8. Yellowstone Highlands Section

Section Description

The Yellowstone Highlands Section lies within the Middle Rocky Mountain Ecoregion in Fremont and Teton counties, Idaho (Fig. 8.1) and represents a geologic and topographic transitional area between the eastern Snake River Plain and the active volcanic field in Yellowstone National Park (Christiansen 1982). The dominant geologic features in this area are 3 calderas, which are large basin-shaped volcanic depressions (http://volcanoes.usgs.gov/vsc/glossary/caldera.html retrieved Nov 1, 2015).

The Island Park, Henrys Fork, and Yellowstone calderas formed during three cycles of rhyolitic volcanism over a two million year period (Christiansen 2000). The Island Park Caldera, likely the largest symmetrical caldera on earth, was formed in the first eruption 2 million years ago when a massive volcano extending well onto the Yellowstone plateau collapsed. Another cycle of volcanism 1.3 million years ago created the smaller Henrys Fork Caldera within the western portion of the Island Park Caldera. A third volcanic cycle that vented in eastern Yellowstone created lava flows on the eastern border of Island Park (Christiansen 1982). The Yellowstone Highland's geologic past is reflected in its current topography, hydrology and namesakes like Island Park, the Island Park Caldera, or simply the Caldera.

View of the Yellowstone Highlands from Warm Butte © Terry Thomas

The area's topography is comprised of an elevated plateau ranging in elevation from 1,500–2,500m (5,100–8,500 ft), bounded on the northwest by Thurmon Ridge, and on the east by the westernmost portions of the Yellowstone Plateau, including the Madison Plateau and the Moose Creek Butte. Between these rugged features, the basin floor is relatively flat (Christiansen 1982). The Yellowstone Highlands also includes portions of two small alluvial valleys, Shotgun Valley and Henrys Lake Flat; and a portion of one large mountain valley, the Teton Valley (Van Kirk and Benjamin 2000). For purposes of geographic continuity and to best incorporate existing regional conservation and management activities, Shotgun Valley, Henrys Lake Flat, and Teton Valley are incorporated into this section in their entirety (Fig. 8.2).

Most of the land (66%) in the Yellowstone Highlands Section falls within the boundary of the Caribou–Targhee National Forest, nearly 17% is private lands, 6.5% is State of Idaho lands, 5.3% falls within Yellowstone National Park, 3.24% is Bureau of Land Management (BLM), and 0.65% is owned by the US Bureau of Reclamation (BOR).

Precipitation ranges from 51 to 114 cm (20 to 45 in) annually with most occurring during the fall, winter, and spring. Precipitation occurs mostly as snow above 1,800 m (6,000 ft) and as rain during the growing season. The climate is generally cold and moist. Temperature averages 2–8 °C (35–47 °F). The growing season lasts 25–120 days with a shorter growing season at higher elevations. The Yellowstone Highlands is a moisture surplus area, where precipitation exceeds evapotranspiration (Clark and Minta 1994). Winter snowfall on the Madison and Pitchstone Plateaus in Yellowstone National Park is a key source of recharge for springs in the Island Park Caldera (Benjamin 2000).

The Henrys Fork of the Snake River emanates from large springs at the eastern edge of Island Park Basin near the base of the Madison Plateau, at a seam between two different aged lava flows (Buffalo Lake and Lava Creek Flows) (Benjamin 2000). Big Springs is the hydrologic source of the Henrys Fork based on maximum annual discharge (Van Kirk and Benjamin 2000), and along with other large volume springs (Lucky Dog Springs, Chick Creek, Buffalo River, Toms Creek, Snow Creek, and Warm River Springs), provides approximately half the streamflow in the upper Henrys Fork watershed (Benjamin 2000). The western portion of the watershed is fed by snowmelt from the Centennial Mountains (Benjamin 2000). The Henrys Fork River flows south through the Island Park basin before cutting its way through the southern rim of the calderas over a series of dramatic falls, including the 114-foot Mesa Falls, before descending onto the Snake River Plain near Ashton, Idaho.

The Yellowstone Highlands are a major component of the Greater Yellowstone Ecosystem (GYE), one of the largest "intact" ecosystems remaining in the temperate zones of the world (Keiter and Boyce 1991). The GYE includes up to 8,903,092 ha (22 million acres) and incorporates two national parks, portions of six national forests, three national wildlife refuges, BLM holdings, private and tribal lands (http://www.nps.gov/yell/learn/nature/ecosystem.htm, November 3, 2015). The Yellowstone Highlands, including Teton Valley, arguably comprise the core habitats of the GYE in Idaho.

Terrestrial fauna of the GYE is unique due to its completeness. Unlike nearly any other location in the contiguous US, most species of birds and mammals present in pre-European settlement times are currently present with relatively viable populations (Hansen 2006). Among the superlative wildlife resources of the GYE are one of the largest Elk (*Cervus elaphus*) herds in North America, one of the few Grizzly Bear (*Ursus arctos*) populations in the contiguous United States, and persistence of regionally rare or at-risk species such as Wolverine (*Gulo gulo*), Trumpeter Swan (*Cygnus buccinator*) and Common Loon (*Gavia immer*). Noss et al. (2002) rated the ecological importance of 43 "megasites" within the GYE based on dual criteria of irreplaceability and vulnerability. Two of the megasites analyzed, "Teton River" and "Henrys Fork," encompass most of the Yellowstone Highlands. The Henrys Fork Megasite ranked as number 1 in the GYE for irreplaceability of resources and was ranked number 2 in the combined ranking (irreplaceability and vulnerability). Teton River had the highest combined rank of all megasites in the GYE (Noss et al. 2002). These rankings reflect other work by Hansen (2006) that suggests, in general, lower

elevation lands in the GYE have some of the most productive habitats, but also face many looming threats, particularly on private lands. Also, it highlights the conservation importance of the Yellowstone Highlands for maintaining the ecological integrity of the GYE.

The Yellowstone Highlands also comprises the eastern flank of the High Divide region of Idaho and Montana. This region is a national conservation priority landscape that encompasses the headwaters for the Missouri and Columbia watersheds, and is the centerpiece for habitat connectivity between the Greater Yellowstone area, northern Montana, and Central Idaho (http://heart-of-rockies.org/where-we-work/high-divide/high-divide-collaborative/). The natural amenities of this landscape are attracting new residents that are driving expansive rural residential development. Within the High Divide (including the Yellowstone Highlands), the number of single-family homes has nearly tripled in the last 50 years, from about 28,000 homes in 1963 to 75,000 in 2013. More than half of these new homes were built in unincorporated portions of rural counties. In the next 10 years, an estimated 150 square miles of currently undeveloped private land will be altered by low-density rural residential development (http://headwaterseconomics.org/economic-development/local-studies/high-divide). Fremont and Teton counties experienced some of the most significant growth within this region. In the 1990s and 2000s, Teton County had one of the highest population growth rates in the Western US. Its new home growth was the 6th fastest in the United States. Most of that real estate development occurred in rural areas outside of towns (within the Teton River riparian corridor, and the foothills of the Teton and Big Hole mountain ranges) (http://www.sonoraninstitute.org/where-we-work/montana/835-teton-county.html).

