methods for assessing and monitoring status.	Evaluate sampling methods and develop monitoring protocols. Conduct periodic assessments of species status relative to habitat conditions and management opportunities. Work with Oregon Department of Fish and Wildlife and the Nevada Department of Wildlife to coordinate management of cross-border populations.	Dark Kangaroo Mouse Columbia Plateau (syn. Merriam's) Ground Squirrel Wyoming Ground Squirrel Southern Idaho Ground Squirrel
Determine status and taxonomic validity of Columbia Plateau (syn. Merriam's) Ground Squirrel populations.	Reevaluate subspecific relationships and species designations within the Columbia Plateau (syn. Merriam's) ground squirrel group.	Develop and implement surveys and sampling, and develop analytical products to determine population status, biogeographic patterns, and conservation priorities.	Columbia Plateau (syn. Merriam's) Ground Squirrel
Increase our current understanding of the status of Wyoming Ground Squirrel.	Determine the status of Wyoming Ground Squirrel.	Develop and implement surveys intended to characterize distribution and status of this ground squirrel taxon.	Wyoming Ground Squirrel
Manage the effects of disease, including plague, on vulnerable small mammal populations.	Monitor outbreaks of plague and other diseases. Investigate the effects of small mammal	Investigate small mammal mortality events to determine causative factors and contribute to interagency coordination of any relevant public health programs. Characterize small mammal populations and associated disease vectors.	Southern Idaho Ground Squirrel

Objective	Strategy	Action(s)	Target SGCNs
	diseases and disease vectors on small mammal population status.	Evaluate the effects of plague and/or other small mammal diseases on population dynamics.	
Evaluate the effects of energy development, primarily natural gas, on the Southern Idaho Ground Squirrel.			Southern Idaho Ground Squirrel

Target: Riverine–Riparian Forest & Shrubland

Riverine and riparian habitats are located in the Owyhee Uplands with a portion of the Snake River and several of its major tributary river systems, including portions of Salmon Falls Creek, Bruneau, Owyhee, Boise, and Payette drainages. In the southern portion of the region, high tributaries of the Owyhee, Bruneau, and Middle Snake drainages originate in the Owyhee Mountains where many smaller streams are intermittent or have seasonal subsurface flows. Base flows of perennial streams are supported by springs much of the year. The Boise and Payette rivers originate in the Idaho Batholith.

Snake River near Walters Ferry, Idaho © 2010 Chris Murphy

The aridity of this region requires water management programs, including water storage, delivery, and regulation frameworks to support agriculture. Major hydroelectric and water storage reservoirs include CJ Strike and Swan Falls reservoirs on the Snake River, and the lower reaches of the Boise and Payette rivers are controlled by upstream dams and are confined by flood control levees.

Ample and diverse riparian vegetation provides many benefits, including stabilizing banks and diffusing the energy of moving water, particularly during floods. This reduces erosion and sediment loading and reduces streambed downcutting. Riparian wetlands can serve as a water retention and storage opportunity, reducing the rate of downstream water movement. Riparian vegetation also reduces stream temperature (Zoellick 2004). In the overall arid Owyhee Uplands section, riparian vegetation is invaluable for fish (e.g., see Dewalter et al. 2015) and wildlife habitat, being particularly important for herbivores owing to high vegetation productivity as well as dense cover. In addition, high insect populations are associated with these areas of greater primary productivity, and wetland and riparian habitat is essential for many insectivorous animals, notably bats and Neotropical migratory birds.

Target Viability

Fair. Rivers and riparian habitat are predominantly affected by anthropogenic disturbance, degraded water quality, changes in hydrology, and other physical disturbances to soils and vegetation (e.g., improper livestock grazing, development). Large river ecosystems, such as the lower Boise, Payette, and Snake rivers, have been severely altered by dams, diversions, agriculture, flood control, transportation, and urbanization. Using the model of landscape integrity, which incorporates mapped land uses and stressors to estimate condition, about half

of riverine and riparian habitat is in "Very Good" condition (Murphy et al. 2012). This model greatly overestimates on-the-ground condition because it does not include localized nonnative species invasion, recreation impacts, flood control development, or livestock grazing impacts. Field rapid assessments of 19 riparian wetlands in the Owyhee Uplands found these wetlands (averaged across samples) were in the "Good" condition class (Murphy and Schmidt 2010, Murphy and Weekley 2012). Primary stressor groups were hydrologic modifications, invasive nonnative plant species, and disturbance to soils. The landscape context of riparian wetlands is highly variable, although numerous stressors are observed in buffers surrounding wetlands assessed in agricultural and urban landscapes.

Spotlight Species of Greatest Conservation Need: Northern Leopard Frog

Northern Leopard Frog (*Lithobates pipiens*) has potentially been extirpated from the lower Payette, lower Boise, and much of the mid-Snake river drainage. Surveys during 1994 and 1995 in Twin Falls County failed to detect populations at historical locations (McDonald 1996). Another survey revealed previously undetected populations in southern Idaho (Makela 1998), but since 2005, only a handful of incidental observations have been made in south-central Idaho. Causes of population decline and extirpation have not been determined, but possible causes could include disease (e.g., amphibian chytridiomycosis, a disease caused by a fungal pathogen, *Batrachochytrium dendrobatidis* [*Bd*]) or competition and predation by introduced American Bullfrog (*Lithobates catesbeianus*). Leopard Frogs were last documented on the Payette and Boise Rivers during the 1970s, and the last specimen or literature records on the Snake River below Grandview were also documented during that decade. However, incidental sightings in the Grandview and Bruneau vicinities along the Snake River were reported during 2004–2006, suggesting that remnant populations could persist in the mid-Snake drainage (IDFG data).

Spotlight Species of Greatest Conservation Need: Columbia Spotted Frog (Great Basin DPS)

Populations of Columbia Spotted Frog (*Rana luteiventris*) south of the Snake River in Owyhee and Twin Falls counties are disjunct, isolated from neighboring populations by extensive areas of unoccupied and unsuitable habitat. The FWS included this portion of the species' range in the Great Basin Distinct Population Segment (DPS), which was designated a Candidate for ESA listing during 1993 (FWS 1993). After being on the Candidate list for 22 years, the FWS announced on October 8, 2015, a 12-month finding of "not warranted" for the Columbia Spotted Frog Great Basin DPS, and removed it from the Candidate list (FWS 2015*b*). A draft management plan (IDFG 2010) lists priority management needs and actions. This plan was developed in conjunction with FWS and with input from a multiagency technical working group. Populations in southern Idaho typically occur in riparian wetlands, beaver ponds, spring-fed pools and wet meadows, and artificial livestock watering ponds and reservoirs. Riparian woody vegetation is predominantly willow (*Salix* L.). Adjacent upland habitat is often dominated by sagebrush, juniper, mountain mahogany, and aspen.

Prioritized Threats and Strategies for Riverine–Riparian Forest & Shrubland

High rated threats to Riverine–Riparian Forest & Shrubland in the Owyhee Uplands

Improper livestock grazing management

In the context of this plan, "improper" is defined as grazing beyond the capacity of the resource in either direction (e.g., overuse such as along riparian areas that need protection or underuse where lack of grazing contributes to increased fuel loads; i.e., need for seasonal adjustments).

Livestock seek out wetlands for forage and for shade. When livestock grazing is uncontrolled, livestock use within the riparian/wetland areas may become excessive. Too much vegetation may be removed or trampled, causing the loss of riparian width and vegetation cover, reduced plant and wildlife diversity, and opportunities for noxious weed and undesirable plant invasion. Loss of riparian vegetation can destabilize banks, increase runoff rates, and increase flow shear stress (function of the fluid forces per unit area) during high-flow events. This can result in increased erosion, sediment loading, and increased rate of streambed downcutting and associated lowered water tables. Incised and channelized streams can lead to disconnected and drained floodplains, which may prevent regeneration of riparian vegetation even after proper management is restored. Livestock trampling may cause undercut banks to collapse, causing sediment loading and creating shallow, wide watercourses. As a result, water temperatures increase, sometimes dramatically, especially when coupled with the loss of shading from riparian vegetation.

Objective	Strategy	Action(s)	Target SGCNs
Manage livestock grazing to maintain or restore riparian condition and habitat quality.	Implement BMPs for riparian grazing systems and grazing infrastructure improvements.	Support and promote the use of Farm Bill programs by private landowners. Increase riparian width and subsequent proper function and condition through the use of wildlife-friendly exclusion fencing and riparian pasture management for grazed riparian systems. Develop off-site watering sources or water gaps for livestock in conjunction with wildlife-friendly exclusion fencing. Incorporate GRSG Seasonal Habitat Objectives (Table 2-2 in BLM 2015) into relevant resource management plans and projects. Conduct fine-scale habitat assessments to inform grazing management. Undertake adaptive management changes related to existing grazing	Western Toad Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis

Objective	Strategy	Action(s)	Target SGCNs
		permits where improper grazing is determined to be the causal factor in declining habitat condition.	
	Reduce erosion sediment and nutrient loads associated with livestock grazing.	Expand riparian widths through the use of wildlife-friendly exclusion fencing and active restoration activities to stabilize streambanks and diffuse stream energy during high-water events. Develop off-site watering sources and/or manage stream access for livestock in conjunction with exclusion fencing. Develop and support programs to encourage or provide incentives for agricultural setbacks from rivers, streams, runoff channels, and riparian habitat. Streamline and improve permitting process for projects intended to restore aquatic habitats. Work with Soil and Water Conservation Districts to get a draft Stream Restoration Permit (in process through Idaho Department of Water Resources) approved and in use.	Western Toad Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis
	Incorporate measures to maintain natural flow levels and periodicity, channel resilience, and riparian habitat in land-use plans.	Use sound, science-based management decisions for federal lands and base these decisions upon flexible policies that take into account local ecological conditions and state planning decisions. Seek improved range and riparian management through federal land-use planning activities (e.g., IDFG Fisheries Management Plan 2013–2018).	Western Toad Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis
Restore river and riparian habitat to functioning condition.	Manage American Beaver (*Castor canadensis*) populations to maximize dam densities in compatible landscapes.	Evaluate opportunity and need for beaver population restoration. Identify watersheds where beaver dam densities should and could be increased. Restore riparian habitat where conditions limit beaver populations in key watersheds. Engage trappers and sportsman organizations in management	Western Toad Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-

Objective	Strategy	Action(s)	Target SGCNs
		programs to maximize beaver populations for long-term fur harvest opportunities. Where appropriate, conduct translocation projects. Manage beavers to minimize property damage and conflicts.	footed Myotis Little Brown Myotis
	Use river and riparian restoration to mitigate the effects of climate change, water pollution, stream channel erosion, loss of surface water, and other conditions that are difficult to remedy; actively restore habitat conditions of value for fish and wildlife.	Develop projects to restore, diversify, and expand riparian vegetation where it has failed to naturally regenerate. Develop and implement restoration projects to restore degraded channels, reestablish stream flow and hydrologic process, and reduce erosion and runoff. Construct wetlands intended to provide or enhance fish and wildlife habitat and manage water quality and retention.	Western Toad Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis

Travel management & infrastructure

Roads are often located in drainage bottoms, adjacent to and sometimes through riparian habitat. River and stream crossings may be undeveloped such that vehicles traverse the streambed, or culverts or bridges used to span the channel. Poorly situated roads can affect stream sedimentation, damage floodplains, constrain river dynamics, or fragment riparian habitat. Culverts that are improperly placed or are affected by erosion can become barriers to fish movement or instigate rapid erosion, including formation of headcuts. Bridges can provide roosting structures for bats and birds and may also be used to facilitate safe wildlife crossings.