Grizzly mother and cub © Terry Thomas

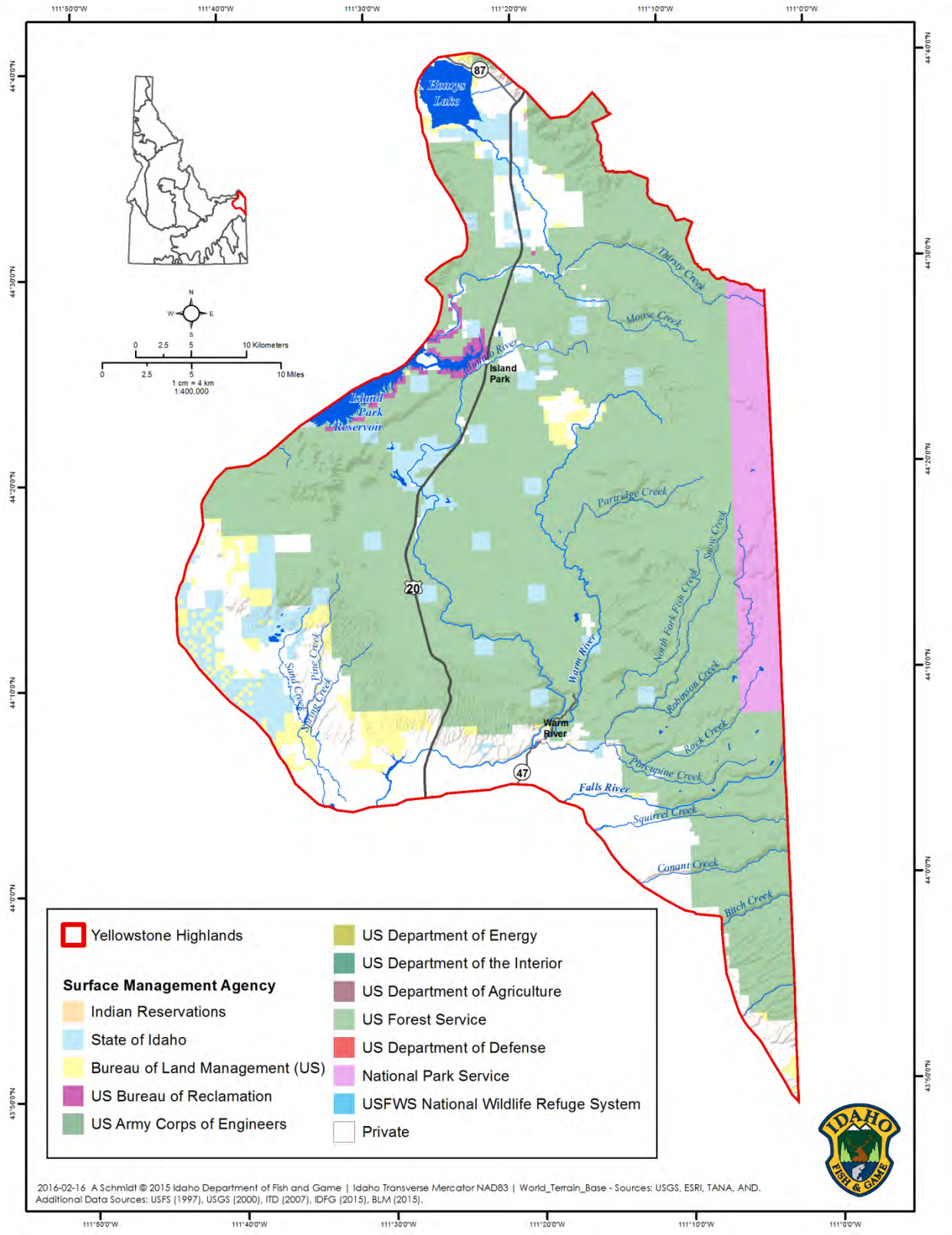


Fig. 8.1 Map of Yellowstone Highlands surface management

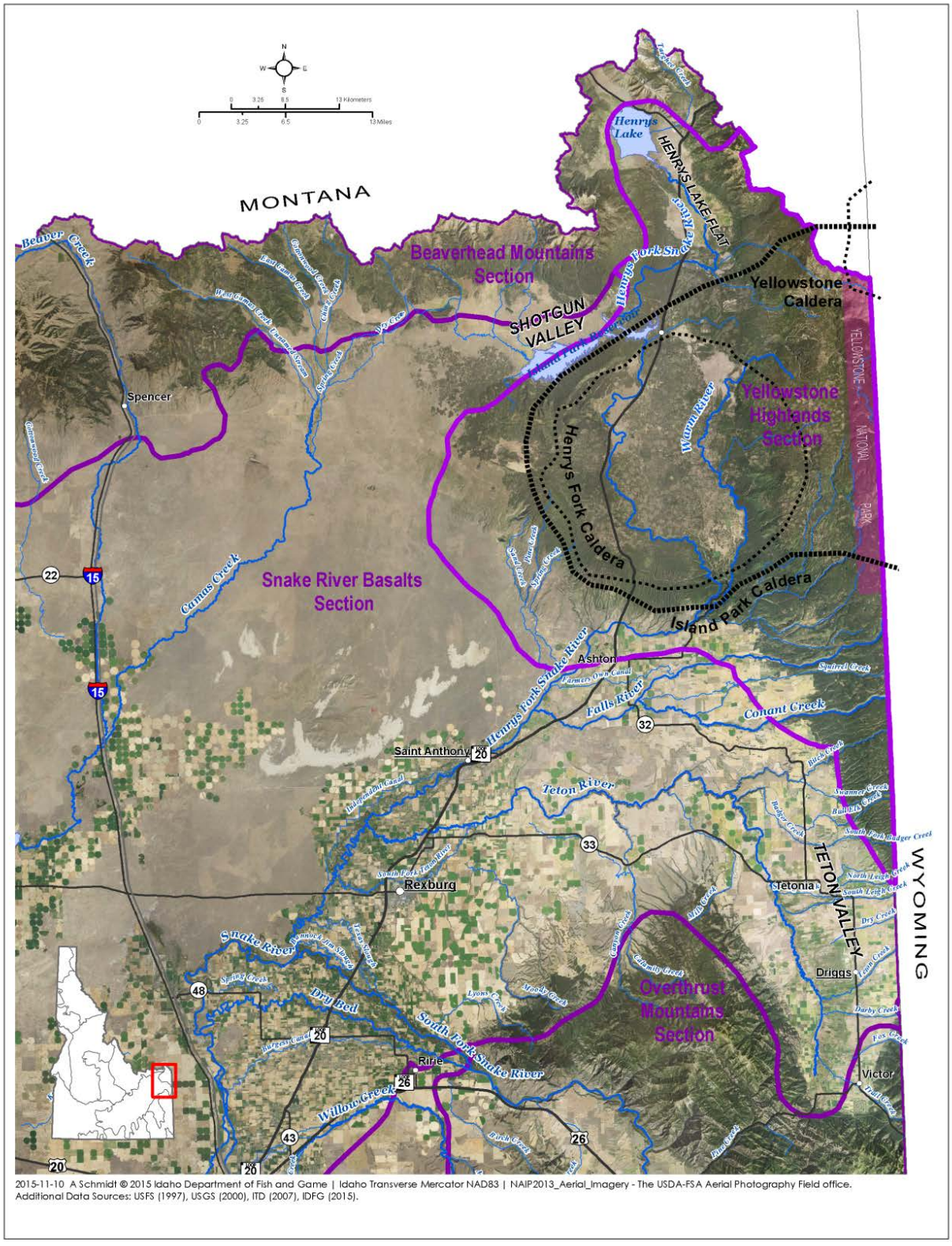


Fig. 8.2 Detail of Yellowstone Highlands with Henrys Lake Flat, Shotgun Valley, and Teton Valley

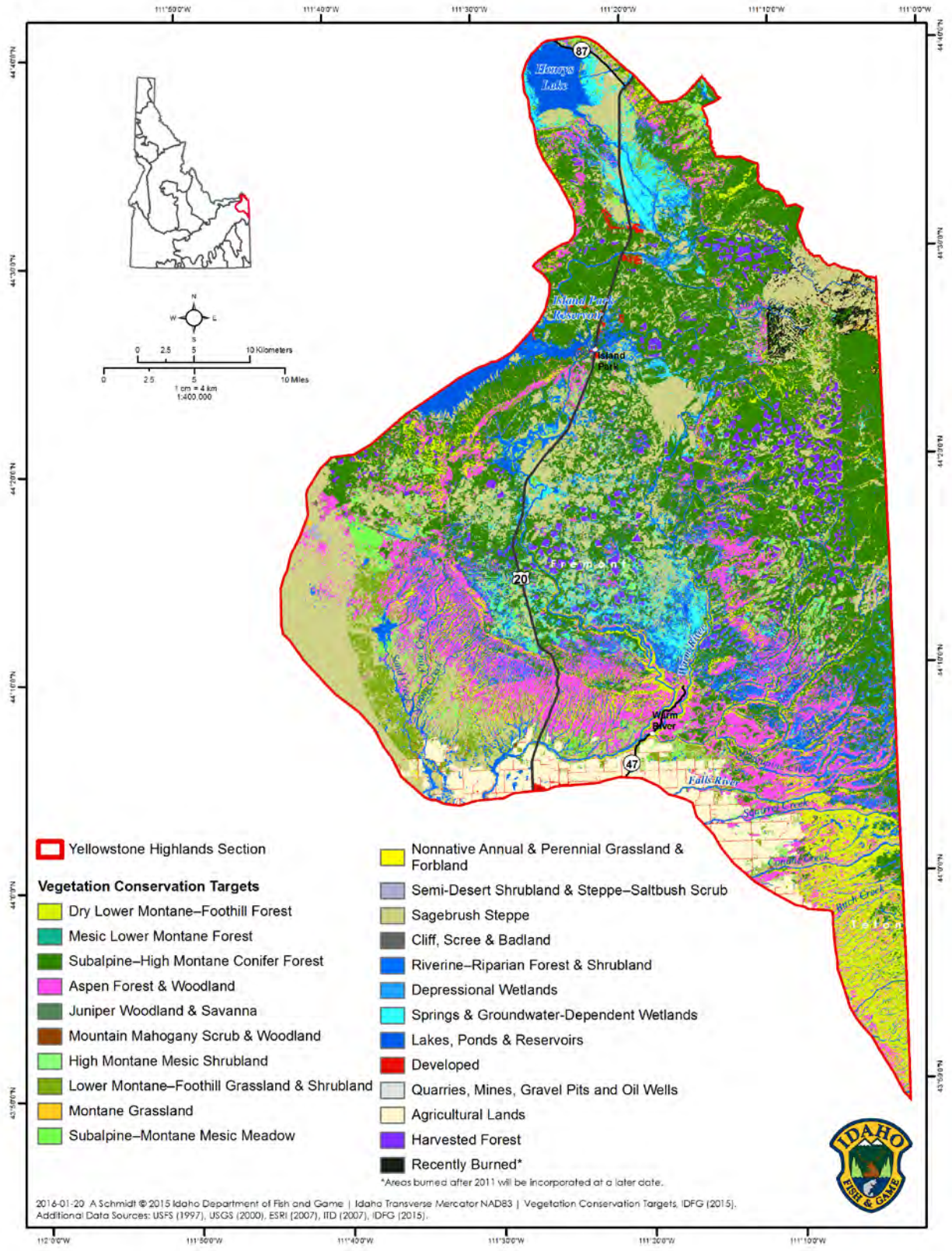


Fig. 8.3 Map of Yellowstone Highlands vegetation conservation targets

Conservation Targets in the Yellowstone Highlands

We selected 5 habitat targets that represent major ecosystems and/or priority landscapes in the Yellowstone Highlands (Table 8.1). Each of these systems provides habitat for key species of greatest conservation need (SGCN), i.e., "nested targets" associated with each target. Conservation of the habitat targets listed below should conserve most of the nested species within them. However, we determined that at least 2 additional species/guilds (Ungulate Migration and Grizzly Bear) face special conservation needs and thus are presented as explicit targets as shown in Table 8.1.

Table 8.1 At-a-glance table of conservation targets in the Yellowstone Highlands

Target	Target description	Target viability	Nested targets (SGCN)	
Montane Forest Mosaic	The Yellowstone Highlands forested areas "are primarily lodgepole pine types (70%) that contain small pockets of aspen, sagebrush/grass, grass meadows, and mountain brush. Douglas-fir (10%) and mixed lodgepole pine/Douglas-fir (15%) cover types provide some diversity in the area."	*Fair*. Forest patch size, species composition, and structure do not reflect historical patterns and frequencies of disturbance. Current dominance by even-aged lodgepole stands limits benefits to wildlife.	*Tier 1* *Tier 2* *Tier 3*	Wolverine Grizzly Bear Western Bumble Bee Suckley's Cuckoo Bumble Bee Western Toad Silver-haired Bat Hoary Bat Great Gray Owl Olive-sided Flycatcher Clark's Nutcracker Kriemhild Fritillary Monarch Gillette's Checkerspot
Mountain Brush–Aspen Ecotone	A large ecotone that forms the southern boundary of the section on the caldera rim from Mesa Falls to the Sand Creek Ponds.	*Fair* to *Good*. Conversion of habitat via rural residential development at lower elevations, associated fire suppression, and road development threaten the integrity and resiliency of aspen on this landscape.	*Tier 1* *Tier 2* *Tier 3*	Grizzly Bear Western Toad Northern Leopard Frog Sharp-tailed Grouse Silver-haired Bat Hoary Bat Great Gray Owl Little Brown Myotis
Riverine–Riparian Forest & Shrubland	Rivers and streams, including aquatic habitats and their associated terrestrial riparian habitats. Includes the upper Henrys Fork subwatershed and a portion of the Teton River subwatershed.	*Fair* to *Good*. High quality fisheries. Some portions of the Section are nearly pristine (e.g., Bitch Creek, some reaches of the Henrys Fork) while others are impacted by adjacent land use	*Tier 2*	Western Toad Northern Leopard Frog Trumpeter Swan Common Loon Western Grebe American White Pelican Caspian Tern Silver-haired Bat Hoary Bat Western Pearlshell Rocky Mountain Duskysnail

Target	Target description	Target viability	Nested targets (SGCN)	
		and/or water withdrawals (e.g., Box Canyon, Henrys Lake Outlet).	*Tier 3*	Sandhill Crane Little Brown Myotis Pondsnail (*Stagnicola*) Species Group Monarch Gillette's Checkerspot A Caddisfly (*Glossosoma idaho*)
Wetlands	Includes groundwater-dependent wetlands (e.g., springs, seeps, mesic meadows, fens) and Depressional Wetlands (e.g., vernal pools, marshes, and meadows).	*Good*. Some wetlands have been negatively impacted by anthropogenic factors, while others are highly functional (e.g., forest vernal pools and fens).	*Tier 1*	Greater Sage-Grouse Grizzly Bear
			Tier 2	Western Toad Northern Leopard Frog Trumpeter Swan Common Loon Western Grebe American White Pelican White-faced Ibis Long-billed Curlew California Gull Caspian Tern Bobolink Silver-haired Bat Hoary Ba
			Tier 3	Sandhill Crane Franklin's Gull Ring-Billed Gull Short-eared Owl Little Brown Myotis Monarch Gillette's Checkerspot
Henrys Lake Flat	This target conforms to the BLM-designated Henrys Lake ACEC boundary and includes important ungulate transitional, calving and fawning habitat; the main tributary to the Henrys Fork; and is important for large carnivore connectivity. In addition, the area supports State rare wetlands and SGCNs.	*Fair*. Despite highly functional protected portions of the target, like The Nature Conservancy's (TNC) Flat Ranch Preserve, the area is currently impacted and threatened by rural residential development.	*Tier 1*	Wolverine Grizzly Bear
			Tier 2	Western Toad Trumpeter Swan Western Grebe American White Pelican Long-billed Curlew California Gull Caspian Tern Silver-haired Bat Hoary Bat
			Tier 3	Sandhill Crane Franklin's Gull Ring-billed Gull Short-eared Owl Little Brown Myotis
Ungulate Migration	This target is intended to capture the process of ungulate seasonal migration	*Good*. Currently, US Hwy 20 presents a threat to connectivity and	*Tier 1*	Greater Sage-Grouse Wolverine Grizzly Bear

Target	Target description	Target viability	Nested targets (SGCN)	
	and resource use through the area as well as more localized species movement. Includes seasonal, transitional, and stopover habitat.	potential expansions to the route would decrease permeability. Rural residential development also poses current and future threats to key transitional habitat in Shotgun Valley, Henrys Lake Flat, and the south rim of the caldera.	*Tier 2*	Sharp-tailed Grouse
Grizzly Bear	Island Park and Teton Valley represent the current suitable and occupied habitat for GYE Grizzly Bears in Idaho. Successful management of Grizzly Bear requires addressing both habitat threats and human dimension threats. Thus, it is important to have this target separate from the habitat targets.	*Good*. Grizzly Bear population in the Greater Yellowstone Distinct Population Segment is recovered.	*Tier 1*	Grizzly Bear Wolverine

Table 8.2 Species of greatest conservation need (SGCN) and associated conservation targets in the Yellowstone Highlands

Taxon	Conservation targets						
	Montane Forest Mosaic	Mountain Brush–Aspen Ecotone	Riverine–Riparian Forest & Shrubland	Wetlands	Henrys Lake Flat	Ungulate Migration	Grizzly Bear
AMPHIBIANS							
Western Toad (*Anaxyrus boreas*)[2]	X		X	X	X		
Northern Leopard Frog (*Lithobates pipiens*)[2]			X	X			
BIRDS							
Trumpeter Swan (*Cygnus buccinator*)[2]			X	X			
Greater Sage-Grouse (*Centrocercus urophasianus*)[1]				X			
Sharp-tailed Grouse (*Tympanuchus phasianellus*)[2]		X					
Common Loon (*Gavia immer*)[2]			X				
Western Grebe (*Aechmophorus occidentalis*)[2]							
American White Pelican (*Pelecanus erythrorhynchos*)[2]							
White-faced Ibis (*Plegadis chihi*)[2]							
Sandhill Crane (*Grus canadensis*)[3]			X	X			
Long-billed Curlew (*Numenius americanus*)[2]				X	X		
Franklin's Gull (*Leucophaeus pipixcan*)[3]				X	X		
Ring-billed Gull (*Larus delawarensis*)[3]				X	X		
California Gull (*Larus californicus*)[2]				X	X		
Caspian Tern (*Hydroprogne caspia*)[2]			X	X			
Great Gray Owl (*Strix nebulosa*)[3]	X						
Short-eared Owl (*Asio flammeus*)[3]				X	X		
Olive-sided Flycatcher (*Contopus cooperi*)[3]	X						
Clark's Nutcracker (*Nucifraga columbiana*)[3]	X						
Bobolink (*Dolichonyx oryzivorus*)[2]				X			
MAMMALS							
Silver-haired Bat (*Lasionycteris noctivagans*)[2]	X	X	X	X	X		
Hoary Bat (*Lasiurus cinereus*)[2]	X	X	X	X	X		
Little Brown Myotis (*Myotis lucifugus*)[3]	X	X	X	X	X		
Wolverine (*Gulo gulo*)[1]	X				X	X	X
Grizzly Bear (*Ursus arctos*)[1]	X	X		X	X	X	X
BIVALVES							
Western Pearlshell (*Margaritifera falcata*)[2]			X				
GASTROPODS							

Taxon	Conservation targets						
	Montane Forest Mosaic	Mountain Brush–Aspen Ecotone	Riverine–Riparian Forest & Shrubland	Wetlands	Henrys Lake Flat	Ungulate Migration	Grizzly Bear
Pondsnail (*Stagnicola*) Species Group[3]			X				
Rocky Mountain Duskysnail (*Colligyrus greggi*)[2]			X				
INSECTS							
Western Bumble Bee (*Bombus occidentalis*)[1]	X						
Suckley's Cuckoo Bumble Bee (*Bombus suckleyi*)[1]	X						
Kriemhild Fritillary (*Boloria kriemhild*)[3]	X						
Monarch (*Danaus plexippus*)[3]	X		X	X			
Gillette's Checkerspot (*Euphydryas gillettii*)[3]	X		X	X			
A Caddisfly (*Glossosoma idaho*)[3]			X				

Target: Montane Forest Mosaic

Most of the land covered by this target is on the Caribou–Targhee National Forest (CTNF) within the Ashton–Island Park and Teton Basin Ranger Districts. The CTNF recently completed a forest-wide, mid-level vegetation map and description, where existing plant communities were assigned to "dominance types" based on the most abundant species of the ecologically dominant life form (e.g., the most abundant tree species in forests or woodlands, USDA 2014).

The map units are based on forest Ranger Districts and do not exactly conform to the Yellowstone Section boundary. Also, portions of Ranger Districts lie in Wyoming. However, a combination of dominance type descriptions and dominance type mapping allows a valuable estimate of the major forest habitat types within the Yellowstone Highlands.

Most of the Ashton/Island Park Ranger District is currently mapped within the lodgepole pine (*Pinus contorta* Douglas ex Loudon) dominance type (54% of land area) and Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco)–lodgepole dominance type (5%). Therefore, dominance type mapping of lodgepole pine indicates coverage of almost 60% of the land area. Another estimate of lodgepole dominance of the Yellowstone Highlands is provided by a summary of Caribou–Targhee Geographic Areas. Much of the Yellowstone Highlands is within the Island Park Tablelands and the Madison–Pitchstone Plateau Geographic Areas, which is described as

approximately 70% lodgepole pine. Other forest habitat dominance types that occur within the Yellowstone Highlands, although in a much lower extent than lodgepole, include spruce-fir (*Picea–Abies*), conifer-mix, Douglas-fir, and quaking aspen (*Populus tremuloides* Michx.). Forest lands in the Teton Basin Ranger District, in general, have a more favorable mosaic of dominance types that are productive for wildlife.

Island Park lodgepole pine landscape © Terry Thomas

Lodgepole pine provides cover for large animals such as bears and elk, but biological diversity in dense, mature lodgepole is low (Lotan and Perry 1983). As seral lodgepole is replaced by climax spruce-fir forest, biodiversity increases, particularly for birds (Lotan and Perry 1983). Hanson (2009) describes Douglas-fir as moderately high in net primary productivity and species richness. Other than riparian habitats, aspen forests support the highest biodiversity in the intermountain west (Kay 1997). Essentially, the Yellowstone Highlands are dominated by forests that have a low value for sustaining biodiversity, whereas forests that have high biological diversity are relatively scarce on the landscape.

Common understory associates of the lodgepole pine forests at sagebrush ecotones include mountain big sagebrush (*Artemisia tridentata* Nutt. subsp. *vaseyana* [Rydb.] Beetle), antelope bitterbrush (*Purshia tridentata* [Pursh] DC.), and Idaho fescue (*Festuca idahoensis* Elmer). Common interior canopy understory types include white spirea (*Spiraea betulifolia* Pall.), mountain snowberry (*Symphoricarpos oreophilus* A. Gray), grouse whortleberry (*Vaccinium scoparium* Leiberg ex Coville), arrowleaf balsamroot (*Balsamorhiza sagittata* [Pursh] Nutt.), silvery lupine (*Lupinus argenteus* Pursh), mountain brome (*Bromus marginatus* Nees ex Steud.), pinegrass (*Calamagrostis rubescens* Buckley), elk sedge, and Kentucky bluegrass (*Poa pratensis* L.) (Bowerman et al. 1999; USDA 2014). Douglas-fir–lodgepole pine dominance types contain understory plants that may include white spirea, mountain snowberry, pinegrass, and timothy (*Phleum pratense* L.) (USDA 2014).

There are approximately 77,429 acres (12.2% of land area) of Douglas-fir forest mapped in the Ashton-Island Park District (USDA 2014). However, most of this is mapped in the Centennial Range and on the southern slopes of the Island Park Caldera (within the Mountain Brush–Aspen Ecotone Conservation Target discussed elsewhere). There are scattered occurrences of Douglas-fir around Henrys Lake Flat, Thurmon Ridge, and in the southeast portion of the

Yellowstone Highlands within elevations of 6,100-7,500 ft (USDA 2014). Common understory components of this dominance type at ecotones and within forest canopies are Rocky Mountain Maple (*Acer glabrum*), Saskatoon serviceberry (*Amelanchier alnafolia*), mountain big sagebrush, snowbrush ceanothus (*Ceanothus cuneatus*), common (*Symphoricarpos albus*) and mountain snowberry, big huckleberry (*Vaccinium membranaceum*), grouse whortleberry, heartleaf arnica (*Arnica cordifolia*), balsamroot, silvery lupine, mule-ears (*Wyethia amplexicaulis*), western coneflower (*Rudbeckia occidentalis*), smooth brome (*Bromus inermis*), elk sedge, pinegrass, and basin wildrye (*Leymus cinereus*) (USDA 2014). Mature Douglas-fir trees along the caldera rim have had outbreaks of spruce budworm and Douglas-fir beetle in the past decade. These infestations have diminished, but could recur and expand with projected changes in climate (USDA 2014).

Mixed Conifer dominance types (existing various combinations of supalpine fir, Douglas-fir, lodgepole, and Engelmann spruce) occur around the Henrys Lake Flat and as a scattered component elsewhere in the Yellowstone Highlands within elevational ranges of 6,700 to 8,200 ft. Understory shrubs may include Rocky Mountain maple, basin big sagebrush (*Artemisia tridentata ssp. Tridentate*), mountain big sagebrush, snowfield sagebrush (*Artemesia spiciformis*), ceanothus, and mountain snowberry (USDA 2014). Spruce-fir dominance types (Engelmann spruce [*Picea engelmannii* Parry ex Engelm.] or Engelmann spruce–subalpine fir [*Abies lasiocarpa*] forests) have a minimal occurrence within the Yellowstone Highlands, primarily around Henrys Lake Flat. These forests have herbaceous understories of mountain brome, nodding bluegrass, white marsh marigold, and sticky geranium (USDA 2014).

Aspen is a minor, scattered component in the Yellowstone Highlands Montane Forest Mosaic. Only 3% of the land area is an aspen dominance type. Within these types understory shrubs variably present may include Rocky Mountain maple, Saskatoon serviceberry, low sagebrush, mountain big sagebrush, snowbrush ceanothus, chokecherry, antelope bitterbrush, white spirea, common snowberry, mountain snowberry, and thinleaf huckleberry. Herbaceous plants may include nettleleaf giant hyssop, sticky geranium, mule-ears, mountain brome, and bulbous bluegrass (USDA 2014).

Another 5% of the Ashton/Island Park Ranger Districts are mapped as either Aspen–Conifer or Conifer–Aspen (depending on relative compositions) (USDA 2014). These dominance types reflect the pervasive encroachment of aspen forests by conifers, primarily Douglas-fir in the Yellowstone Highlands. Widespread encroachment of conifers into aspen types has been further documented during a collaborative effort by the CTNF and Idaho Department of Fish and Game (IDFG) to assess risk to existing aspen during the summer of 2015 (IDFG and FS unpublished data).

Aspen forests are considered a Keystone Species, which is "a species that affects the survival and abundance of many other species in the community" and whose loss may result in a "relatively significant shift in the composition of the community and sometimes even in the physical structure of the environment" (Wilson 1992). The relatively scarce aspen composition in the Yellowstone Highlands, combined with the dominance of lodgepole pine, limits the value of the Yellowstone Highlands for sustaining biodiversity (Bartos and Amacher 1998), including Idaho SGCN.

Several montane forest habitats that occur in the Yellowstone Highlands are described by Hanson (2009) as being at greatest risk in the GYE. These are Aspen (1% of land area in GYE), low-elevation Douglas-fir (5% of GYE), mature and old growth coniferous forest (5% of GYE). The key threats in aspen habitat types are a lack of disturbance that reduces conifer encroachment and allows initiation of regeneration. Douglas-fir habitats are threatened by fire exclusion and rural residential development, while mature coniferous forests are most threatened by habitat fragmentation from roads (Hanson 2009).

Target Viability

Fair. Current dominance by even-aged lodgepole pine and habitat fragmentation by roads impact the quality of wildlife habitat in the Yellowstone Highlands.

Spotlight Species of Greatest Conservation Need: Great Gray Owl

The Great Gray Owl (*Strix nebulosa*) is North America's largest owl (in length but not weight) and occupies northern forests around the world. In North America its range encompasses most of the boreal forest of Alaska and Canada and montane forests in the northern Rockies and Sierra mountain ranges.

Great Gray Owl family in Yellowstone Highlands Douglas-fir forest
© TomVezo.com

Great Gray Owls nest in old raptor or corvid nests, broken-topped snags, dwarf mistletoe and rust brooms, or artificial structures in forest-dominated landscapes (Bouchart 1991). On the Targhee National Forest, most known Great Gray nests are in goshawk nests or in broken-topped snags (S. Derusseau, Wildlife Biologist CTNF, pers. comm.). In eastern Idaho, Great Grays commonly nest in lower montane mid- to late-successional Douglas-fir with an open understory. Elevation ranges of nests found in southeast Idaho and northwestern Wyoming ranged from 1,524 to 3,000 m (4,999 to 9,842 ft) with an average elevation of 2,078 m (6,816 ft) (Franklin 1988). Although nests sites are usually within relatively dense forest canopy, they are typically situated close to openings (Bouchart 1991). One study in Idaho found that the average distance from a Great Gray Owl nest to an opening was 143 m (Franklin 1987).

Forest openings that are relatively close to the nest site are important for adult foraging. Great Gray Owls feed primarily on Northern Pocket Gophers (*Thomomys talpoides*) and Voles (*Microtus spp.*) that are often abundant in meadows and other forest openings. After fledging, young

Great Gray Owls leave the nest and climb to adjacent roosts in the nest stand canopy. According to Franklin (1988), survival of young depends on the availability of roosts (particularly leaning or deformed trees accessible from the nest tree) that are high enough to provide protection from predators; and forested habitat within a 500 m radius surrounding the nest.