Objective	Strategy	Action(s)	Target SGCNs
Minimize damage to fish and wildlife habitat from roads and associated infrastructure.	Manage travel to reduce loss of sensitive river, stream, and riparian habitat. Identify and correct existing culverts that present a barrier to fish and wildlife movements or cause habitat degradation from flow impediments or erosion. Mitigate damage through post-construction restoration and providing structures that are beneficial to wildlife.	Install and maintain culverts to correct barriers arising from their placement or installation technique. Realign or close roads having serious impacts to streams, rivers, or key riparian habitat. Design new crossing structures that facilitate desirable fish and wildlife movements. Add wildlife-centered design elements, such as bat roost structures, to bridge construction projects.	Western Toad Columbia Spotted Frog Townsend's Big-eared Bat Western Small-footed Myotis Little Brown Myotis Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail

Dams & water diversions

Flooding and the associated scouring and sediment changes are critical for river systems. Active floodplains contain riverside wetlands and redistributed fine and coarse materials. Regeneration of native black cottonwood (*Populus balsamifera* L. subsp. *trichocarpa* [Torr. & A. Gray ex Hook.] Brayshaw) stands is reduced when disturbance regimes associated with natural hydrographs and hydroperiods are disrupted and conditions required for seed dispersal and germination are not created. High flows also establish new channels, create oxbows and keep low-gradient rivers moving within their floodplain. Dams and water diversions change the hydrograph of a river. Periods of flooding may be shortened or stopped completely. Discharges from dams can come at unusual times and can be restricted during critical periods for wildlife. Rivers are no longer allowed to move within their floodplains. Dams constructed without accommodations for fish migrations and movement create barriers that have implications for population viability and access to important habitat. Diversions for irrigation or other uses reduce river and stream flows, sometimes completely dewatering streams necessary for aquatic and riparian species.

Objective	Strategy	Action(s)	Target SGCNs
Flow regime in dammed rivers mimics natural flow regime, including seasonal and long-term flow variations.	Work with agency partners and stakeholders to manage flows to benefit fish and wildlife.	Consider needs and benefits of fish and wildlife populations in decision-making process regarding new dams and existing dam management. Seek opportunities to create flows that mimic maximum feasible flow events to support or mimic natural flow conditions.	Yellow-billed Cuckoo Silver-haired Bat Hoary Bat California Floater Western Ridged Mussel Snake River Physa Bliss Rapids Snail
Riparian systems remain functional in dammed river systems.	Work with landowners to protect riparian tracts, particularly mixed-age cottonwood forest. Manage suburban and urban development in riparian zones and floodplains, which often happens when flood risks are reduced below dams.	Strategically implement voluntary land swaps, acquisitions, or easements to minimize development. When possible, work with landowners to restore riparian habitat, such as cottonwood forests. Work with county planning and zoning to discourage subdivision development within floodplains and particularly within cottonwood forests.	Yellow-billed Cuckoo Silver-haired Bat Hoary Bat

Nonnative species

Invasive plants and invertebrates can alter habitat structure and ecological function. Predation by nonnative and invasive animals can lead to lower densities of native species and, in some situations, cause local or regional extirpations of native species. Interspecific competition between native and nonnative species can also arise when nonnative and native species

overlap in terms of habitat or food requirements. Some nonnative aquatic species have been intentionally introduced for sportfish recreation, but in other situations introductions have been unintentional or accidental (e.g., "aquatic hitchhikers," escapes from rearing facilities, etc.) or from illegal releases. In addition to important implications for Idaho's wildlife, nonnative species may have direct economic impacts. An example is the cost of Zebra Mussel (*Dreissena polymorpha*) invasion in eastern North America. The State of Idaho has developed *The Idaho Invasive Species Strategic Plan 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012).

Objective	Strategy	Action(s)	Target SGCNs
No new populations of unwanted nonnative species are established.	Do not allow importation of species that are identified as Invasive Species by the ISDA.	Implement *The Idaho Invasive Species Strategic Plan 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012). Support ISDA's regulation of invasive species and maintenance of the Idaho Invasive Species List. Develop and implement surveillance programs to support EDRR to new invasions.	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail
Unwanted populations of nonnative aquatic species are eliminated.	Identify and document nonnative aquatic animal occurrence.	Maintain information databases to document and track nonnative species occurrence and status. Support programs intended to detect new occurrences of unwanted species before they are well-established.	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail
	Develop and apply techniques to remove populations of unwanted nonnative species.	Develop, maintain, and implement protocols for responding to new occurrences of unwanted species. Use and integrate control techniques to achieve objectives of reducing unwanted populations to nonfunctioning levels.	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail
Economically important populations of nonnative aquatic animals are managed to minimize negative consequences for maintaining native fish and wildlife populations.	Manage populations that may affect high-priority animal populations.	Install barriers to expansion of unwanted aquatic animal populations. Apply harvest management programs to reduce or remove sport fish from areas where they are having unwanted effects. Use chemical, mechanical, and other treatments to reduce or remove unwanted populations.	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail

Nutrient enrichment & chemical pollution

Historical and current management practices have reduced riparian widths that formerly captured and retained nutrient runoff from both agriculture (fertilizers and pesticides) and livestock (animal waste) operations. Introduction of excess nutrients and undesired chemicals into surface water can be from either a point source (i.e., from a single source and discharge location) or a nonpoint source (i.e., from diffuse, multiple sources). Excess fertilizers, organic wastes, and pesticides can leach into water systems. The Snake River acts as the nutrient drain for most of southern Idaho, and reservoirs are impacted by fish disease episodes and die-offs as both water temperatures and nutrient levels increase.

An emerging threat is neonicotinoid insecticides. Developed in the 1990s, neonicotinoids have become the most widely-used insecticides on earth. They are used on crops, pet collars, home and garden products, and as seed coatings to name a few. They are often used pre-emptively, as in the case of seed coatings, instead of only when pests are actually present. Although they are much less acutely toxic to farm workers, they are highly toxic to wildlife. A single corn seed coated with neonicotinoids can kill 80,000 bees and up to 10 birds (Mineau and Palmer 2013). Sublethal doses also can have significant, chronic reproductive impacts (Mineau and Palmer 2013). Neonicotinoids have also been detected in streams in Idaho (Hladik and Kolpin 2015). This genre of insecticides is suspected to play a part in the significant decline of insectivorous birds, such as Common Nighthawk, but research is needed.

Objective	Strategy	Action(s)	Target SGCNs
Agricultural nutrient waste is managed to prevent impacts to water systems.	Provide incentives for private landowners to reduce runoff.	Support and promote the use of Farm Bill programs by private landowners that improve the ability to minimize and retain nutrients. Develop and support programs to encourage or provide incentives for agricultural setbacks from rivers, streams, runoff channels, and riparian habitat. Encourage and support the use of BMPs.	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail
	Minimize runoff by increasing riparian habitat width and developing proper function and condition.	In grazed riparian systems, manage livestock to develop desired riparian structural and functional components. Develop and support programs to encourage or provide incentives for agricultural setbacks from rivers, streams, runoff channels, and riparian habitat. Develop off-site watering sources for livestock in	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail

Objective	Strategy	Action(s)	Target SGCNs
		conjunction with exclusion fencing. Where applicable, use wildlife-friendly exclusion fencing and riparian pasture management for grazed riparian systems. Implement active restoration of riparian habitats where opportunities and need exist.	
Nonpoint source pollution is managed to levels that have no effect on fish and wildlife.	Develop wetlands to remove pollutants; manage and mitigate nonpoint source pollution.	Construct new wetlands in strategic areas to manage nonpoint source pollution. Manage and restore existing wetlands to manage nonpoint source pollution.	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail
Determine cause(s) of decline for nightjar species in Idaho.	Work with Western Working Group Partners in Flight (WWG PIF) and the Pacific Flyway Nongame Technical Committee (PFNTC) to assess causes(s) of decline.	Assist WWG PIF with adjusting current Nightjar Survey Network protocols to collect data that will inform potential cause(s) of decline. Work with WWG PIF and PFNTC to identify opportunities for research on contaminant impacts.	Common Nighthawk
Reduce potential impacts of neonicotinoids on insectivorous birds and native insects.	Reduce use of neonicotinoids on the landscape. Encourage adherence to the principles of Integrated Pest Management and encourage use of environmentally-benign pesticides at small scales.	Ban the use of neonicotinoids as seed coatings. Cooperate with IDL to reduce or eliminate any use of neonicotinoids on state endowment Trust Lands, and IDFG on Wildlife Management Areas. Work with NRCS to prohibit use of neonicotinoids on conservation easement/Farm Bill properties. Suspend the use of neonicotinoids to allow scientific review of impacts. Work with American Bird Conservancy to develop agricultural industry-targeted outreach materials to inform of impacts to both wildlife and crop health.	Yellow-billed Cuckoo Common Nighthawk A Mayfly (*Paraleptophlebia jenseni*) Duckhead Snowfly Boise Snowfly
Determine level of	Conduct research on	Provide relevant bird and bat	Yellow-billed Cuckoo

Objective	Strategy	Action(s)	Target SGCNs
impacts of neonicotinoids on insectivorous birds and native insects.	impact levels at watershed scale. Update EPA thresholds for incident reporting, which are currently set too low.	data to American Bird Conservancy for ongoing research project. Develop neonicotinoid-free communities and watersheds to provide means for comparing with communities and watersheds that are exposed to neonicotinoids. Work with American Bird Conservancy and other NGOs on project design and implementation. Provide support for American Bird Conservancy's efforts to update EPA thresholds.	Common Nighthawk A Mayfly (*Paraleptophlebia jenseni*) Duckhead Snowfly Boise Snowfly

Changes in temperature, precipitation & broad-scale hydrologic regimes

Changes in precipitation type (rain compared to snow), seasonal timing, and amount are expected. Snowpack levels are decreasing and more moisture is falling as rain during winter months, changing hydrologic regimes. Less snowpack equates to more drought stress to native plants, and increases conditions favorable for drought adapted invasive species to establish. Less precipitation also results in lower in-stream water levels, higher water temperatures, and conversion of cold water systems to warm water systems during summer and irrigation months. Climate change decreases water flow, sometimes changing flow regimes from perennial to intermittent. Rapid runoff from heavy rain, sudden melting of the snowpack, or rain-on-snow events have the potential to destroy riparian vegetation or create rapid erosion and stream channel alterations.