Great Gray Owls are an indicator of a healthy Montane Forest Mosaic because management of their habitat requires a landscape-scale and long-term view of forest succession (Hayward and Verner 1994). More specifically, Great Gray Owl conservation requires natural disturbance agents such as fire and insects to ensure adequate presence of foraging habitats including meadows and open forest, and forest management practices that allow mid- to lower-elevation conifers to transition to structurally complex later successional forests.

Prioritized Threats and Strategies for Montane Forest Mosaic

High rated threats to Montane Forest Mosaic in the Yellowstone Highlands

Altered fire regimes

Frequent, low–intensity fires maintain a naturally diverse stand composition and structure that benefits a wide range of wildlife including Idaho SGCNs. Fire-dependent habitats such as Dry Lower Montane–Foothill Forest were probably subject to a moderate severity fire regime in pre-settlement times, with fire return intervals of 30 to 100 years. Since 1900, fire suppression policies have contributed to densification of low– mid-elevation conifer forests. This eliminates more valuable conifer habitats, such as lodgepole pine/steppe grassland community types (Habeck 1994). It also results in fuel build-up and a likelihood of more severe fire regime, further exacerbating the lack of complexity in conifer forests.

Fire suppression has also greatly reduced the presence of aspen in the forested landscape on the Targhee National Forest. Over the past 150 years, there has been an estimated 40% decline in the amount of aspen acres on the Targhee National Forest, primarily due to fire suppression. This is a major decrease in composition from historic ranges of variability (USDA 1997).

The growth of the wildland–urban interface (essentially rural development at the forest boundary) complicates fire management due to the nearby presence of dwellings and other structures in forested habitat that might otherwise benefit from a burn.

Objective	Strategy	Action(s)	Target SGCNs
Manage forests for a diversity of structure and composition. Maintain or restore productive and diverse populations of plants. Maintain conifer types and early successional stages and	Use methods of vegetation treatment that emulate natural disturbance and successional processes. Restore natural disturbance regimes (e.g., beaver activity).	To the extent possible, Allow naturally-caused (lightning) fires to play their role in the ecosystem by allowing them to burn (i.e., Managing wildfire for resource benefit; CTNF Management Plan 2003 p. 3-4) Implement a variety of vegetation management projects on federal, state, and privately managed lands (these could include prescribed fire and mechanical treatments such as thinning, timber harvest, etc.) across the Section to return areas to early seral conditions. Although a variety of benefits can be realized from these projects,	Western Toad Great Gray Owl Olive-sided Flycatcher Clark's Nutcracker Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear Western Bumble Bee

Objective	Strategy	Action(s)	Target SGCNs
restore disturbance processes through beaver management, vegetation management, and fire.		restoration of proper ecological functions and benefits to wildlife habitat should be the primary drivers. When planning treatments on federal, state, and private lands, the treatment of noxious and invasive weeds should be integral to project planning, and appropriate actions both during and following project implementation should take place to prevent establishment of noxious/invasive weeds. Reintroduce beaver where appropriate.	Suckley's Cuckoo Bumble Bee Kriemhild Fritillary Monarch Gillette's Checkerspot

Motorized access & recreation (state, county, legal secondary roads)

Roads can have negative impacts on fish, amphibians, reptiles, birds, and mammals (Joslin and Youmans 1999). Numerous studies of wildlife have demonstrated physiological, displacement, and indirect impacts from active roads and trails (Canfield et al. 1999).

Roads on the Targhee National Forest are a significant source of fragmentation of forest habitats. As of 1997, there were approximately 2,791 miles of existing roads on the Targhee National Forest. According to the Targhee National Forest Revised Plan (1997) "the current road system has created resource conflicts with wildlife, fish and watersheds"(USDA 1997).

A common technique for managing the impacts of roads and trails on the Targhee National Forest is the use of administrative closures. However, according to Canfield et al. (1999) "Once the original purpose of a forest road is satisfied (normally a timber sale), management agencies tend to assume that daily traffic is primarily recreational in nature. Accordingly, many roads have been gated under the assumption that limited use by "administrative traffic" will not unduly disturb elk and other wildlife. Unfortunately, this assumption is untrue, and even a limited amount of administrative traffic behind closed gates provides more than adequate reinforcement of the avoidance behavior".

Objective	Strategy	Action(s)	Target SGCNs
Maintain adequate security habitat for wildlife.	Work with the appropriate land and road management agencies to ensure adequate security habitat during the development of road and trail projects.	Balance road density standards with the amount of secure habitat. Identify and evaluate for each project proposal and the cumulative effects of all activities, including past, current, and future projects. Continue to provide input into the planning process for all roads and new construction. Recommend that roads, trails, other infrastructure, etc., be located to avoid habitat components important to seasonal wildlife use (e.g., wintering Sharp-tailed Grouse, migrating Mule Deer and Elk, etc.).	Trumpeter Swan Sandhill Crane Great Gray Owl Olive-sided Flycatcher Clark's Nutcracker Wolverine Grizzly Bear

Objective	Strategy	Action(s)	Target SGCNs
		Recommend that new roads that are not compatible with area management objectives and are no longer needed be restricted or decommissioned. Where appropriate, recommend seasonal closures and/or vehicle restrictions bases on seasonal wildlife use.	

Target: Mountain Brush–Aspen Ecotone

The Mountain Brush–Aspen Ecotone encompasses the southwest and southern rim and slopes of the Island Park Caldera (Ashton Hill) and its slopes from Island Park to Ashton. It ranges in elevation from approximately 1,585-2,195 m (5,200 ft to 7,200 ft) and includes national forest lands at the upper and mid-elevations and private lands from mid-elevations down to the toe of the slope. The forest habitats at upper elevations are primarily Douglas-fir. Other forest dominance types mapped by USDA (2014) in order of relative abundance are Aspen, Conifer Mix, Douglas-fir–lodgepole pine mix, aspen–conifer mix.

Ashton Hill © Eddie Shea

The southwest portion of the ecotone (on public and private lands) is covered by the largest expanse of the Bigtooth Maple Mix dominance type on the Targhee National Forest. Trees and/or small forest stands scattered within the Bigtooth Maple complex include aspen, juniper woodlands, conifer, and conifer aspen mix (USDA 2014). This type has diverse shrub species that include bigtooth maple, Rocky Mountain maple, black hawthorn, Saskatoon serviceberry, low sagebrush, mountain big sagebrush, common chokecherry, and common snowberry. The lower slopes of the Mountain Brush–Aspen Ecotone are primarily privately owned with scattered inholdings of BLM and State of Idaho Lands (Fig. 8.1). The habitat types present in this zone are lower montane woodlands, Bigtooth Maple Mix, and sagebrush steppe (Fig. 8.3).

Sagebrush steppe occurs on foothills and lower slopes and is a vegetational transition between the woodlands and mountain brush of this ecotone to the relatively flat expanses of sagebrush-steppe of the Snake River Basalts Section. The dominant shrubs are mountain big sagebrush with bitterbrush. Common grasses are Indian ricegrass, needle-and-thread, Sandberg bluegrass, Idaho fescue, bluebunch wheatgrass, and basin wildrye. Forbs are diverse, their cover reflecting moisture availability (IDFG 2015).

Foothill and lower montane riparian shrublands along Sand Creek, Pine Creek, Spring Creek, and other permanent, intermittent, and ephemeral streams are scattered throughout the ecotone. A diverse mix of shrubs are present, especially willows, gray alder, black hawthorn, Woods' rose, chokecherry, common snowberry, golden currant, redosier dogwood, and Rocky Mountain maple. The herbaceous layer is diverse, but cover varies depending on the density of the shrub overstory and amount of flood-scouring (IDFG 2015).

At-risk quaking aspen stand with encroaching conifers (juniper and Douglas-fir) near Ashton, Idaho © Tamara Sperber

The vegetational mosaic in this landscape creates some of the richest wildlife habitat in the Ashton–Island Park area. This ecotone hosts high amphibian diversity including Western Toad (*Anaxyrus boreas*), Northern Leopard Frog (*Rana pipiens*), Columbia Spotted Frog (*Rana luteiventris*), Boreal Chorus Frog (*Pseudacris maculata*), and Blotched Tiger Salamander (*Ambystoma tigrinum melanostictum*). The rich shrub and forb diversity and complex vertical structure provide excellent habitat for breeding songbirds and Ruffed Grouse (*Bonasa umbellus*), winter habitat for Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*), transitional habitat for big game moving to and from winter range on the Sand Creek Desert, and fawning habitat for Mule Deer (*Odocoileus hemionus*). During mild winters, the lower slopes of this ecotone also provide big game wintering habitat.

Target Viability

Fair to Good. Conversion of habitat via rural residential development at lower elevations, associated fire suppression, and road development threaten the integrity and resiliency of aspen and mountain shrub communities on this landscape.

Prioritized Threats and Strategies for Mountain Brush–Aspen Ecotone

Very High rated threats to Mountain Brush–Aspen Ecotone in the Yellowstone Highlands

Altered fire regimes

Aspen is a key driver of wildlife values in the Mountain Brush–Aspen Ecotone. Aspen requires disturbance to regenerate and thwart conifer encroachment. In general, disturbance refers to natural or human-generated fire, logging, avalanche, etc. These disturbances all serve to reset succession away from dominant late seral conifers towards early seral aspen and mountain

shrublands. Fire plays an important role in the maintenance of seral stages and stand structure. Aspen regenerates after fire or stand disturbances through root sprouting. Conifer invasion, or encroachment, commonly a result of wildfire suppression policies dating back 100 years and activities such as improper timing and levels of livestock grazing that remove fine fuels and surface litter needed to carry fire, is likely the number one reason for aspen decline. Further, studies on aspen have determined that the transition from a fire-shaped ecosystem to one protected from fire results in profound changes in ratios of aspen to conifer and is the driver for changes in forest dynamics. In one study, conifer coverage increased from 15% to 50% and aspen decreased from 37% to 8% over a 100-year period (Gallant et al. 2003).

Objective	Strategy	Action(s)	Target SGCNs
Optimize extent of aspen and mountain brush communities.	Increase the number of acres of young age class/early seral stands. Improve diversity of age class structure/manage conifer encroachment. Protect, maintain and enhance remnant stands and high-quality stands.	To the extent possible, allow naturally caused (lightning) fires to play their role in the ecosystem by allowing them to burn (e.g., managing wildfire for resource benefit). Prescribed fire. Mechanical treatments. Consider the implementation of relevant design features/mitigation measures described in the Aspen Toolbox prepared by the Eastern Idaho Aspen Working Group (www.EIAWG.org) and other guidance documents when implementing mechanical treatments and prescribed fire. Often these measures should be incorporated to prevent damage to existing aspen trees and ensure survival of roots to provide for adequate suckering post treatment (Cox et al. 2009, Bartos 2007, Shepperd 2000).	Western Toad Sharp-tailed Grouse Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear Western Bumble Bee Suckley's Cuckoo Bumble Bee Monarch Gillette's Checkerspot

High rated threats to Mountain Brush–Aspen Ecotone

Rural housing development

Rural residential development expanded significantly along the lower elevation private lands within this area during the 1990s and early 2000s. Rural development in this area impacts important lower elevation habitats through direct loss and fragmentation. It also represents a systemic threat to habitat integrity of the Mountain Brush–Aspen Ecotone by undermining tolerance for beneficial wildfires and prescribed burns, which are necessary to sustain the biological value of the ecotone. Fire suppression on higher-elevation national forest lands also represents a threat to the viability of this conservation target.

Objective	Strategy	Action(s)	Target SGCNs
Work Collaboratively with Fremont County.	Where appropriate, provide technical service on fish and wildlife issues to	Provide timely technical service to Fremont county on potential impacts to important mountain brush habitat, SGCNs, big game migration, calving/fawning habitat to balance county growth with wildlife and habitat	Western Toad Northern Leopard Frog Sharp-tailed Grouse Silver-haired Bat Hoary Bat

Objective	Strategy	Action(s)	Target SGCNs
	County leaders.	protection.	Little Brown Myotis Wolverine Grizzly Bear Western Bumble Bee Suckley's Cuckoo Bumble Bee Monarch Gillette's Checkerspot
Protect and restore private lands.	Improve stewardship of mountain brush habitat on private lands. Advance ongoing easement programs for mountain brush habitat on private lands.	Support programs/efforts that facilitate partnership with willing private landowners to restore mountain brush habitat. Work with willing private landowners interested in protecting key parcels with conservation easements. Support conservation partners, (NRCS, Teton Regional Land Trust, TNC) in securing financial resources to support ongoing conservation easement acquisitions.	Western Toad Northern Leopard Frog Sharp-tailed Grouse Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear Western Bumble Bee Suckley's Cuckoo Bumble Bee Monarch Gillette's Checkerspot

Motorized access & recreation (state, county, legal secondary roads)

Outdoor recreation (hiking, camping, wildlife watching, photography, horse-back riding, motorized recreation) in the West is popular, due primarily to large tracts of public land available for use. All-terrain vehicles, including motorcycles, roads and trails, both managed and un-authorized, create management concerns and negative environmental impacts including proliferation of illegal roads/trails, creation of new pathways for the spread of invasive plants, soil erosion, displacement of wildlife sensitive to human and vehicle activity, habitat fragmentation, and sportsmen dissatisfaction.