Objective	Strategy	Action(s)	Target SGCNs
River and riparian habitat is resilient to the effects of climate change.	Manage for intact and functional riparian zones and river systems.	Apply management programs and incentives to support development and maintenance of ecologically functioning riparian zones.	Western Toad Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis Western Ridged Mussel Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail
River and riparian habitat that is not currently functioning	Manage American Beaver populations to maximize dam densities in	Evaluate opportunity and need for beaver population restoration. Identify watersheds where	Western Toad Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk

Objective	Strategy	Action(s)	Target SGCNs
despite current land management is restored to functioning condition.	compatible landscapes.	beaver dam densities should and could be increased. Restore riparian habitat where conditions limit beaver populations in key watersheds. Engage trappers and sportsman organizations in management programs to maximize beaver populations for long-term fur harvest opportunities. Where appropriate, conduct translocation projects. Manage beavers to minimize property damage and conflicts.	Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis
	Use river and riparian restoration to mitigate the effects of climate change, water pollution, stream channel erosion, loss of surface water, and other conditions that are difficult to remedy; actively restore habitat conditions of value for fish and wildlife.	Develop projects to restore, diversify, and expand riparian vegetation where it has failed to naturally regenerate. Develop and implement restoration projects to restore degraded channels, reestablish stream flow and hydrologic process, and reduce erosion and runoff. Construct wetlands intended to provide or enhance fish and wildlife habitat and manage water quality and retention.	Western Toad Columbia Spotted Frog Sandhill Crane Yellow-billed Cuckoo Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis

Medium rated threats to Riverine–Riparian Forest & Shrubland in the Owyhee Uplands

Groundwater withdrawal

Water is a limiting resource and urban and suburban uses, fish and wildlife habitat, industrial uses, agriculture, and other interests compete for it. Economics and availability drive decisions about the source of water for these competing interests. For example, agricultural irrigation practices have been transitioning from flood irrigation to direct on-site groundwater pumping. This shift is related to system efficiency, labor costs, and water costs. In some circumstances, overuse of water withdrawn from groundwater aquifers has led to a lowering of the water table, causing reduction of stream and river levels. In addition, wells that remove water from subsurface storage in floodplains and other wetlands lower the water table and cause normally standing water to more rapidly percolate through underlying substrates. Aside from affecting availability of surface water and aquatic habitat, lowered subsurface water tables can reduce floodplain and riparian habitat.

Objective	Strategy	Action(s)	Target SGCNs
Manage groundwater withdrawal to sustain surface water flows and riparian habitat.	Work with land and water managers to identify opportunities for balancing competing demands for groundwater.	Evaluate programs intended to recharge aquifers and implement those not compromising fish and wildlife habitat. Create market incentives for reducing demand. Apply Farm Bill and other programs intended to provide incentives for applying BMPs. Create incentives to match crop types to water systems and availability.	Yellow-billed Cuckoo Western Ridged Mussel Banbury Springs Limpet Snake River Physa Bruneau Hot Springsnail Bliss Rapids Snail

Species designation, planning & monitoring

Amphibian pathogens

Diseases have been implicated in the decline and extinction of amphibian populations worldwide. Amphibian chytridiomycosis, a disease caused by a fungal pathogen, *Batrachochytrium dendrobatidis* (*Bd*), has been of particular importance, although other pathogens, such as ranavirus, are also relevant. Although *Bd* was detected in an Owyhee Mountain population of Columbia Spotted Frog during the early 2000s, *Bd* is no longer considered a threat to the persistence of spotted frog populations (FWS 2015c). However, *Bd* has been documented to affect Western Toad (*Anaxyrus boreas*) populations. Actions are needed to examine occurrence of these nonnative aquatic species to provide empirical support for management decision-making.

Objective	Strategy	Action(s)	Target SGCNs
Minimize the introduction and spread of pathogens.	Implement protocols to minimize the introduction and spread of pathogens.	Follow recommended decontamination protocols during surveys and monitoring. Survey for *Bd* and other pathogens in amphibian populations. Document and investigate mortality events that may be related to pathogen outbreaks.	Western Toad Woodhouse's Toad Northern Leopard Frog

Ring-billed and California Gull

Until as recently as 2009, the Owyhee Uplands contained 1 nesting island along the Snake River used by Ring-billed Gull (*Larus delawarensis*) and California Gull (*Larus californicus*). This nesting island has since become inactive, and a new colony has become established within a fenced industrial settling pond in shrubsteppe habitat. Gulls nesting at this location are faced with multiple threats, including mortality from heavy truck traffic, malnutrition, and predation.

Objective	Strategy	Action(s)	Target SGCNs
Encourage the	Discourage use of	Work with landowner to remove the	Ring-billed Gull

Objective	Strategy	Action(s)	Target SGCNs
colony to return to the Snake River to nest.	current location for nesting.	fence surrounding the settling pond and/or establish a hazing protocol within the fence to discourage nesting. Conduct surveys at both the current and historic nesting locations to determine if actions to discourage nesting are having the intended effect.	California Gull

Northern Leopard Frog population status

The status of the Northern Leopard Frog in the Owyhee Uplands is unknown. To better understand species status, surveys of historical and potentially occupied sites are needed.

Objective	Strategy	Action(s)	Target SGCNs
Determine the status of the historic populations of Northern Leopard Frog.	Conduct surveys with particular focus on historical distribution.	Conduct surveys to evaluate current status and restoration opportunities.	Northern Leopard Frog

Target: Depressional Wetlands

Vernal pools, playas, old oxbows or meanders that are disconnected from river floodplains and ponded wetlands with emergent marsh and aquatic bed habitats are common examples of Depressional Wetlands. Surface water accumulates from adjacent uplands in areas of closed contours, and the direction of flow is normally from the surrounding uplands toward the center of the depressional wetland. Dominant hydrodynamics are seasonal fluctuations in water depth. Depressional Wetlands lose water through intermittent or perennial drainage from an outlet, evapotranspiration, or infiltration to ground water.

Jewel Wetland Complex, Snake River near Payette, Idaho © 2010 Chris Murphy

Emergent marshes, typically supporting tall plants such as broadleaf cattail (*Typha latifolia* L.) and hardstem bulrush (*Schoenoplectus acutus* [Muhl. ex Bigelow] Á. Löve & D. Löve), occur throughout the Owyhee Uplands. Other common types of Depressional Wetlands in the Owyhee Uplands include vernal pools and playas.

The Owyhee Uplands has more vernal pools and playas than any other part of the state. Vernal pools are precipitation-filled Depressional Wetlands that flood during winter and spring, but dry by early summer. Playas are more intermittently and less predictably flooded than vernal pools, and are more likely to have alkaline water and evaporative salt deposits. They often support specialized plants and invertebrates.

Playa, Snake River Plain near Mountain Home, Idaho © 2008 Tim Weekley

Target Viability

Fair. The current area occupied by Depressional Wetlands in the Owyhee Uplands is likely reduced

from historic extent. This is especially true in former floodplains of the Boise, Payette, and Snake River valleys where oxbow and meander wetlands have been drained and filled for agricultural and urban land uses. However, these losses have been partly offset by the creation of numerous Depressional Wetlands in agricultural and urban areas for the purpose of processing wastewater (e.g., irrigation return, stormwater) and restoration of wildlife habitat. Using the model of landscape integrity, which incorporates mapped land uses and stressors to estimate condition, most Depressional Wetlands are in "Very Good" condition (Murphy et al. 2012). This model likely overestimates on-the-ground condition because many vernal pools and playas occur in the minimally-developed landscape of the Owyhee Plateau or on less-developed Wildlife Management Areas and does not include the extent of nonnative species. However, field rapid assessments of Depressional Wetlands in the Owyhee Uplands found these wetlands (averaged across samples) were in the "Fair "condition class (Murphy and Schmidt 2010, Murphy and Weekley 2012, Weekley and Murphy 2012). For example, 48% of 80 vernal pools and playas assessed were in "Fair" condition (Weekley and Murphy 2012).

Prioritized Threats and Strategies for Depressional Wetlands

High rated threats to Depressional Wetlands in the Owyhee Uplands

Improper livestock grazing management & agricultural modifications

Livestock grazing affects many Depressional Wetlands in the Owyhee Uplands (Murphy and Schmidt 2010, Murphy and Weekley 2012). Livestock disturbance to Depressional Wetlands can be managed with stocking rates and timing stocking to avoid wetland flooding in ephemeral systems. Depressional Wetlands are also often affected by modifications for livestock or other agricultural purposes, including levees, ditches or drainage pipes, and water control structures. Wetland alterations are often intended to manage seasonal flooding or drain flooded sites to improve site value for agricultural purposes. Wetlands may also be dredged to extend the availability of surface water for livestock. Excavated livestock water reservoirs were documented at 13% of assessed vernal pools and playas (Weekley and Murphy 2012). Excavations can cause erosion of the playa or pool bottom from water draining into the reservoir, accelerate playa and vernal pool desiccation, and cause establishment of invasive nonnative plants (Euliss and Mushet 2004). Livestock disturbance to vernal pools and playas has been rated moderate to heavy at 51% of assessed wetlands (Weekley and Murphy 2012). Observed effects of livestock use included alteration of vegetation composition and structure, soil compaction and churning, elevated nutrient inputs, increased erosion and channeling, and the establishment of nonnative plants (Weekley and Murphy 2012). Light grazing in vernal pools can prolong water availability and reduce competition from nonnative vegetation (Pyke and Marty 2005). Similarly, targeted grazing has been used during drawdown periods in emergent marshes to control undesirable vegetation.

Objective	Strategy	Action(s)	Target SGCNs
Maintain high water quality, native vegetation, and ecological integrity of depressional	Manage livestock use and disturbance to wetlands to maintain or improve wildlife habitat.	Use temporary and permanent wildlife-friendly fencing to manage livestock access to wetland habitat. Manage livestock access to maintain vegetation and avoid damage to soils.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog American

Objective	Strategy	Action(s)	Target SGCNs
wetland habitat.		Provide off-site water sources for livestock excluded from pools or flooded sites and include wildlife escape ramps. Provide livestock ramps or other hardened livestock access points to water when off-site watering sources are not preferred or are infeasible. Where appropriate, develop management plans that change seasons of use or prescribe rest for areas with vernal pools and playas.	Bittern White-faced Ibis Sandhill Crane Black Tern Raptor Fairy Shrimp
Minimize extent of habitat loss or degradation by improper livestock grazing management.	Restore sites degraded by improper livestock grazing management. Mitigate habitat loss by constructing new wetlands designed for wildlife benefits.	Develop funding and public-private partnerships to restore wetlands degraded by improper livestock grazing management. Restore hydrologic function by removing unnecessary control structures, obliterating relict ditches and drainage pipes, filling excavated reservoirs that lower water tables, and restoring water supply. Develop projects to construct wildlife-friendly wetlands. Design livestock water sources to benefit wildlife and minimize potential for invasive species establishment, which could include, e.g., shallow-water impoundments that dry periodically to mimic natural Depressional Wetlands or including water control structures to allow depth to be varied and to allow periodic draw-down and desiccation.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog American Bittern White-faced Ibis Sandhill Crane Black Tern Raptor Fairy Shrimp

Nonnative invasive plants & animals

Noxious weeds and invasive plants are frequently observed in Depressional Wetlands in the Owyhee Uplands (Murphy and Schmidt 2010, Murphy and Weekley 2012). Twenty-nine percent of assessed vernal pools and playas had at least moderate infestation of nonnative invasive plants (Weekley and Murphy 2012). Litter from annual nonnative plants has been shown to accumulate on playas and reduce cover of native plants, such as Davis' pepperweed (*Lepidium davisii* Rollins) (Moseley 1995). Some seeded perennial plants, such as forage kochia (*Bassia prostrata* [L.] A.J. Scott) and intermediate wheatgrass (*Thinopyrum intermedium* [Host] Barkworth & D.R. Dewey), may also reduce cover of Idaho endemic plants such as Davis' pepperweed and Idaho pepperweed (*Lepidium papilliferum* [L.F. Hend.] A. Nelson & J.F. Macbr.) that are restricted to playas and/or slickspot microsite habitats (see Harrison et al. 2000). Emergent marshes are susceptible to invasion by Canada thistle (*Cirsium arvense* [L.] Scop.), climbing nightshade (*Solanum dulcamara* L.), common reed (*Phragmites australis* [Cav.] Trin. ex Steud.), purple loosestrife (*Lythrum salicaria* L.), reed canarygrass (*Phalaris arundinacea* L.), and Russian olive (*Elaeagnus angustifolia* L.). Water management can stabilize water levels in these normally dynamic systems. Stabilized water levels can lead to decreased plant diversity and productivity (Murphy 2014). In emergent marshes with stable hydrologic regimes, native

broadleaf cattail (*Typha latifolia* L.) and nonnative narrowleaf cattail (*T. angustifolia* L.) often become extremely dense, minimizing structural and compositional diversity of vegetation and decreasing marsh productivity. Shallow, ephemeral systems that are excavated to create deep, constantly flooded systems are focal areas for Common Carp (*Cyprinus carpio*), American Bullfrog, and nonnative plant invasions. Shallow-water wetlands are sometimes converted to deep water wetlands and ponds by mining operations (e.g., gravel mine ponds) or for agricultural water storage, recreation (e.g., fishing ponds), or aesthetics (e.g., decorative ponds).

Objective	Strategy	Action(s)	Target SGCNs
Prevent establishment of new populations of unwanted nonnative species.	Do not allow importation of species that are identified as Invasive Species by the ISDA. Develop and implement surveillance programs and partnerships to support EDRR to new invasions.	Implement *The Idaho Invasive Species Strategic Plan, 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012). Support ISDA's regulation of invasive species and maintenance of the Idaho Invasive Species List. Contribute to collaborations, working groups, and public-private partnerships to support and improve surveillance and response programs.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog American Bittern White-faced Ibis Sandhill Crane Black Tern Raptor Fairy Shrimp
Eliminate established populations of nonnative aquatic species.	Identify and document nonnative aquatic animal occurrence.	Maintain information databases to document and track nonnative species occurrence and status. Support programs and partnerships intended to detect new occurrences of unwanted species before they become well-established.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog American Bittern White-faced Ibis Sandhill Crane Black Tern Raptor Fairy Shrimp
	Develop and apply techniques to remove populations of unwanted nonnative species.	Develop, maintain, and implement protocols and partnerships for responding to new occurrences of unwanted species. Use and integrate control techniques to achieve objectives of reducing unwanted populations to nonfunctioning levels. Contribute to development of tools, techniques, and protocols for managing nonnative and invasive species.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog American Bittern White-faced Ibis Sandhill Crane Black Tern Raptor Fairy Shrimp
Maintain ecological function and disturbance processes.	Manage disturbance and water availability to manage invasive species.	Use fire, livestock grazing, or other prescribed disturbance to manage invasive species. At managed sites, use seasonal flooding or drawdowns to mimic natural wetland hydrology and simulate long-term natural fluctuations	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog

Objective	Strategy	Action(s)	Target SGCNs
		between wet years and extreme drought years to reduce establishment of carp, bullfrog, and other nonnative species exploiting stabilized systems.	American Bittern White-faced Ibis Sandhill Crane Black Tern Raptor Fairy Shrimp
Minimize negative impacts of economically important populations of nonnative aquatic animals on native fish and wildlife populations.	Manage populations that may affect high-priority animal populations.	Install barriers to expansion of unwanted aquatic animal populations. Apply harvest management programs to reduce or remove sport fish from areas where they are having unwanted effects. Use chemical, mechanical, and/or other treatments to reduce or remove unwanted populations.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog Raptor Fairy Shrimp

Nutrient, sediment & bacterial pollutants from agricultural and urban runoff

Many emergent marsh Depressional Wetlands in the Owyhee Uplands receive water from agricultural and/or urban runoff (e.g., irrigation return, stormwater). Runoff often carries sediment, bacteria, nutrients, and toxic pollutants (e.g., pesticides, metals, road de-icer, etc.) (IDEQ 2003). Urban wastewater, septic systems, and stormwater are significant contributors of phosphorus, bacteria (e.g., *Escherichia coli*), and chemicals (IDEQ 2003). Although wetlands retain and biologically process pollutants, excess sediment, bacteria, and nutrients can diminish beneficial functions (Murphy and Weekley 2012). Water pollution affects habitat quality (e.g., Egea–Serrano 2012). Sediment fills Depressional Wetlands, reducing their extent, altering the hydrologic regime, and changing the plant community. Excess nutrients can promote excessive plant and algal growth resulting in eutrophication. Urban wastewater, septic systems, and stormwater are significant contributors of phosphorus, bacteria (e.g., *Escherichia coli*), and chemicals (IDEQ 2003).

Objective	Strategy	Action(s)	Target SGCNs
Reduce agricultural nutrient waste and chemical runoff to prevent impacts to water systems.	Provide incentives for private landowners to reduce runoff. Minimize runoff by increasing riparian habitat width and developing proper function and condition. Develop capacity of wetlands to remove	Support and promote the use of Farm Bill programs by private landowners that improve the ability to minimize and retain nutrients. Develop and support programs to encourage or provide incentives for agricultural setbacks from wetlands. Implement voluntary, incentive-based, cost-effective, market-based pollution reduction approaches such as pollution and ecosystem services credit markets. Construct new wetlands in strategic areas to manage nonpoint source pollution. Support programs for collecting, managing, and interpreting water quality data.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog American Bittern White-faced Ibis Sandhill Crane Black Tern

Objective	Strategy	Action(s)	Target SGCNs
	pollutants. Manage and mitigate nonpoint source pollution.	Identify and address sources of water quality degradation. Support programs that develop, disseminate, and promote application of BMPs for improving water quality. Create, enhance, and restore emergent marsh Depressional Wetlands with designs that maximize water quality. Implement BMPs to reduce bacterial inputs to wetlands, such as modernized and efficient waste management and storage systems (including septic systems) and livestock management. Implement BMPs to reduce nutrient inputs to wetlands, such as improved nutrient management as well as modernized and efficient wastewater storage and management systems.	

Medium rated threats to Depressional Wetlands in the Owyhee Uplands

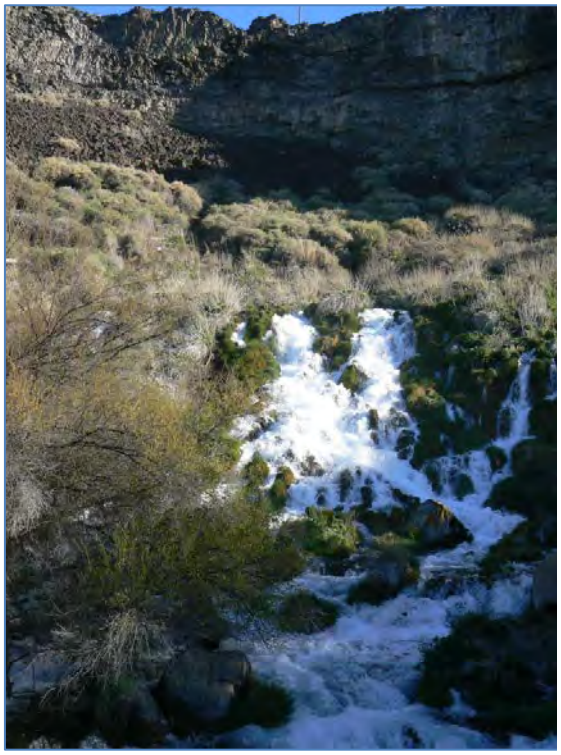
Roads

Roads constructed through Depressional Wetlands are not prevalent but have important effects on depressional wetland habitat in the Owyhee Uplands. In one study, <10% of assessed vernal pools and playas in the Owyhee Uplands were directly impacted by roads (Weekley and Murphy 2012). Primary impacts of roads include soil compaction, increased soil erosion, sediment loading, and decreased infiltration rates. In addition, roads promote nonnative plant dispersal.