Objective	Strategy	Action(s)	Target SGCNs
Maintain adequate security habitat for wildlife.	Work with the appropriate land and road management agencies to ensure adequate security habitat during the development of road and trail projects.	Balance road density standards with the amount of secure habitat. Identify and evaluate for each project proposal and the cumulative effects of all activities, including past, current, and future projects. Continue to provide input into the planning process for all roads and new construction. Recommend that roads, trails, other infrastructure, etc., be located to avoid habitat components important to seasonal wildlife use (e.g., wintering Sharp-tailed Grouse, migrating Mule Deer and Elk, etc.)	Sharp-tailed Grouse Wolverine Grizzly Bear

Objective	Strategy	Action(s)	Target SGCNs
		Recommend that new roads that are not compatible with area management objectives and are no longer needed be restricted or decommissioned. Where appropriate, recommend seasonal closures and/or vehicle restrictions based on seasonal wildlife use.	

Target: Riverine–Riparian Forest & Shrubland

Riverine aquatic, riparian, and wetland habitats occur in, and adjacent to, river and stream channels. They include floodplains and riparian vegetation influenced by stream channel hydrology. Riparian habitat is included in this definition of riverine wetlands and is described below. The dominant water sources are overbank flooding from the channel and subsurface shallow water table connections between the stream channel and wetlands (Brinson et al. 1995). Other water sources are overland runoff from adjacent uplands, tributaries, and precipitation. Flow may be perennial, perennial but interrupted, or ephemeral/intermittent. Surface flows are complex seasonally and in multiple directions. Water also moves laterally in the shallow groundwater table between the channel and riparian zones, as well as out of the system through infiltration into deep groundwater.

The Yellowstone Highlands encompasses portions of the Upper Henrys Fork subwatershed and the Teton subwatersheds of the Henrys Fork of the Snake River. The principal riverine features in the section are the Henrys Fork River, Buffalo River, Fall River, Warm River, Bitch Creek, and Teton River, which are important habitats for native fish and other biota. Much of the baseflow of these streams and rivers are supported by springs. The Yellowstone Cutthroat Trout (YCT; *Oncorhynchus clarkii bouvieri*) is the only trout native to the Henrys Fork and Teton watersheds (Behnke 1992), but widespread decline of the YCT in the Henrys Fork watershed has resulted from hybridization with Rainbow Trout (*Oncorhynchus mykiss*) and (Brook Trout (*Salvelinus fontinalis*) (Gregory and Griffith 2000). Native Mountain Whitefish (*Prosopium williamsoni*) are common throughout the drainage as are several species of nongame fish.

Teton River riverine habitat © Rob Cavallaro

Currently, the Henrys Fork River is a world-renowned sport fishery comprised of nonnative Rainbow Trout, Brown Trout, and limited numbers of YCT. The fisheries of the Upper Henrys Fork subwatershed (primarily located in the Yellowstone Highlands), and a short reach

of the lower Henrys Fork collectively, supports 851 jobs and an estimated annual economic contribution of 29 million dollars to Fremont County, Idaho communities. Total economic output is >50 million dollars (Loomis 2005).

The maintenance of the high-quality fishery in the upper Henrys Fork River is dependent on ensuring adequate winter baseflows and maintaining the integrity of winter refugia found at springheads. Both of these habitat elements are crucial for overwinter survival of juvenile trout (Van Kirk and Benjamin 2000).

The Teton River subwatershed is an important system for conservation of YCT, which has been an important catalyst for conservation in the Upper Snake Region of Idaho and within the GYE. YCT in the Teton subwatershed occurs sympatrically with nonnative Rainbow Trout, rainbow-cutthroat hybrids, and Brook Trout. Bitch Creek, a free-flowing tributary of the Teton River, is one of the two most important spawning tributaries for YCT in the Upper Snake Watershed in Idaho. In some reaches of this subwatershed, irrigation diversions have negatively impacted YCT by disrupting connectivity to spawning and rearing habitats or otherwise degrading habitats.

Riverine aquatic habitats in the Yellowstone Highlands provide regionally significant habitat for migrating and wintering waterbirds, particularly Trumpeter Swan and other waterfowl. The Henrys Fork, Buffalo, and Teton rivers are particularly important to wintering Trumpeter Swans that depend on the combination of open water habitat maintained by springs and aquatic vegetation to overwinter. Harriman Wildlife Refuge and Teton Basin are two Idaho Important Bird Areas (IBA) in the Yellowstone Highlands that were designated primarily for the value of their riverine habitats to waterbirds.

Terrestrial riparian habitats in the Yellowstone Highlands are primarily tree and shrub dominated. At higher elevations or in cold air drainages, Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) commonly form open riparian woodlands along streams with lush herbaceous understories. Typical riparian shrubs in higher, colder environments are willows (e.g., *Salix boothii*, *S. drummondiana*, and *S. geyeriana*), which sometimes form extensive stands filling valley bottoms with sedge (*Carex* spp.), bluejoint (*Calamagrostis canadensis*), or other herbs in the understory. At lower elevations, black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and quaking aspen (*Populus tremuloides*) line some stream and river reaches, with Rocky Mountain juniper (*Juniperus scopulorum*) in canyons. Typical lower elevation shrubs include coyote willow (*Salix exigua*), redosier dogwood (*Cornus sericea*), and black hawthorn (*Crataegus douglasii*). These riparian habitats provide important habitat for birds, bats, and pollinators, while stabilizing streambanks and providing large woody debris important for properly functioning aquatic habitat.

Target Viability

Fair to *Good.* Many reaches within the Caribou–Targhee National Forest have high-quality fisheries aquatic and riparian habitat while others are impacted by adjacent land use and/or water withdrawals (e.g., Box canyon, Henrys Lake Outlet) that impact both instream and riparian habitats. Less than 20% of rivers and streams in the Upper Henrys Fork and Teton subwatersheds are water quality limited. Sediment and nutrient pollution, flow alteration, and high temperature resulting from water diversion, irrigated agriculture, and livestock grazing are not common stressors (NPCC 2004). However, housing development, flow alteration and diversions for

agriculture, and riparian habitat fragmentation from land uses (e.g., livestock grazing) are locally important (NPCC 2004). Using the model of landscape integrity, which incorporates mapped land uses and stressors to estimate condition, Murphy et al. (2012*b*) found that 66% of riverine–riparian habitat in the Yellowstone Highlands is in Very Good condition and 26% is in Fair condition. However, this model may overestimate on-the-ground condition because it does not include the extent of nonnative species invasion and livestock grazing.

Several major water storage projects were completed in the upper Henrys Fork Basin during the early 20th century to support agricultural development on the Snake River Plain. In 1923, an organization of farmers constructed a dam across the Henrys Lake Outlet, raising Henrys Lake approximately 5 m and creating 111 million m^3 of storage (Van Kirk and Benjamin 2000). Grassy Lake Dam on the Fall River and Island Park Dam on the Henrys Fork were both completed in 1939. The Island Park Reservoir has 167 million m^3 of storage and has had profound effects on the hydrology and fisheries of the Upper Henrys Fork watershed (Van Kirk and Benjamin 2000). These projects have disrupted river hydrology by altering the natural hydrograph, leading to changes in riparian and aquatic habitat condition and function. In some reaches of this subwatershed, irrigation diversions have negatively impacted YCT aquatic habitat by disrupting connectivity to spawning and rearing habitats or otherwise degrading riparian habitat condition and function. Documented impacts to habitat quality in both the Upper Henrys Fork and Teton River subwatersheds include altered pool/riffle ratios, increased fine sediment, decreased shade and streambank stability, and nonnative species (NPCC 2004). The Upper Henrys Fork is also impacted by changes in discharge, while the Teton River is susceptible to excessive low flows (NPCC 2004).

Spotlight Species of Greatest Conservation Need: Trumpeter Swan

Trumpeter Swan, the largest waterfowl species in North America, was once threatened with extinction due primarily to unregulated harvest. Trumpeter feathers were sought after for quill pens, women's hats, and for use as powder puffs. Establishment of refuges and legal protection has brought Trumpeter Swan back from the brink and several populations are thriving. In Idaho, Trumpeter Swan is designated as an SGCN due to the small size of the breeding population and threats to its breeding and wintering habitat.

Trumpeters in eastern Idaho are part of the Rocky Mountain Population (RMP) that numbers approximately 7,000 individuals. Most RMP swans breed in Canada but there is a smaller struggling breeding flock in the Greater Yellowstone area (Idaho, Wyoming, Montana). Despite the ongoing recovery of RMP Trumpeter Swans, the viability of the Greater Yellowstone Flock remains a conservation challenge as production at nest sites in eastern Idaho and Yellowstone National Park are perennially low. In the Yellowstone Highlands, the average number of active Trumpeter Swan nest sites since 2012 is five (Henry 2012, 2013; Shea 2014*a*,*b*).

Nesting Trumpeter Swans require large, isolated, productive wetlands to breed. These sites are increasingly rare on many public lands. In an effort to increase the Greater Yellowstone population of Trumpeter Swan, IDFG, Teton Regional Land Trust, US Fish and Wildlife Service (FWS), Wyoming Wetlands Society, Trumpeter Swan Society, and private landowners are releasing captive-reared cygnets (young swans) into suitable habitat on conservation easement properties in Teton Valley. The goal is to establish a bond between the released cygnets and

selected wetlands that will result in eventual new swan breeding territories over the next 10–15 years. Other conservation initiatives in the Yellowstone Highlands include establishing nesting islands in potentially suitable breeding habitat, and wetland restoration/enhancement.

Wintering Trumpeters on the Teton River © Beach Huntsman

Although trumpeters breed in relatively low numbers in the State, eastern Idaho provides the most important winter habitat for trumpeters in the Rocky Mountains. Both Canadian and Greater Yellowstone birds winter along the Henrys Fork, South Fork, Teton, and Main Snake River corridors. In the Yellowstone Highlands, the most important wintering habitat is the Henrys Fork from Last Chance to Pine Haven and the Teton River including both valley and canyon reaches. In mid-winter, key habitats are shallow river reaches, sand/gravel bars, sloughs and their associated aquatic bed wetlands; and adjacent farm fields for foraging and loafing.

The Great Northern Land Conservation Cooperative has identified Trumpeter Swan as a conservation target for the Rocky Mountains due to its iconic status and sensitivity to climate-related impacts on its breeding habitat (Chambers et al. 2013).

Prioritized Threats and Strategies for Riverine–Riparian Forest & Shrubland

High rated threats to Riverine–Riparian Forest & Shrubland in the Yellowstone Highlands

Dams & water diversions

Several major water storage projects were completed in the upper Henrys Fork Basin during the early 20th century to support agricultural development on the Snake River Plain. In 1923, an organization of farmers constructed a dam across the Henrys Lake Outlet, raising Henrys Lake approximately 5 m and creating 111 million m^3 of storage (Van Kirk and Benjamin 2000). Grassy Lake Dam on the Fall River and Island Park Dam on the Henrys Fork were both completed in 1939. The Island Park Reservoir has 167 million m^3 of storage and has had profound effects on the hydrology and fisheries of the Upper Henrys Fork watershed (Van Kirk and Benjamin 2000).

Existing and proposed future diversions have the potential to limit the complexity of riverine aquatic and riparian systems and negatively impact YCT conservation.