Objective	Strategy	Action(s)	Target SGCNs
Minimize negative impacts of roads on Depressional Wetlands.	Manage travel to reduce or avoid impacts to depressional wetland habitat.	Close or reroute roads that cross or affect wetlands. Avoid road construction within or adjacent to wetland habitat (BLM 2015). Alter roads, or design new roads, to prevent or minimize sediment delivery to wetlands from the road surface (BLM 2015). Harden road surfaces to minimize erosion. Avoid the use of road de-icer or other chemicals toxic to wildlife within or adjacent to wetlands.	Woodhouse's Toad Northern Leopard Frog Columbia Spotted Frog American Bittern White-faced Ibis Sandhill Crane Black Tern Raptor Fairy Shrimp

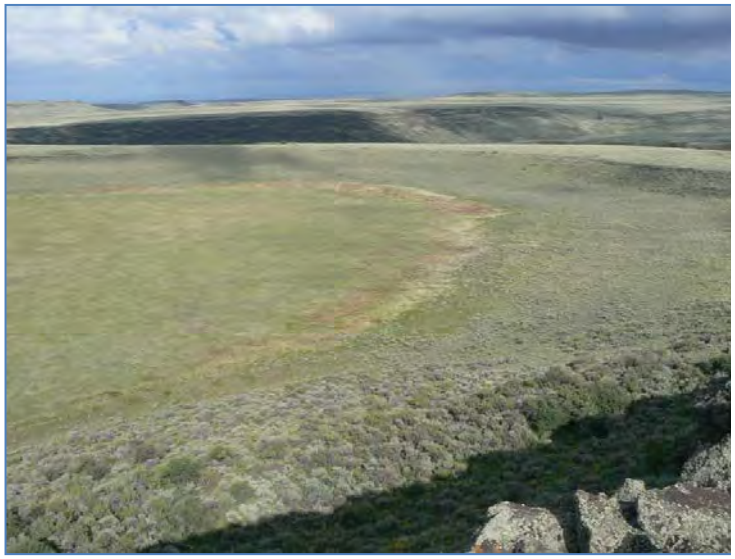
Target: Springs & Groundwater-Dependent Wetlands

This target contains a subset of groundwater-dependent ecosystems (GDEs), specifically springs and groundwater-dependent slope wetlands (e.g., meadows, seep-fed tree- or shrub-dominated wetlands). Groundwater-dependent wetlands often occur on sloping land with gradients that range from steep hillsides to nearly imperceptible slopes. Slope wetlands differ from Depressional Wetlands by the lack of closed contours. Groundwater sources can originate from either a regional aquifer or from localized infiltration of surface water (e.g., precipitation, seasonal flooding). Water flow is downslope and unidirectional. Groundwater-dependent wetlands lose water primarily by subsurface outflow, surface flows, and evapotranspiration. Groundwater-dependent wetlands may develop channels, but the channels serve only to convey water away from the groundwater-dependent wetland.



Niagara Springs, Snake River, Idaho © 2007 Chris Murphy

In the Owyhee Uplands, most occurrences of GDEs are in the form of springs and seeps emanating from basalt canyon walls, talus, and toeslopes of bluffs. These include geothermal springs concentrated in the lower Bruneau River valley. The Owyhee Uplands Section supports several of the most important large groundwater-dependent wetland complexes. Important GDE wetlands include Duck Valley Indian Reservation, Centennial Marsh on Camas Prairie, and spring-fed Silver Creek. Wetland vegetation communities in Duck Valley and the Camas Creek drainage are closely associated with runoff resulting in spring flooding and seeps, and consist of several rush species, sedges, small camas (*Camassia quamash* [Pursh] Greene), and other emergent plants.



Seep at China Hat, Sheep Creek, Owyhee Plateau, Idaho © 2009 Chris Murphy

Numerous high volume springs fed by the Snake River aquifer emerge from basalt walls and alcoves on the northern side of the Snake River Canyon on the eastern border of the Owyhee Uplands. Important, high-quality springs include Box Canyon, Banbury Springs, Billingsley Creek, Malad Gorge, and Thousand Springs. These provide critical habitat for endemic mollusks.

Alkaline-saline wetlands occur throughout the Owyhee Uplands in areas of groundwater discharge where evaporative alkali and salt deposits accumulate in the soil. Such wetlands support unique communities of plants and invertebrates adapted to these high pH and salt-rich soils.

Spanning the high-elevation area north of the East Fork Owyhee River from Big Springs down to Riddle, and Deep Creek to the escarpment, lies an area characterized by large seeps and springs dominated by native grasses and forbs, rocky sites, and tablelands dominated by little sagebrush (*Artemisia arbuscula* Nutt.). This area comprises most of the Sage-Grouse brood-rearing habitat west of the Bruneau River and a high percentage of year-round habitat for Pronghorn (*Antilocapra americana*).

Target Viability

Poor to *Fair*. The current area occupied by Springs & Groundwater-Dependent Wetlands in the Owyhee Uplands is significantly reduced from historic extent. Water from many seeps and springs has been diverted for agricultural and livestock production, resulting in less water available for wetland and aquatic habitat. In 1 study, about 61% of groundwater-dependent wetlands were classified in "Very Good" condition and 34% in "Fair" condition (Murphy et al. 2012). This model likely overestimates on-the-ground condition because many meadows occur in the minimally developed landscape of the Owyhee Plateau and the model does not account for the impacts of livestock grazing and localized water development on these habitats. However, limited field rapid assessments of groundwater-dependent wetlands in the Owyhee Uplands found these wetlands (averaged across samples) were in the "Good" condition class (Murphy and Schmidt 2010, Murphy and Weekley 2012). Primary stressor groups included invasive nonnative plant species followed by hydrologic modifications and soil disturbance. Springs in the Snake River and Bruneau River canyons are reduced by agricultural groundwater pumping. The landscape context of groundwater-dependent wetlands is often "Fair" to "Good," with a moderate number of stressors in wetland buffers because many seeps and springs are located in undeveloped areas of the Owyhee Plateau. Springs in the Snake River Canyon are sometimes buffered by cliff topography, but occur in an otherwise agricultural landscape.

Prioritized Threats and Strategies for Springs & Groundwater-Dependent Wetlands

Very High rated threats to Springs & Groundwater-Dependent Wetlands in the Owyhee Uplands

Groundwater withdrawal

Water is a limiting resource. Overuse of water withdrawal from groundwater aquifers affects springs. Because regional aquifers can be extensive, the negative impacts of withdrawal on spring flows can be observed many miles from where pumping takes place (Sada et al. 2001,

University of Idaho 2002, Brown et al. 2009, (Abele 2011)). For example, since the 1950s, an increase in groundwater pumping for irrigation on the Snake River Plain, combined with less recharge from surface irrigation, has resulted in decreased spring discharge in the Snake River Canyon by 500,000 acre ft per year (University of Idaho 2002).

Groundwater withdrawal has been identified as the most serious threat to Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*) (Wood 2000), an ESA-listed species endemic to natural springs within the lower Bruneau River drainage and that occurs in thermally-influenced springs. For example, reductions in spring flows limit the extent and quality of aquatic Bruneau Hot Springsnail habitat (Mladenka 1992, Wood 2000, FWS 2002, Lysne 2003). Intensive groundwater pumping for irrigation during the last 35 years (e.g., 66,200 acre ft per year) has resulted in a drop in the regional aquifer of up to 30 ft (Berenbrock 1993, FWS 2002, Northwest Power and Conservation Council 2004a). As a result, discharge from the geothermal spring habitat for the Bruneau Hot Springsnail along Hot Creek and the Bruneau River has significantly decreased or completely dried up (Mladenka 1992, FWS 2002). Prior to extensive groundwater withdrawal, about 10,100 acre ft were discharged annually from these springs (Berenbrock 1993).

Many flood-irrigated habitats (FIH) occur in historic wet meadow and wetland footprints of intermountain valleys and basins. These FIHs, particularly perennial pasture and hayfields in the historic floodplain, serve as surrogate wetlands that largely mimic the historic ecological function of natural flooding in the floodplain. These surrogate wetland functions are particularly manifested when diverted surface water for flood-irrigation originates from snowpack driven rivers and streams. Although the timing and duration of surface flooding on FIHs varies widely, many reflect annual environmental variation in snowpack and streamflow conditions. The spread of surface water across FIH mimics natural hydrologic processes and contributes to important ecological functions including soil hydration, aquifer recharge, water recycling/circulation, ameliorating stream temperatures through soil saturation and discharge, and increasing persistence of hydric habitats during the growing season.

Over the past 2 decades, surface-irrigated habitats in the Intermountain West have declined by 23% (123,000 acres/year) while sprinkler-irrigated acres have increased correspondingly. Sprinkler irrigation techniques dramatically reduce the amount of standing or flowing surface water on fields, which makes them less attractive as foraging habitat for wetland birds. Throughout the West, the conversion to sprinkler irrigation has been incentivized through federal programs, including the USDA Farm Bill programs, for perceived water use efficiencies. However, studies have indicated that incentivizing sprinkler conversion may not provide the intended or perceived water savings, economic return, or environmental benefits. Typically, sprinkler irrigation originates as a groundwater withdrawal with virtually no groundwater return or input while flood irrigation imparts surface withdrawal resulting in a groundwater input. The latter is more representative of historical floodplain hydrologic processes.

Objective	Strategy	Action(s)	Target SGCNs
Increase the quality and extent of spring and groundwater-dependent	Work with land and water managers to identify opportunities for balancing	Identify and build multistakeholder partnerships for long-term water conservation across the Snake and Bruneau River basins. Promote agricultural practices that reduce groundwater irrigation pumping, such as	White-faced Ibis Sandhill Crane Long-billed Curlew Banbury

Objective	Strategy	Action(s)	Target SGCNs
wetland habitats.	competing demands for groundwater.	fallowing ground, changing crops to less water-intensive species, increasing irrigation efficiency, and converting to surface water sources where possible. Acquire water rights or easements, where opportunities arise. Support continuation of moratoriums on new groundwater pumping. Evaluate programs intended to recharge aquifers and implement those not compromising fish and wildlife habitat. Create market incentives for reducing demand. Apply Farm Bill and other programs intended to provide incentives for applying BMPs. Create incentives to match crop types to water systems and availability.	Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail
Manage irrigation practices to balance groundwater withdrawal, recharge, and stream flow.	Work with stakeholders to identify water management priorities for wildlife and incentivize beneficial management approaches.	Where appropriate, work with NRCS to develop flood irrigation initiatives through the Regional Conservation Partnership Program. Work with NRCS to develop a flood irrigation enhancement for the Conservation Stewardship Program. Work with Ducks Unlimited and other NGOs to conduct habitat projects that encourage retention of flood irrigation agriculture in converted floodplains and wetlands. Use Habitat Improvement Program funding to leverage funds to encourage retention of flood irrigation agriculture. Work with FWS to determine if Partners for Fish and Wildlife funding may be used to help private landowners wanting to provide flood-irrigated lands for wildlife. To minimize unintended hydrologic consequences associated with land-use changes, increase the integration of water and land-use planning and actively communicate this message to stakeholders and decision makers (Van Kirk et al. 2012).	White-faced Ibis Sandhill Crane Long-billed Curlew Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail

High rated threats to Springs & Groundwater-Dependent Wetlands in the Owyhee Uplands

Improper livestock grazing management

The semiarid climate of the Owyhee Uplands, which contributes to an overall scarcity of surface water, tends to concentrate livestock around seeps and springs. Observed negative impacts from improper livestock grazing at springs and groundwater-dependent wetlands primarily relate to the alteration of vegetation and damage to soil. Improper livestock management can lead to loss or decrease of trees and shrubs (e.g., aspen and willows) and deeply-rooted native herbaceous vegetation; this reduces protective cover for wildlife, shading of aquatic habitat, and stabilization of soils (Sada et al. 2001, NPCC 2004b, (Abele 2011)). It can cause increased runoff energy and soil erosion due to spring outflow bank trampling, soil compaction, and reduced vegetative protection resulting in incised drainages and headcuts; this lowers the groundwater table and dries out seep-fed meadows (Sada et al. 2001, NPCC 2004b, (Abele 2011)). Improper grazing management can also cause elevated fine sediment and organic materials entering springs from spring banks and adjacent uplands (Abele 2011), which can impact spring-dependent mollusks by smothering rocks, sand, and gravel upon which their food, algal films, grows (Varricchione et al. 1998, Wood 2000, NPCC 2004a).

Objective	Strategy	Action(s)	Target SGCNs
Ensure that all springs, seeps, and groundwater-dependent wetlands are in "Proper Functioning Condition" (NPPC 2004b).	Manage livestock grazing around meadows, springs, and seeps that promotes desired vegetation structure and composition.	Evaluate on a case-by-case basis the viability of livestock exclosure fencing to protect meadows, springs, and seeps; install and maintain exclosures where needed (Otter 2012). When fencing is used, mark fences to minimize wildlife collision. Inventory, prioritize, and map springs in need of restoration and protection. Actively restore riparian vegetation (e.g., plantings) and aquatic habitat in springs that have been degraded. Work with willing livestock operators to implement BMPs. Provide input for allotment management plans to ensure springs are protected.	Western Toad Columbia Spotted Frog Greater Sage-Grouse White-faced Ibis Sandhill Crane Long-billed Curlew Common Nighthawk Townsend's Big-eared Bat Silver-haired Bat Hoary Bat Western Small-footed Myotis Little Brown Myotis

Stream rechannelization & water diversion

Diversion of springs and alteration of their outflow channels for livestock watering, hydroelectric power production, aquaculture, recreation, domestic use, or other purposes directly threatens aquatic and terrestrial groundwater-dependent habitats by reducing water volume, creating species migration barriers, directly destroying physical habitat and vegetation, and reducing biological diversity (Sada et al. 2001). Decreased water volume results in decreased soil moisture necessary for supporting riparian vegetation (Abele 2011). Reductions in water depth may be associated with greater exposure to UVB radiation and higher susceptibility to disease in amphibians. Although considered a restoration action, thinning or removing dense vegetation and digging out sediment within springs can harm aquatic habitat for springsnails if done inappropriately or too often (Abele 2011). Dams that pool spring outflows for livestock water or other uses can benefit some species, but they reduce linear habitat extent, alter the thermal regime, and can eliminate species specifically adapted to flowing springs (Sada et al. 2001). In the Owyhee Uplands, developed spring pools may concentrate Columbia Spotted Frog and increase the risk of disease and predation (Engle 2001). Roads, OHV trails, and dispersed recreation trampling (e.g., camping, picnicking, angling, hiking) can also negatively impact springs, seeps, and meadows by diverting or channelizing surface and subsurface flows away from wetlands (Sada et al. 2001, (Abele 2011)). Other spring developments, such as those that use a pipe or box to fully capture the spring source and direct water to a livestock watering trough or other use, reduce habitat extent and quality. Such developments reduce and degrade overwintering sites of Columbia Spotted Frog (Munger et al. 2002). Overall, diversion and outflow alteration reduces spring flow and decreases the ability of the spring to flush fine sediments or other pollutants (Varricchione et al. 1998, Wood 2000, NPCC 2004a). Mitigation of this threat is often difficult and expensive because it may require purchase of water rights or removal of physical infrastructure (Abele 2011).

Objective	Strategy	Action(s)	Target SGCNs
Locally protect and restore springs for endemic mollusks and other spring-dependent plants and animals measured by maintaining or increasing spring flows, improving spring outflow channel aquatic habitat condition, and increasing the quality of riparian vegetation condition (NPPC 2004a).	Work with partners to protect and restore Snake River and lower Bruneau River springs by improving or maintaining spring flows, spring outflow channel aquatic habitat, and riparian vegetation condition (NPPC 2004a).	Preserve undeveloped and minimally-impacted natural springs that have high value for endemic mollusks by using conservation funding programs for private lands. Acquire water rights or easements, where opportunities arise, to locally increase spring flows for endemic mollusks. Work with Idaho Power Company, Idaho Department of Parks and Recreation, NGO conservation partners, and private water users to restore spring habitat by reestablishing flows and riparian vegetation. Concentrate recreational use and access in one area in lieu of dispersed access points by creating boardwalks, bridges,	Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail

Objective	Strategy	Action(s)	Target SGCNs
		and foot paths for spring access; restricting vehicles and equipment to existing access roads; and using nonmotorized off-trail travel in areas not accessible by roads (Abele 2011). Reintroduce locally extirpated mollusks where spring hydrology has been restored.	
Protect, maintain, and/or restore aquatic habitat and hydrologic function of springs, seeps, and meadows as measured by increased extent and duration of saturated wetland vegetation, increased continuity of flowing water, decreased fine sediment input to spring outflow channels, increased diversity and productivity of plant communities, and maintained or expanded use of habitat by SGCN.	Implement projects to protect, maintain, and/or improve aquatic habitat and hydrologic function of springs, seeps, and meadows.	Locate points of diversion on a spring away from source to provide naturally flowing habitat for spring-dependent species (Abele 2011). Use boulders, anchored large wood, beaver, or other methods to stabilize headcuts and raise the water table of incised channels in seep-fed meadows; scatter small logs (e.g., juniper) to disperse overland flow (Abele 2011). Avoid, or decrease frequency of, vegetation clearing and/or digging out silt in springs (Abele 2011). Remove barriers to spring flow; locate any necessary impoundments as far from the spring source as possible. Where feasible, maintain or increase the duration of saturation and shallow flooding in meadows during late spring to keep groundwater closer to the surface for longer periods in summer to maximize invertebrate production and plant germination. Concentrate recreational use and access in lieu of dispersed sites; prevent new roads and trails, relocate roads and trails, and eliminate OHV access.	Columbia Spotted Frog Greater Sage-Grouse American Bittern Sandhill Crane Common Nighthawk
Protect, maintain, and/or restore terrestrial riparian and wetland vegetation of springs, seeps, and meadows as measured by	Implement projects to protect, maintain, and/or improve terrestrial riparian and wetland vegetation of springs, seeps,	Plant locally-adapted native trees, shrubs, and deeply-rooted native herbaceous species to shade out undesirable, invasive vegetation and stabilize soil on spring outflow banks.	Columbia Spotted Frog Greater Sage-Grouse American Bittern Sandhill Crane Common Nighthawk

Objective	Strategy	Action(s)	Target SGCNs
increased extent of hydric plant species, increased native species diversity and productivity of plant communities, decreased percent of flora comprised of nonnative species, and maintained or expanded use of habitat by SGCN.	and meadows.	Use mechanical disturbance (e.g., disking, mowing, harrowing, etc.), fire, herbicides, seasonal flooding, seeding, and/or other treatments where appropriate and practical to increase diversity and productivity of wet meadows.	

Upland & aquatic invasive species

Invasive nonnative species displace native vegetation and alter food webs of springs and groundwater-dependent wetlands (Sada et al. 2001). Russian olive (*Elaeagnus angustifolia* L.), tamarisk (*Tamarix* L.), purple loosestrife (*Lythrum salicaria* L.), common reed, waterthyme (syn. Hydrilla; Hydrilla *verticillata* [L. f.] Royle) (geothermal springs), and other invasive and noxious nonnative plants have degraded native spring habitats in the Owyhee Uplands. The presence of noxious weeds and nonnative invasive plants was the most frequently observed stressor in this habitat during field rapid assessments in the Owyhee Uplands (Murphy and Schmidt 2010, Murphy and Weekley 2012). Native western juniper trees have colonized some springs and meadows due to meadow dessication and lack of wildfire. Encroaching juniper can alter the hydrologic regime and eliminate meadow plant communities. Introduced mollusks and predators (e.g., nonnative fish, American Bullfrog) also displace native spring-adapted biota (Sada et al. 2001). For example, invasive nonnative tilapia (*Oreochromis* spp., *Tilapia zillii*) negatively impact Bruneau Hot Springsnail populations in Hot Creek, which is an outflow of a spring (Myler and Minshall 2000). The State of Idaho has developed *The Idaho Invasive Species Strategic Plan 2012–2016* ([ISDA] Idaho State Department of Agriculture 2012).

Objective	Strategy	Action(s)	Target SGCNs
Prevent establishment of new populations of unwanted nonnative species.	Do not allow importation of species that are identified as Invasive Species by the ISDA.	Implement *The Idaho Invasive Species Strategic Plan 2012–2016* (ISDA 2012). Support ISDA's regulation of invasive species and maintenance of the Idaho Invasive Species List. Develop and implement surveillance programs to support EDRR to new invasions. Work with Cooperative Weed Management Areas to maintain awareness of new noxious weeds and invasive species, and to coordinate control programs.	Western Toad Columbia Spotted Frog Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail
Reduce encroachment by native western	Remove juniper from springs and meadows to	Use site-specific analysis to refine the location for specific areas to be treated.	Western Toad Columbia Spotted Frog Banbury Springs Limpet

Objective	Strategy	Action(s)	Target SGCNs
juniper into springs and meadows.	minimize the harmful effects on these systems.		Bruneau Hot Springsnail Bliss Rapids Snail
Eliminate unwanted populations of nonnative aquatic species.	Identify and document nonnative aquatic animal occurrence.	Maintain information databases to document and track nonnative species occurrence and status. Support programs intended to detect new occurrences of unwanted species before they are well established. Control invasive plants (reed canarygrass, tamarisk) through the use of fire, water-safe herbicides, seasonal flooding, seeding, cutting, and/or other treatments in an integrated approach. Use water-safe herbicides only as last resort.	Western Toad Columbia Spotted Frog Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail
	Develop and apply techniques to remove populations of unwanted nonnative species.	Develop and implement protocols for responding to new occurrences of unwanted species. Use and integrate control techniques to achieve objectives of reducing unwanted populations to nonfunctioning levels.	Western Toad Columbia Spotted Frog Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail
Manage economically important populations of nonnative aquatic animals to minimize negative consequences for native fish and wildlife populations.	Manage populations that may affect high-priority animal populations.	Install barriers to expansion of unwanted aquatic animal populations. Apply harvest management programs to reduce or remove sport fish from areas where they are having unwanted effects. Use chemical, mechanical, and other treatments to reduce or remove unwanted populations.	Western Toad Columbia Spotted Frog Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail

Medium rated threats to Springs & Groundwater-Dependent Wetlands in the Owyhee Uplands

Nutrient enrichment & sediment from agricultural runoff

Agricultural irrigation water and municipal wastewater can infiltrate into groundwater resulting in springs with excess nutrient levels (Sada et al. 2001). This can result in changes to aquatic habitat. For example, elevated nutrients may result in excess plant or algae growth that changes the food web required by endemic biota. Groundwater is at risk of nutrient, pesticide/herbicide, or other toxic chemical contamination where there is high agricultural use of fertilizer, high densities of septic systems and urban land use, confined animal feeding operations (including dairies and feedlots), and injection wells for wastewater disposal (Brown et al. 2009, IDEQ 2010). Sediment enters spring outflow channels from adjacent agricultural activity. All of these activities

exist above the Snake River Plain aquifer, which feeds spring systems in the Snake River Canyon (IDEQ 2010, IDFG 2013).