Objective	Strategy	Action(s)	Target SGCNs
Preserve the ecological function of riverine aquatic and riparian habitat in the upper Henrys Fork and Teton subwatersheds.	Engage with BOR, Idaho Department of Water Resources, water users and the public on strategic issues related to current and future water use.	Provide technical expertise and input on crucial riverine habitats and habitat functions to help guide the ongoing BOR Henrys Fork Basin Study. Educate landowners and the public on the importance of natural hydrologic regimes for sustaining riparian vegetation and associated SGCNs.	Western Toad Northern Leopard Frog Trumpeter Swan Sharp-tailed Grouse Silver-haired Bat Hoary Bat Little Brown Myotis Grizzly Bear Western Pearlshell Pondsnail Species Group Rocky Mountain Duskysnail Monarch Gillette's Checkerspot A Caddisfly (*Glossosoma idaho*)
Maximize ecological function on the Henrys Fork River.	Optimize winter flows in the Henrys Fork.	Engage with water user groups on winter releases from Island Park dam, through participation in the Henrys Fork Watershed Council.	Trumpeter Swan Western Pearlshell Pondsnail Species Group Rocky Mountain Duskysnail A Caddisfly (*Glossosoma idaho*)
	Restore Henrys Lake Outlet riparian habitat.	Engage with landowners and other partners to establish/improve riparian habitat.	Western Toad Trumpeter Swan American White Pelican Sandhill Crane Franklin's Gull Ring-billed Gull California Gull Caspian Tern Silver-haired Bat Hoary Bat Little Brown Myotis Grizzly Bear Western Pearlshell Pondsnail Species Group Rocky Mountain Duskysnail Monarch Gillette's Checkerspot A Caddisfly (*Glossosoma idaho*)
Maximize ecological function on the Teton River.	Maintain hydrologic integrity of Bitch Creek.	Engage with stakeholders for protecting hydrologic, instream, and riparian habitat integrity.	Sharp-tailed Grouse Sandhill Crane Silver-haired Bat Hoary Bat Little Brown Myotis Grizzly Bear Western Pearlshell Pondsnail Species Group Rocky Mountain Duskysnail Monarch Gillette's Checkerspot A Caddisfly (*Glossosoma idaho*)

Objective	Strategy	Action(s)	Target SGCNs
	Where appropriate, restore/improve connectivity to fluvial tributaries of the Teton River.	Seek public-private partnership to improve hydrologic, instream and riparian habitat on Teton Creek, Trail Creek and other important fluvial tributaries of the Teton River.	Trumpeter Swan Sharp-tailed Grouse Sandhill Crane Long-billed Curlew Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear Western Pearlshell Pondsnail Species Group Rocky Mountain Duskysnail Kriemhild Fritillary Monarch Gillette's Checkerspot A Caddisfly (*Glossosoma idaho*)
Ensure reservoir operations protect existing riverine and wetland ecological function.	Work with stakeholders to develop reservoir management strategies.	Work with Henrys Fork Watershed Council.	Trumpeter Swan Common Loon Western Grebe American White Pelican White-faced Ibis Sandhill Crane Long-billed Curlew Ring-billed Gull California Gull Caspian Tern Western Pearlshell Pondsnail Species Group Rocky Mountain Duskysnail A Caddisfly (*Glossosoma idaho*)

Loss & degradation of habitat on private lands

The cumulative effects of human land uses have resulted in degradation or loss of riparian and aquatic habitat and the important functions they provide. Land uses causing impacts are agriculture and livestock grazing (medium in both Upper Henrys Fork and Teton subwatersheds), housing development (medium in Upper Henrys Fork, high in Teton), recreation, and, to a lesser extent, timber harvest (NPCC 2004). Other than housing development, all of these land uses occur on both public and private land. The following impacts have been documented at high levels in the Upper Henrys Fork and Teton River subwatersheds (NPCC 2004): reduced shading of streams by riparian trees and shrubs; decreased streambank stability; increased fine sediment; and higher noxious and invasive nonnative plant species populations. When deeply-rooted native trees, shrubs, and herbaceous riparian vegetation are reduced by development (and associated roads and bridges), livestock, and recreation, streambank stability declines, leading to sediment input and instream aquatic habitat changes (e.g., less woody debris, changes to pool/riffle ratios, etc. NPCC 2004). The loss of riparian habitat complexity and structure negatively impacts SGCN bats, amphibians, and pollinators, while also leading to less quality habitat for aquatic invertebrates and amphibians. Other observed stressors to riparian and aquatic habitat are related to floodplain development, such as armoring streambanks (e.g., rip-rap) and building of levees for flood control. Roads, bridges, and culverts associated with development are additional major stressors observed in the Yellowstone Highlands.

Cumulatively, land uses have fragmented riparian habitat, reducing connectivity necessary for species movements. This can disrupt species life stage needs and reduce genetic diversity.

Objective	Strategy	Action(s)	Target SGCNs
Conserve or restore the ecological integrity and function of streams and rivers in the Teton and Upper Henrys Fork River subwatersheds.	Collaborate with landowners and conservation partners to improve the ecological integrity and function of riverine aquatic and riparian habitat.	Support programs/efforts (e.g. conservation easements, Farm Bill programs, etc.) that educate landowners and facilitate partnership with willing landowners to restore and protect riverine aquatic and terrestrial riparian habitats. Determine riparian and stream channel condition and function, ownership status, restoration needs, sources of stressors, and management needs at a reach-specific scale through riparian condition and function assessments; incorporate SGCN habitat requirements. Implement site-specific projects based on site prioritization using assessment results. Develop site-specific implementation plans for stream channel and riparian vegetation restoration, including measurable objectives and time frames. Acquire and/or secure key riparian habitats through conservation easements, fee-title acquisition, landowner agreements, or long-term management rights. Seek public-private partnerships to improve hydrologic, instream, and riparian habitat on Teton Creek, Trail Creek, and other important tributaries of the Teton River. Where possible, restore or improve connectivity to fluvial tributaries of the Teton River. Improve stream channels and riparian habitats by removing unnecessary dikes and restoring natural meanders to straightened channels. Restore or stabilize stream reaches that have become unstable (e.g., braided channels, downcutting, etc.) due to land management practices. Engage with landowners and other partners in projects to establish and restore Henrys Lake Outlet riparian habitat. Monitor and evaluate the effectiveness of channel and riparian habitat protection, stewardship, and restoration; adapt management to meet objectives based on monitoring.	Western Toad Northern Leopard Frog Trumpeter Swan Sharp-tailed Grouse Silver-haired Bat Hoary Bat Little Brown Myotis Western Pearlshell Monarch Gillette's Checkerspot A Caddisfly (*Glossosoma idaho*)

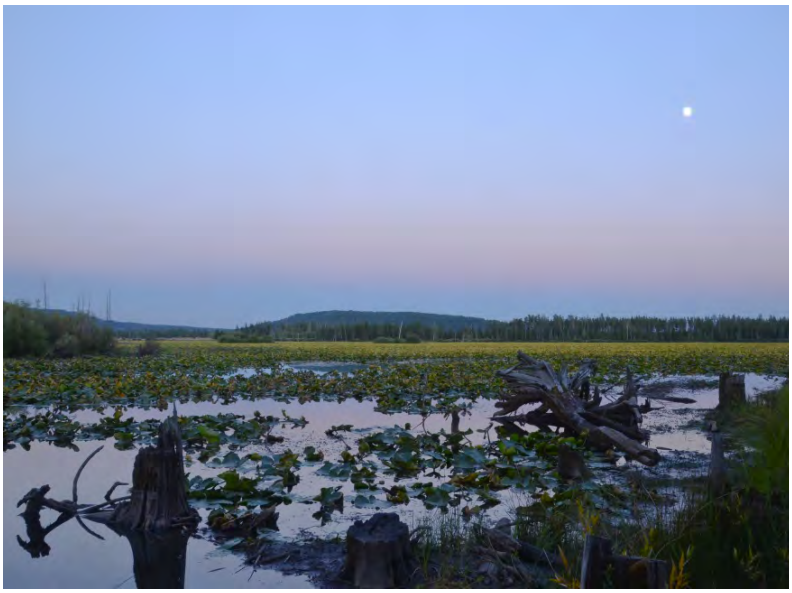
Changing precipitation patterns

Yellowstone National Park has experienced decreasing annual precipitation and increasing summer temperatures during the last 25 years, and drought is more common (McMenamin et al. 2008). As a result, riparian and wetland habitats and the species dependent on them are in decline (McMenamin et al. 2008, Ray et al. 2015). Similar climate change patterns and declines in riparian and wetland habitats are likely to occur throughout the Yellowstone Highlands based on observed and projected warming leading to increased evaporation and decreases in snow pack resulting in less snowmelt runoff for streams and rivers (Ray et al. 2015). Beavers have historically been important in the Yellowstone Highlands for slowing and storing surface water runoff, raising groundwater tables, expanding wetland habitat, and improving soil moisture for riparian vegetation (NPCC 2004). Restoration of beaver populations plays an important role in mitigating the effects of climate change in watersheds (Ray et al. 2015).

Objective	Strategy	Action(s)	Target SGCNs
Improve resiliency of riverine and riparian habitats to climate change through planning and actions.	Incorporate climate change data and models in strategic planning to guide research, management, and conservation actions to improve resiliency of riverine and riparian habitat.	Assemble and summarize relevant climate information, such as temperature, precipitation, and runoff data, needed for strategic climate change mitigation planning. Identify knowledge gaps that inhibit prioritization and action. Initiate research to address knowledge gaps. Combined with current and projected runoff data, identify the location, extent, and condition of streams and rivers most vulnerable to climate change (Ray et al. 2015) and which will benefit most from beaver reintroduction. Educate landowners and the public on the benefits of beavers for mitigating climate change impacts. Conduct beaver translocations into appropriate habitat identified during prioritization. Monitor and evaluate the effectiveness of riparian restoration and beaver reintroduction projects.	Western Toad Northern Leopard Frog Trumpeter Swan Sharp-tailed Grouse American White Pelican Silver-haired Bat Hoary Bat Little Brown Myotis Western Pearlshell Monarch Gillette's Checkerspot A Caddisfly (*Glossosoma idaho*)

Target: Wetlands

The dominant depressional and spring and groundwater-dependent wetland habitats in the Yellowstone Highlands are palustrine emergent and palustrine scrub-shrub (Jankovsky–Jones 1996). Lacustrine limnetic wetlands within ponds, lakes, and reservoirs are included in this target. Depressional Wetlands occur in shallowly-flooded depressions such as oxbows, created wetlands, shallow lakes and reservoirs, beaver ponds, and marshes. Spring and groundwater-fed wetlands are typically seeps and springs on gentle to steep slopes, including peatland fens, mesic and wet meadows, and shrub-dominated wetlands.

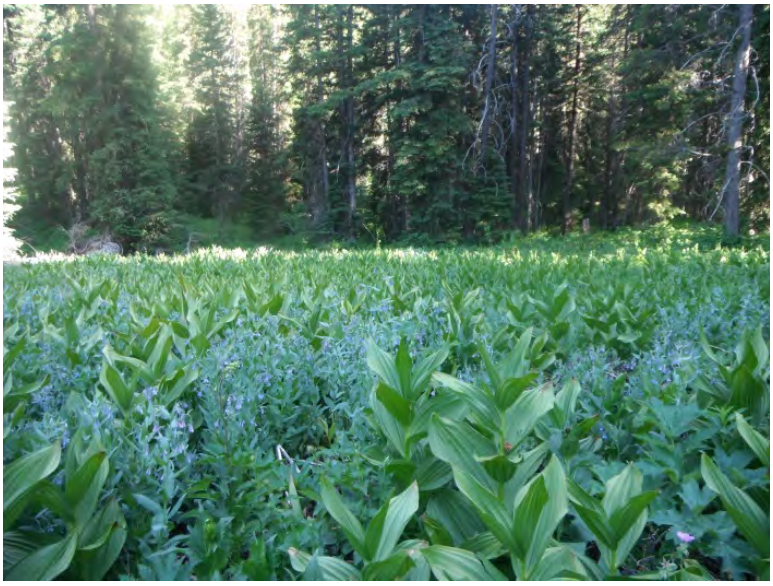


Mesa Marsh Targhee National Forest © Terry Thomas

Numerous large wetlands and wetland complexes in the Island Park area are associated with Henrys Lake, Island Park Reservoir, and springs. These waterbodies support diverse wetland types including aquatic vegetation, wet mudflat, emergent marsh, swamp forests, fens, and meadows. Lake- and reservoir-associated wetlands in Island Park are key habitats supporting SGCN waterbirds. Large volume springs originating on the eastern margin of the Island Park Caldera are important for supporting over 50% of the base flow of Henrys Fork above Ashton. These springs provide thermal refugia for fish and other aquatic biota all year (Van Kirk and Benjamin 2000), and open water areas for waterfowl, including Trumpeter Swan, during winter. Other springs support fens dominated by woollyfruit sedge (*Carex lasiocarpa*) and other specially adapted and rare plants. Vernal pools are scattered throughout coniferous forests on the CTNF. These small basins are typically <0.5 acre and their principal hydrologic source is snowmelt. There are approximately 2,200 acres of wet meadow habitats mapped on the Ashton–Island Park and Teton Basin Ranger Districts (USDA 2014). These meadows are most often dominated by graminoids, such as water sedge (*Carex aquatilis*), forbs such as California false hellebore (*Veratrum californicum*), or are weedy herbaceous communities. A number of ponds with marsh and aquatic vegetation such as Mesa Marsh, Upper and Lower Goose lakes, and Tule Lake provide the current or potential principal nesting habitats for Trumpeter Swan and Common Loon in the Yellowstone Highlands.