Objective	Strategy	Action(s)	Target SGCNs
Measurably reduce nutrient contamination in aquifers, especially nitrate, to protect and improve groundwater quality.	Use cooperative multistakeholder approaches including education and incentives for landowners; monitoring and evaluation; and implementing agricultural, industrial, and residential BMPs (IDEQ 2010).	Implement nutrient management plans at confined animal feeding operations to control runoff and infiltration of animal waste; monitor effectiveness of implementation (IDEQ 2010). Implement BMPs for preventing groundwater and spring pollution from agricultural practices (IDEQ 2010) such as irrigation water management, nutrient management, pest management, conservation crop rotation, residue management, prescribed grazing, upgrade of irrigation systems and technologies to improve efficiency, filter strips and riparian buffers, and sediment basins and pumpback systems. Buffer springs from development by ≥50 m (Sada et al. 2001). Inspect existing septic systems when new homes or other structures are developed (IDEQ 2010). Monitor groundwater quality to determine effectiveness of BMPs (IDEQ 2010). Use incentive programs to reduce the impact of agricultural or other production on groundwater quality (IDEQ 2010).	Banbury Springs Limpet Bruneau Hot Springsnail Bliss Rapids Snail

Development of springs for aquaculture

In addition to impacts related to water diversion (see prior discussion), in the Snake River Canyon, development of springs for the purpose of aquaculture has decreased water quality in spring outflows and the Snake River (IDFG 2013, IDEQ 2015). Commercial aquaculture has increased nutrient levels (especially phosphorus) in groundwater, springs, and the Snake River, resulting in an overall decrease in aquatic habitat extent and quality (IDFG 2013, IDEQ 2015). Solid and liquid pollutants in wastewater discharged from aquaculture can include excess feed for fish, fecal matter, nutrients (especially phosphorus), algae, parasites and pathogens, drugs and chemicals, and warm water (IDEQ 2015), all of which can enter spring systems. Aquaculture can also be a source for nonnative species introduction. Discharges alter water temperature and chemistry, increase turbidity, decrease oxygen in water, and increase nutrients, which increase the risk of eutrophication in receiving waterbodies (IDEQ 2015). Poorly functioning wastewater treatment ponds may also cause groundwater contamination.

Objective	Strategy	Action(s)	Target SGCNs
Protect water quality of springs	Work with regulatory	Ensure that regulatory agencies have the resources necessary to enforce regulations	Banbury Springs Limpet

Objective	Strategy	Action(s)	Target SGCNs
and aquatic habitat for endemic mollusks by preventing water pollution from aquacultural facilities.	agencies and aquaculture operators to prevent pollution of springs and associated aquatic habitat for endemic mollusks.	and monitor discharge to prevent water quality degradation. Implement design and carryout production that prevents nutrients and waste from entering groundwater. Collect and reuse nutrients (e.g., fertilizer) to minimize potential pollution of groundwater. Implement BMP plans for waste management.	Bruneau Hot Springsnail Bliss Rapids Snail

Species designation, planning & monitoring

Sandhill Crane

Three Sandhill Crane (*Grus canadensis*) populations exist in the Owyhee Uplands. They include the Lower Colorado River Valley Population (LCRVP), Pacific Coast Population (PCP), and the Rocky Mountain Population (RMP). Lower Colorado River Valley and RMP cranes nest in riparian and palustrine wetlands in a matrix of semidesert xeric habitat found in Blaine, Elmore, Gem, Owyhee, Payette, and Washington counties. Pacific Coast Population cranes stage in the Payette River valley west of Emmett in Gem and Payette counties during spring.

These 3 populations occupy multiple habitats during the course of Sandhill Crane round-trip movements from nesting to wintering areas; each of the populations pose different management challenges. The Association of Fish and Wildlife Agencies' Migratory Shore and Upland Game Bird Working Group selected migratory Sandhill Crane populations as a focus for the development of an individual funding strategy for priority research and management needs because of their unique life history characteristics, separate from the other hunted species of webless migratory birds.

Objective	Strategy	Action(s)	Target SGCNs
Assess the effects of habitat change on Sandhill Crane populations.	Coordinate research and management efforts to identify limiting factors throughout the range of RMP cranes.	Map the extent of summer, staging, and wintering habitat, and assess patterns of associated ownership and land use that characterize the LCRVP and RMP landscapes. Develop spatially-explicit rangewide models that predict landscape carrying capacity and anthropogenic changes (e.g., water use and rural development) that impact habitat availability, abundance, and configuration. Identify and examine broad-scale landscape stressors (e.g., drought and anthropogenic changes) that influence rangewide demographic patterns in LCRVP and RMP cranes.	Sandhill Crane

Target: Lakes, Ponds & Reservoirs

Reservoir behind Swan Falls Dam with emergent marsh fringe, Snake River, Idaho © 2007 Chris Murphy

Lakes, Ponds & Reservoirs include aquatic and wetland habitats in permanently- to seasonally-flooded lakes and reservoirs with extensive areas of deep water and/or wave-eroded beach or bedrock shorelines (Cowardin et al. 1979). This habitat includes waterbodies that are more than 8 ha (20 acres) in area and have water depth exceeding 2 m (6.6 ft) at low water (Cowardin et al. 1979). However, natural deep water ponds and lakes are rare in the Owyhee Uplands. Several large reservoirs exist that were created primarily for hydroelectric (e.g., CJ Strike Reservoir) and irrigation water storage (Lake Lowell, Magic Reservoir, Salmon Falls Creek Reservoir). Several smaller reservoirs on the Snake River also exist, created for hydroelectric production (e.g., Bliss, Lower and Upper Salmon, Swan Falls). In addition, numerous smaller reservoirs exist that were primarily created for irrigation water storage. Most of these reservoirs have areas of emergent vegetation and aquatic bed vegetation on their fringes, as well as riparian vegetation on their shores. Availability of open water is a rare commodity in the arid west. As a result, Lakes, Ponds & Reservoirs in the Owyhee Uplands are of critical importance to many aquatic birds for both breeding and foraging including Western Grebe (*Aechmophorus occidentalis*), Clark's Grebe (*Aechmophorus clarkii*), Ring-billed Gull, California Gull, and Caspian Tern (*Hydroprogne caspia*).

Target Viability

Fair. Water level fluctuations and land bridging of nesting islands, as a result of unusually low water levels, are the main issues. Water level fluctuations, from both dam operations and boat wake, results in grebe nests that become flooded or inaccessible. Land bridging of nesting islands in reservoirs of the Owyhee Uplands has resulted in the loss of 2 (out of 8 statewide) historic nesting colonies of gulls and Caspian Tern.

Spotlight Species of Greatest Conservation Need: Western and Clark's Grebes

Clark's Grebe is one of many Idaho birds identified on The State of the Birds 2014 Yellow Watch List, which highlights species that are either range restricted (small range and population), or are more widespread but with troubling declines and high threats (Rosenberg et al. 2014). Both Western Grebe and Clark's Grebe breed in the Owyhee Uplands and face similar threats. In the Owyhee Uplands, all breeding sites are in anthropogenic habitat. Both species nest at CJ Strike

Reservoir (32 nests, 67 birds) and Western Grebe also nests at Deer Flat National Wildlife Refuge. Boat wakes cause flooding of nests. At Deer Flat National Wildlife Refuge, the Refuge does not have control over water levels, as Lake Lowell is an irrigation reservoir. The daily operations of the dam can result in grebe nests becoming flooded or stranded above waterline, resulting in nest failure.

Prioritized Threats and Strategies for Lakes, Ponds & Reservoirs

Medium rated threats to Lakes, Ponds & Reservoirs in the Owyhee Uplands that have a High impact on at least one target

Water level fluctuations in reservoirs

Existing large reservoirs mimic lake habitat, but reservoirs have widely fluctuating levels and often have high disturbance from recreation. Although reservoirs may attract lake-adapted species, habitat may not be optimal. Lake-adapted bird colonies may be susceptible to disturbance or nests may be destroyed by changing reservoir levels. Fluctuating water levels is a significant issue for both Western and Clark's Grebe. Most Western and Clark's Grebe colonies are located on reservoirs, or along rivers susceptible to water level fluctuations resulting from dam operations. Rapid increase in water levels results in nest flooding, while rapid releases of water results in nests that are no longer accessible to grebes. All grebe colonies that have been monitored in recent years, including the colony at Deer Flat National Wildlife Refuge, have shown extremely low nesting success and recruitment (B. Flanders–Wanner, pers. comm.). One potential contributor is water level fluctuations at the colony level, resulting from boat wake and daily operations at dams.

Objective	Strategy	Action(s)	Target SGCNs
Reduce grebe nest failure.	Work with FWS, Bureau of Reclamation (BOR), and irrigation districts to reduce water level fluctuations during grebe nesting period.	Create boating no-wake zones around nesting colonies, and monitor their effectiveness. Develop BMPs with BOR for water level management around grebe colonies. Work with FWS to determine opportunities for reducing water level fluctuation issues on Deer Flat National Wildlife Refuge.	Western Grebe Clark's Grebe
Increase grebe nest success and recruitment.	Investigate potential causes of low nesting success and recruitment of Western and Clark's Grebes in Idaho.	Collaborate with FWS on proposed research project.	Western Grebe Clark's Grebe
Minimize disturbance to sensitive sites (e.g., colonial bird breeding colonies) to maximize habitat values of necessary reservoirs.	Manage recreation and other activities to maximize habitat value.	Work with land and water managers to manage recreational activities to minimize disturbance at Western and Clark's Grebe colonies.	Western Grebe Clark's Grebe American White Pelican Caspian Tern

Drought & water management impacts

Until as recently as 2006, 8 nesting colonies of Ring-billed Gull and California Gull existed in Idaho, including three in the Owyhee Uplands: Magic Reservoir, Mormon Reservoir, and Smith Island in the Snake River (cross reference Riverine–Riparian Forest & Shrubland). In addition, Magic and Mormon reservoirs also provided nesting habitat for Caspian Tern (IDFG 2007). Low water levels in these reservoirs, presumably driven by drought and low snow levels in the mountains (T. Gregory, IDFG, pers. comm.), have created land bridges at both Mormon and Magic Reservoir colonies. If gulls and terns attempt to nest at these sites at all, land bridging results in high predation rates on both young and adults. The Mormon Reservoir colony has been inactive since 2009; the Magic Reservoir colony has been inactive since 2010. Both of these colonies have been inactive because of land bridging (IDFG unpublished data). To our knowledge, only 1 new colony has become established, and it is in an unsuitable location.

Caspian Terns have mostly disappeared from Idaho, and currently nest reliably in only one location—Island Park Reservoir. This species is highly sensitive to the land bridging issue, but is also typically at a competitive disadvantage when nesting with other colonial species such as gulls and pelicans. Terns initiate nesting later than these other colonial species, and are therefore either pushed out because of lack of space, or they are subject to high predation pressure from the gulls that are often already feeding chicks.