In Teton Valley, almost 10% of the land area is designated as wetlands. Dominant types are meadows, emergent marsh, and fens. Depressional Wetlands support emergent marshes dominated by sedges (*Carex* spp.), common spikerush (*Eleocharis palustris*), and bulrush (*Schoenoplectus* spp.). Common fen plants include bog birch (*Betula glandulosa*) and analogue sedge (*Carex simulata*). Meadows are frequently dominated by sedges (e.g., *Carex*

nebrascensis, *C. utriculata*), Baltic rush (*Juncus balticus*), shrubby cinquefoil (*Dasiphora floribunda*), and tufted hairgrass (*Deschampsia caespitosa*). Introduced forage grasses such as reed canarygrass (*Phalaris arundinacea*) characterize wetlands used for haying and livestock pasture. There are also several large created and restored wetlands and wetland complexes that are key habitats for avian wildlife. Many of these wetlands are concentrated along the Teton River corridor and occur on private lands.



California false hellebore meadow on the CTNF © Rob Cavallaro

Several sites from the Yellowstone Highlands are designated as statewide priorities for conservation by IDFG (Murphy et al. 2012*a*). The sites are Henrys Lake, Henrys Fork–Flat Ranch, and Teton Basin. All of these sites are threatened by changing precipitation patterns and rural residential development, but are also the focus of major collaborative public–private conservation efforts.

Henrys Lake has extensive wetland complexes along the north, east, and southwest lakeshores. Geyer's, Booth's, and diamondleaf willows (*Salix geyeriana*, *S. boothii*, *S. planifolia*) are present along streams entering the valley from adjacent mountains. Where springs are present, Wolf's and shortfruit willow (*Salix wolfii*, *S. brachycarpa*) communities are common. Rare white spruce (*Picea glauca*) swamps occur on the north lake shore, and five rare plant species are documented in this wetland complex (Murphy et al. 2012*a*). Henrys Lake is an Idaho IBA due to its importance to breeding and foraging waterbirds, including Red-necked Grebe (*Podiceps grisegena*), Trumpeter Swan, Greater Sandhill Crane (*Grus canadensis*), and American

Blue camas in wet meadow, Shotgun Valley © Rob Cavallaro

White Pelican (*Pelecanus erythrorhynchos*). TNC and other partners have protected approximately 3,600 acres of private lands around Henrys Lake that help to preserve and buffer wetland function.

The Henrys Fork–Flat Ranch site is a large wet meadow complex interspersed with springs, seeps, and creeks that subsidize flows of the Henrys Fork River. The site is a mosaic of meadow types, ranging from beaked sedge (*Carex utriculata*), common spikerush, and analogue sedge in wet depressions to tufted hairgrass on slightly drier soil. Booth's willow communities occur on streambanks and silver sagebrush (*Artemisia cana*) occurs on margins (Murphy et al. 2012*a*). TNC has protected approximately 1,300 acres of this area in the Flat Ranch Preserve. Most of the remaining area is private and State of Idaho lands. The extensive wet meadows support regionally significant nesting concentrations of Long-billed Curlew (*Numenius americanus*), Short-eared Owl (*Asio flammeus*), and Greater Sandhill Crane.

Teton Basin is an extensive wetland complex in the cold, high mountain basin between the Big Hole Range and Teton Mountains. Numerous fluvial streams from the west slope of the Tetons and spring-fed creeks emanating from the valley floor converge to form the headwaters of the Teton River. Among these spring-nourished habitats are large areas of peat soils (fen wetlands). Riparian and wetland communities along the Teton River and tributaries typically contain a mosaic of sedge, Baltic rush, grassy meadows, shrubby cinquefoil, willow riparian shrublands, and cottonwood and aspen forests. Within the Teton Basin there are several large subcomplexes including Woods Creek Fen, the Foster's Slough Wetland Complex, and the lower Teton Creek corridor that are individually recognized as Idaho wetland conservation priorities (Jankovsky–Jones 1996). Teton Regional Land Trust, based in Driggs, Idaho, has protected >11,000 acres of lands via conservation easement agreements with willing private landowners. Much of this protected land base protects or buffers important wetlands. Teton Basin is designated as an Idaho IBA due to its importance to nesting waterbirds, wintering Trumpeter Swans, and premigration staging Sandhill Cranes.

Other important large wetland complexes that are priorities for conservation in the Yellowstone Highlands include CTNF wetlands and Island Park Reservoir/Shotgun Valley.

CTNF wetlands are a crucial component of landscape-scale wetland conservation due to their extensive distribution across the Yellowstone Highlands landscape, type diversity, and relatively high functional value. The northern and western shore of Island Park Reservoir and adjacent Shotgun Valley support mudflats, aquatic vegetation, marsh, and meadow wetland types. The land ownership is a mix of Harriman State Park, BLM, private, and State of Idaho lands. In 2008, Island Park Reservoir was designated as an Idaho IBA. The foundation of the Island Park Reservoir IBA designation is the breeding bird concentrations in reservoir-influenced wetlands. During the nesting season, the north shore wetlands are used by at least 10,000 breeding birds representing a great variety of colonial waterbirds including Ring-billed (*Larus delawarensis*) and California Gull (*Larus californicus*), Caspian Tern (*Hydroprogne caspia*), Black-crowned Night Heron (*Nycticorax nycticorax*), Western Grebe (*Aechmophorus occidentalis*), Eared Grebe (*Podiceps nigricollis*), White-faced Ibis (*Plegadis chihi*), and American White Pelican. In late summer and early fall, the shallows and mudflats around the island support thousands of ducks, geese, and migrating shorebirds. Wet meadow habitats in Shotgun Valley support high concentrations of nesting Long-billed Curlew and provide regionally significant brood-rearing habitat for Greater

Sage-Grouse (*Centrocercus urophasianus*) nesting in the Sand Creek Desert. Several created wetlands on private lands support breeding and foraging habitat for Trumpeter Swans.

Target Viability

Good. Some wetlands are negatively impacted by anthropogenic factors, while others are highly functional (forest vernal pools and fens). Challenges to maintaining good ecological condition and maximizing ecological function of wetlands across the Yellowstone Highlands are improper livestock grazing, changing precipitation patterns, rural residential development, decreased beaver abundance, and both human-caused and natural disturbances. Using the model of landscape integrity, which incorporates mapped land uses and stressors to estimate condition, most wetlands in the Yellowstone Highlands are in Very Good condition (e.g., 58% of Depressional Wetlands, 55% of lakes, ponds, and reservoirs, and 64% of spring and groundwater-dependent wetlands; Murphy et al. 2012*b*). Although a substantial number of wetlands are in good ecological condition (especially in the Island Park area), where adequately buffered from forest practices, roads, or other development, this model likely overestimates on-the-ground condition because it does not accurately include the extent of nonnative species invasion and livestock grazing. For example, human land uses (e.g., mostly ranching and residential) comprised over 70% of the area adjacent to a limited number of Depressional Wetlands assessed in the Teton Basin (Murphy and Weekley 2012). These wetlands were in fair ecological condition, primarily impacted by hydrologic alterations, followed by nonnative plant species invasion and alterations to vegetation and soil (e.g., most often livestock related). However, substantial wetland conservation efforts are in place to protect and restore wetlands throughout the Upper Henrys Fork and Teton River subwatersheds.

Wetland habitat mosaic along lower Teton Creek © Rob Cavallaro

Spotlight Species of Greatest Conservation Need: Greater Sandhill Crane

The Intermountain West Joint Venture (IWJV) identified Greater Sandhill Cranes as an umbrella species to serve as a vehicle for wetland conservation in the Intermountain West. An umbrella species is "a species whose conservation is expected to confer protection to a large number of naturally co-occurring species" (Roberge and Angelstam 2004). According to the IWJV, Sandhill Cranes "had the broadest connectivity to partners across the Intermountain West, had high population reliance on Intermountain West landscapes, exhibited strong relationships to wetland habitats amenable to existing conservation programs, and possessed sufficient population-habitat data to inform planning models" (http://iwjv.org/wetland-focal-strategies). Therefore, conservation of Sandhill Cranes has the potential to benefit many other important wildlife species including invertebrates, fish, amphibians, reptiles, songbirds, waterfowl, and big game.

Sandhill Cranes and Trumpeter Swans foraging in a spring barley field in Teton Valley © Tamara Sperber

Sandhill Cranes in the Yellowstone Highlands are part of the Rocky Mountain Population (RMP) which includes approximately 20,000 birds. The breeding range for RMP cranes is centered around the Greater Yellowstone Area including the Yellowstone Highlands. Henrys Lake Flat and Teton Valley both support large nesting concentrations of Sandhill Cranes, and Teton Valley is one of the most important pre-migration staging areas for Rocky Mountain Sandhills in the West.

Sandhill Cranes arrive in Teton Valley from their wintering areas in the Central Rio Grande Valley of New Mexico and adjacent habitats in Mexico beginning in late March through April. Subadult, nonbreeding cranes often gather in unplowed grain fields, pastures, and other open habitats to forage and socialize in small flocks. Breeding adult cranes head straight for their wetland nesting territories. Isolated wetlands around the valley support nesting cranes, but the largest concentrations occur on the east side of the Teton River and on Henrys Lake Flat. During breeding, cranes require wetlands surrounded by protected open space ideally comprised of pasture, meadows, or sage steppe habitats. Wetlands are preferred nesting areas because of the increased cover afforded by flooded habitat, robust wetland vegetation, and abundant protein-rich food such as small mammals and invertebrates, which are crucial for egg-producing females and newly hatched chicks.

Sandhill Cranes lay 2 eggs, typically in the latter part of May. The chicks hatch after about 30 days. When the second chick has hatched, the adults move the family into dense cover where, for the next 2 months they will carefully attend their chicks as they grow and begin to develop flight. Isolated wetland habitats are crucial to support Sandhill Crane egg-laying, incubation, and early brood-rearing activities.

Sandhill Crane chicks fledge approximately 70 days after hatching and, by late August, many crane families and nonbreeding subadults are leaving their nesting/summering areas to gather in flocks at special premigration staging areas. In the Greater Yellowstone Area, the premigration period extends from late August to early October. This period is vitally important for Rocky Mountain Sandhill Cranes as it allows flocks to fully form while cranes forage intensively, usually in wetlands, pastures, and cutover barley and wheat fields prior to their long migration south.

Every night during the fall, Sandhill Crane flocks roost in isolated wetlands. Through the night, cranes rest while standing in water that comes partway up their legs but is not deep enough to wet their feathers. To consistently provide appropriate water levels from year to year for roosting cranes, it is necessary to have a variety of sheltered wetlands to allow for varying annual water conditions. Some managed wetland roosts are used consistently, while the use of natural roosts varies depending on available water.

In Teton Valley, crane flocks leave their night roosts to gather in harvested barley fields on the west side of the Teton River. Island Park nesting cranes may leave the area for fall premigration staging areas; or they may stage in large wet meadow complexes in the Yellowstone Highlands. Cranes prefer to forage as close to their night roosts as possible, usually within 2.5 km (IDFG unpublished data).

Prioritized Threats and Strategies for Wetlands

High rated threats to Wetlands in the Yellowstone Highlands

Improper livestock grazing management

Improper livestock grazing removes current growth, decreasing pollinator plants and altering habitat structure for other species. The productivity and survival of native trees, shrubs, and deeply rooted herbaceous species can decline, resulting in less soil stability. Soil can become compacted or eroded, resulting in stream head-cutting through meadows that lowers groundwater and leads to wetland replacement by upland species and nonnative invasive weeds. Increased fine sediment, decreased shading of aquatic communities, poor streambank stability, and larger populations of nonnative invasive plant species are all outcomes of improper livestock grazing documented in the Yellowstone Highlands (NPCC 2004). Livestock grazing is a medium level stressor across both Teton and Henrys Fork subwatersheds (NPCC 2004), mostly associated with Springs & Groundwater-Dependent Wetlands such as mesic and wet meadows, but also occurring in riverine–riparian habitat. However, this stressor can be locally high where improper livestock grazing directly impacts crucial habitat for SGCNs. For example, Mountain Marshsnail (Pondsnail) (*Stagnicola montanensis*) is absent from springs polluted by fine sediment that can result from trampling and overgrazing by livestock (Frest 1999).