Objective	Strategy	Actions	Target SGCNs
Assess potential impacts of drought on aquatic birds.	Conduct wetland connectivity assessment in the West.	Work with PFNTC to develop and implement a connectivity assessment.	Western Grebe Clark's Grebe American White Pelican American Bittern White-faced Ibis Sandhill Crane Long-billed Curlew Ring-billed Gull California Gull Caspian Tern Black Tern
Increase island nesting habitat availability.	Work with resource managers to identify opportunities at Magic and Mormon reservoirs.	Work with water managers to develop and implement water level management guidelines during the breeding season that balance irrigation and wildlife needs. Work with land managers, such as FWS, to create new nesting locations that will not be subject to low water level concerns in the foreseeable future.	California Gull Ring-billed Gull Caspian Tern
Reduce impacts of competition with other nesting species on Caspian Tern.	Create areas on nesting islands for late breeding initiation.	Work with FWS, Pacific Region, to develop protocol for creating late-breeding initiation areas. Work with land managers, such as FWS, to test protocol on a historic Caspian Tern nesting island that has seen recent nesting attempts (e.g., Minidoka NWR, Blackfoot Reservoir).	Caspian Tern

Target: Bat Assemblage

Bats as small K-selected vertebrates are long-lived, slowly reproducing organisms that maintain relatively stable populations (Findley 1993). Bats use caves, rock shelters, hollows of various kinds, buildings, and foliage as roosts. Some hibernate in the winter while other species migrate considerable distances. The Owyhee Uplands contains all 14 bat species that occur in Idaho, all members of the Family Vespertilionidae (vesper bats), which includes aerial insectivores and gleaners. The Owyhee Uplands Bat Assemblage is focused on the 5 bat SGCN: Townsend's Big-eared Bat (*Corynorhinus townsendii*), Silver-haired Bat, Hoary Bat, Western Small-footed Myotis (*Myotis ciliolabrum*), and Little Brown Myotis (*M. lucifugus*). In addition to more generalized habitat threats, which have been addressed elsewhere in this document, bats face taxa-specific threats such as roost loss or entombment from Abandoned Mine Land (AML) closures, fatality associated with wind turbine strikes, roost loss or direct mortality associated with pest control activities, and the potential incidence of white-nose syndrome (WNS).

Maternity colony Myotis cluster photographed for survey purposes, Snake River, Idaho, 2015 IDFG

Target Viability

Good. Main concerns include fatality associated with wind energy, AML closures, and potential incidence of WNS. Surveillance efforts in Idaho (coordinated with the National Wildlife Health Center) have not yet detected WNS nor *Pd*.

Prioritized Threats and Strategies for the Bat Assemblage

Very High rated threats to the Bat Assemblage in the Owyhee Uplands

Abandoned Mine Lands (AML) closures

Mining remains an integral part of the cultural, economic, and ecological fabric of the West. Over time, however, once rich prospects gave way to abandoned shafts and adits, creating subterranean complexes. These mines have become of fundamental importance to bat ecology and the relationship between bats and mines is well documented (Riddle 1995, Pierson 1998, Tuttle and Taylor 1998, Meier and Garcia 2000, Vories and Throgmorton 2000). Bats use

abandoned underground mines for day roosts, night roosts, maternity colonies, hibernacula (winter resting areas), swarming sites (where bats congregate at certain times of the year), and temporary migratory stopover sites. However, these same mines often present safety hazards for humans. Although the Idaho Department of Lands (IDL) and federal land management agencies (e.g., FS, BLM) have existing AML programs to identify hazardous mines and implement appropriate closure procedures, preclosure biological evaluations are often of limited scope and intensity. If not carefully managed, this threat has the potential to eliminate many critical bat roosting and hibernating sites. Further study is also needed to understand the subtle aspects of roost use and to assess the impacts of reclamation efforts (Sherwin et al. 2009). In addition, some gated mine entrances have become nonfunctional to bats when erosion or invasive nonnative vegetation blocks the portal. Other closures have changed the airflow pattern that may render the mine unsuitable to bats. Some gates have been vandalized, which creates a human safety hazard. To ensure both the success of AML programs and the continued accessibility and use by bats, agencies should conduct post-closure monitoring on a subset of gated mines.

Many of the following objectives, strategies, and actions have been adapted from Sherwin et al. (2009) *Managing Abandoned Mines for Bats*.

Objective	Strategy	Action(s)	Target SGCNs
Manage abandoned mine lands as part of a roosting landscape to maintain various types of subterranean habitat (and associated roost types).	Develop collaborative partnership to achieve broader bat conservation and to ensure adequate mitigation.	Identify project partners and protocols; implement best management practices. Establish project goals, priorities, tasks, targets, and desired outcomes. Develop and implement comprehensive project management plan for efficient, collaborative program. Require effective communication among partners. Develop comprehensive safety plan that adequately addresses the requirements of all collaborating partners (e.g., industry, state, and federal) on the project. Establish safety standards; require training for personnel; communication protocols; and emergency procedures and contingencies. In coordination with partners, establish significance by identifying the objectives of closure projects and determine what biological threshold(s) will trigger protection rather than destructive closure of the mine). Define biological significance and management priorities locally. Use decision tree outlined in Sherwin et al. (2009) to determine whether to base management decisions on BATS or on HABITAT.	Townsend's Big-eared Bat Western Small-footed Myotis Little Brown Myotis

Objective	Strategy	Action(s)	Target SGCNs
Minimize negative impacts on bats and/or other wildlife associated with closure projects.	Manage mine-closure projects to ensure the goals of the project are accomplished.	Of mines slated for closure, conduct pre-closure bat surveys to identify and protect critical bat roosts. Following site evaluations, base reclamation decisions on a balance between physical safety and the practicality of protection versus actual or potential roosting quality and the site's absolute or relative significance in the landscape. In mines where multiple uses occur throughout the year, implement activities during a time when fewer bats are in the mine and impacts will be minimized. Install bat-friendly closures (fitted with administrative closures) at mines deemed to be important bat habitat. Include adequate exclusions for destructive closures as a routine part of mine reclamation programs to minimize the risk of entombing bats in closed workings (see Sherwin et al. 2009 for further details). Conduct post-closure monitoring to evaluate whether bats are still using the mine. Organize a workshop for state & federal agency biologists on assessing mines as bat habitat.	Townsend's Big-eared Bat Western Small-footed Myotis Little Brown Myotis
Minimize potential risk of transferring WNS or other diseases to bats.		Follow accepted decontamination protocols for known infectious-disease risks, e.g., WNS, when conducting internal underground surveys.	
Minimize the loss of mines that have significant bat use and are scheduled for destructive closure.	Identify mitigation sites (i.e., replacement habitat).	Find existing abandoned mines or caves that will provide suitable replacement habitat and then secure them for the bats in perpetuity. Conduct research on the potential value of creating artificial subterranean roosts to enhance the availability of subterranean habitat.	
Maintain bats in active mines.		Since the impacts for many mining activities are poorly understood, use caution when continuing mining activities while large numbers of bats roost within a mine.	
Obtain critical information to guide future management efforts, rectify past management mistakes, and provide information about past successes.	Use an adaptive management framework.	Ensure that protective and/or destructive closures continue to function as designed. The integrity of closures should be monitored annually for the first 4 to 5 years, with the timing adjusted after that to meet local needs; sites with a history of human visitation, especially in regions where gate vandalism is prevalent, may require 3 to 4 visits during periods of peak public use during the first pre-closure year.	

Owyhee Uplands Section Team

An initial version of the Owyhee Uplands Section project plan was completed for the 2005 Idaho State Wildlife Action Plan (formerly Comprehensive Wildlife Conservation Strategy). The Owyhee Uplands was selected as one of 2 initial pilot sections for the 2015 Idaho State Wildlife Action Plan revision. A small working group developed an initial draft of the section plan (Miradi v. 0.12), which was then reviewed by a wider group of partners and stakeholders during a 2-day workshop held at the Idaho Department of Fish and Game Headquarters office, Boise, Idaho, in August 2014 (this input was captured in Miradi v. 0.14). That draft was then subsequently distributed for additional stakeholder input including a half-day meeting in December 2014. Since then, we have continued to work with key internal and external stakeholders and subject matter experts to improve upon the plan. Individuals, agencies, and organizations involved in this plan are listed in Table 12.1.

Table 12.1 Individuals, agencies, and organizations involved in developing this plan [a]

First name	Last name	Affiliation
Rita	Dixon* [b]	Idaho Department of Fish and Game, Headquarters
Bob	Unnasch*	The Nature Conservancy in Idaho
Jon	Beals	Idaho Governor's Office of Species Conservation
Regan	Berkley	Idaho Department of Fish and Game, Southwest Region
William R	Bosworth	Idaho Department of Fish and Game, Southwest Region
Jay	Carlisle	Intermountain Bird Observatory
Michelle	Commons–Kemner	Idaho Department of Fish and Game, Southwest Region
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Jim	Desmond	Owyhee County
Sean P	Finn	Golden Eagle Audubon Society
Chad C	Gibson	Owyhee County
Terry	Gregory	Idaho Department of Fish and Game, Magic Valley Region
Amy	Haak	Trout Unlimited
Nick	Hardy	US Fish and Wildlife Service
Todd	Hopkins	Great Basin Landscape Conservation Cooperative
Dave	Hopper	US Fish and Wildlife Service Idaho
Brad	Jost	Bureau of Land Management (US) Idaho
Charlie	Justus	Idaho Department of Fish and Game, Southwest Region
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Kristin	Lohr	US Fish and Wildlife Service

First name	Last name	Affiliation
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Colleen	Moulton	Idaho Department of Fish and Game, Headquarters
Chris	Murphy	Idaho Department of Fish and Game, Headquarters
Lisa	Nutt	US Forest Service Intermountain Region
Brian	Oakey	Idaho State Department of Agriculture
Sal	Palazzolo	Idaho Department of Fish and Game, Headquarters
Dave	Pilliod	USGS Forest and Rangeland Ecosystem Science Center
Katie	Powell	US Fish and Wildlife Service
Wyatt R	Prescott	Idaho Cattle Association
Jason	Pyron	US Fish and Wildlife Service Idaho
Nick	Salafsky	Foundations of Success
Bruce	Schoeberl	Bureau of Land Management (US) Idaho
Delwyne	Trefz	Owyhee County, Natural Resources Committee Member
Joe	Weldon	Bureau of Land Management (US) Idaho
Craig	White	Idaho Department of Fish and Game, Southwest Region
Ross	Winton	Idaho Department of Fish and Game, Magic Valley Region

[a] Apologies for any inadvertent omissions.

[b] An asterisk "*" denotes team leader(s) and contact point if you would like to become involved in this work.