Objective	Strategy	Action(s)	Target SGCNs
Protect, enhance, and restore ecological condition and function of springs and other wetland habitats negatively impacted by improper grazing.	Work with livestock operators to improve ecological condition of wetlands.	Inventory, prioritize, and map wetlands in need of restoration and protection based on condition and use by SGCNs. Use Best Management Practices to protect high priority sites. Work with land management agencies and private landowners to implement grazing regimes that promote sustaining and recruiting native trees, shrubs, and deeply rooted herbaceous species. Collaborate with federal and state land managers on allotment reviews and revisions. Educate partners, agency personnel, and livestock operators on the need for protecting and restoring wetlands.	Western Toad Northern Leopard Frog Trumpeter Swan Greater Sage-Grouse Sharp-tailed Grouse Sandhill Crane Long-billed Curlew Short-eared Owl Bobolink Silver-haired Bat Hoary Bat Little Brown Myotis Grizzly Bear Pondsnail Species Group Western Bumble Bee Suckley's Cuckoo Bumble Bee Kriemhild Fritillary Monarch

Loss & degradation of wetland habitat on private lands

The cumulative effects of human land uses have resulted in degradation or loss of riparian and aquatic habitat and the important functions they provide. Habitat fragmentation is a high level stressor in the Teton subwatershed and a medium level stressor in the Upper Henrys Fork (NPCC 2004). Land uses within, or immediately adjacent, to wetlands observed in the Yellowstone Highlands include agriculture (e.g., especially pasturing and haying), housing development, road construction and maintenance, trail development, and construction and maintenance of utility corridors (NPCC 2004). These activities often remove wetland vegetation, facilitate nonnative species invasion, increase water pollution (e.g., sediment, nutrients, bacteria, toxic chemicals), and degrade and fragment wildlife habitat. For example, the potential negative effects of water pollutants on amphibians are well studied. Across most groups of amphibians, water pollutant exposure (especially toxic chemicals) causes a moderate, but significant decrease in amphibian survival (14%) and biomass (8%), but an extremely large increase in the frequency of body abnormalities (Egea-Serrano 2012). In addition, people and pets disturb wildlife populations during recreational activities. Roads are associated with direct vehicle-caused wildlife mortality.

Objective	Strategy	Action(s)	Target SGCNs
Protect and restore wetlands on private lands using easements or related programs, with a focus on Henrys Lake Flat, Henrys Fork River, Teton Basin, Island Park Reservoir, and	Work with landowners and partners to protect and restore wetlands and improve stewardship on private lands using a variety of conservation programs and	Identify wetlands vulnerable to development and prioritize sites in need of protection and restoration. Support/initiate programs/efforts (e.g. Farm Bill, NAWCA, Soil Conservation Commission, etc.) that facilitate partnership with willing private landowners to restore and protect wetlands. Provide technical support to land trusts	Western Toad Northern Leopard Frog Trumpeter Swan Sharp-tailed Grouse White-faced Ibis Sandhill Crane

Objective	Strategy	Action(s)	Target SGCNs
Shotgun Valley.	mechanisms.	working with willing private landowners to protect wetlands with conservation easements or other tools. Support conservation partners, (NRCS, Teton Regional Land Trust, TNC, etc.) in securing financial resources to support conservation easement acquisitions. Seek public-private partnerships to identify willing landowners and funding to support a conservation easement program in Shotgun Valley. Work with Harriman State Park and willing private landowners to maintain extraordinary wetland values associated with the northwest shore of Island Park Reservoir, associated island habitat, and crucial Sage-Grouse and waterbird breeding areas.	Long-billed Curlew Short-eared Owl Bobolink Silver-haired Bat Hoary Bat Little Brown Myotis Grizzly Bear Pondsnail Species Group Western Bumble Bee Suckley's Cuckoo Bumble Bee Kriemhild Fritillary Monarch
Protect, maintain, and/or restore habitat and hydrologic function of springs, seeps, marshes, and meadows.	Collaborate with land management agencies, landowners, and NGOs to Implement projects to protect, maintain, and/or improve habitat and hydrologic function of springs, seeps, marshes, and meadows.	Work with land management agencies and private landowners to secure funds and create incentives for control of noxious weeds. Stabilize headcuts and raise the water table of incised channels in meadows, remove barriers to natural water movement in and out of wetlands. Restore wetland vegetation with locally adapted native trees, shrubs, and deeply rooted native herbaceous species. Where feasible, maintain or increase duration of saturation and shallow flooding in meadows and marshes. Where feasible, use mechanical disturbance, fire, herbicides (if safe for aquatic biota), seasonal flooding, seeding, and/or other treatments where appropriate and practical to increase diversity and productivity of wet meadows and marshes.	Western Toad Northern Leopard Frog Trumpeter Swan Greater Sage-Grouse White-faced Ibis Sandhill Crane Long-billed Curlew Short-eared Owl Bobolink Grizzly Bear Pondsnail Species Group Western Bumble Bee Suckley's Cuckoo Bumble Bee Kriemhild Fritillary Monarch

Changing precipitation patterns

Yellowstone National Park has experienced decreasing annual precipitation and increasing summer temperatures during the last 25 years, and drought is more common (McMenamin et al. 2008). As a result, the number of ponds and Depressional Wetlands completely drying up has increased 4-fold. This has led to a significant decline in amphibian populations, including

Western Toad (*Anaxyrus boreas*; McMenamin et al. 2008). Other species, including Trumpeter Swan and Sandhill Crane, may also be negatively impacted by long-term wetland desiccation (Ray et al. 2015). Similar climate change patterns and declines in Depressional Wetlands are likely to occur throughout the Yellowstone Highlands based on observed and projected warming leading to increased evaporation and decreased snowmelt runoff (Ray et al. 2015).

Objective	Strategy	Action(s)	Target SGCNs
Improve resiliency of wetland habitats to climate change through planning and actions.	Incorporate climate change data and models in strategic planning to guide research, management, and conservation actions (e.g., beaver restoration) to improve resiliency of wetland habitat.	Assemble and summarize relevant climate information, such as temperature, precipitation, and runoff data, needed for strategic climate change mitigation planning. Identify knowledge gaps that inhibit prioritization and action. Initiate research to address knowledge gaps. Combined with current and projected runoff data, identify the location, extent, and condition of wetlands most vulnerable to climate change (Ray et al. 2015) and which will benefit most from beaver reintroduction. Educate landowners and the public on the benefits of beavers for mitigating climate change impacts. Conduct beaver translocations into appropriate habitat identified during prioritization. Monitor and evaluate the effectiveness of riparian restoration and beaver reintroduction projects.	Western Toad Northern Leopard Frog Trumpeter Swan Greater Sage-Grouse Sharp-tailed Grouse White-faced Ibis Sandhill Crane Long-billed Curlew Short-eared Owl Bobolink Silver-haired Bat Hoary Bat Little Brown Myotis Grizzly Bear Pondsnail Species Group Western Bumble Bee Suckley's Cuckoo Bumble Bee Kriemhild Fritillary Monarch

Target: Henrys Lake Flat

This landscape includes Henrys Lake and the surrounding mosaic of mostly open habitats. It is a mix of land ownership including BLM, Idaho Department of Lands, Harriman State Park and one of the larger concentrations of private lands in Island Park. The Henrys Lake Flat (HLF) ranges in elevation from approximately 6,400–6,800 ft. Most of HLF is described by USDA (2014) as montane and riparian herblands. Common herbs of the lower elevations include pasture grasses, horsetail (*Equisetum* spp.), water sedge (*Carex aquatilis*), Nebraska sedge (*Carex nebrascensis*), Kentucky bluegrass (*Poa pratensis*), tufted hairgrass (*Deschampsis caespitosa*), common spikerush, Baltic rush (*Juncus balticus*), mule-ears (*Wyethia* spp.) and slender cinquefoil (*Potentilla gracilis*).

Dominant shrubs include shrubby cinquefoil (*Dasiphora floribunda*), Wolf's, Geyer's and Booth's willow (*Salix wolfii, S. geyeriana, S. boothii*) in riparian areas and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) in uplands. Cattails (*Typha latifolia*) are common flooded emergent plants. Forested habitat on the periphery of the HLF is primarily coniferous including lodgepole pine and Douglas-fir, although scattered aspen (*Populus tremuloides*) groves occur in various locations (BLM 1997). There are a variety of state rare plants that occur in the HLF including hoary willow (*Salix candida*) and green-keeled cottongrass (*Eriophorum viridicarinatum*). A rare white spruce (*Picea glauca*) community exists on the northwest corner of Henrys Lake.

The Nature Conservancy's Flat Ranch © TNC

HLF is identified by several agencies and/or nongovernmental organizations as a priority landscape for conservation. The BLM classifies Henrys Lake as an *Area of Critical Environmental Concern* (ACEC) due to its extraordinary value to wetlands and wildlife (BLM 1997). Specifically, BLM designated Henrys Lake, including the HLF, as an ACEC to facilitate "protection of riparian, wildlife, recreation, and water quality resources from land disposal, unrestricted rights-of-way, and development as well as other adverse impacts" and to "increase opportunities to pursue future protection and acquisition projects to augment the unique resources on public lands" (BLM 1997). TNC's 1,450 acre Flat Ranch Preserve, located on the HLF seven miles west of Yellowstone National Park, is a working cattle ranch where conservation and sustainable ranching practices are applied to promote highly functional habitats. The Flat Ranch is a lynchpin for surrounding private lands conservation and restoration. The IDFG identifies both HLF and the Flat Ranch as high conservation priorities in the *Idaho Wetland Conservation Prioritization Plans* (IDFG 2005; 2012). The BLM designation of HLF as an ACEC, along with protection of TNC's Flat Ranch, has helped generate interest and funds to work with willing private landowners interested in conservation. To date, TNC, BLM, and other partners have worked with private landowners to protect over 3,600 acres of private lands in permanent conservation easements.

IDFG formally designated HLF as an IBA due to its high value to breeding and migrating waterbirds. HLF is a regionally important Greater Sandhill Crane nesting area, subadult concentration area and, periodically, a fall staging area. The area also supports the highest known concentration of nesting Long-billed Curlews in east Idaho. Trumpeter Swan and other

waterfowl use Henrys Lake for foraging and roosting. Colony-nesting waterbirds that breed in Island Park Reservoir, Henrys Lake, Sheridan Reservoir, and other areas spend some time foraging on HLF. Special status colony-nesting species documented as breeding or foraging on HLF include Red-necked Grebe, Forster's Tern (*Sterna forsteri*), Caspian Tern, White-faced Ibis, Ring-billed Gull, California Gull, Franklin's Gull (*Leucophaeus pipixcan*) and American White Pelican.

The HLF's geographic position makes it an important zone of connectivity (and a potential barrier) for wildlife moving between Yellowstone National Park and surrounding national forest lands. This area is particularly crucial to big game and large carnivores.

Henrys Lake Flat as seen from the Henrys Lake Mountains © Rob Cavallaro

The HLF provides important fawning/calving and transitional habitat for Elk, Moose (*Alces alces*), Pronghorn (*Antilocapra americana*), Mule Deer, and White-tailed Deer (*Odocoileus virginianus*). The HLF provides summer habitat for these species, as well as important movement paths for seasonal migrants. During spring (late May to early June), Pronghorn from Montana move into the HLF by crossing Raynolds Pass and traveling southeast along the Henrys Lake Mountains. Many Pronghorn spend the summer in the HLF, while others proceed further south into other areas within the Island Park Caldera. Elk also use the HLF for calving. During an Elk calf survival and movement research project conducted in the spring of 2009, the sagebrush flats surrounding Henrys Lake (including the HLF) were heavily used for calving and early calf rearing (IDFG unpublished data).

Target Viability

Fair. Despite some public ownership and almost 5,000 acres protected in conservation easements, or other protected private lands, much of the HLF is threatened by current and potential rural housing development.

Spotlight Species of Greatest Conservation Need: Long-billed Curlew

Long-billed Curlew is a grassland-nesting sandpiper and the largest shorebird in North America. Curlews that breed in Idaho are known to winter in both California and Mexico in a variety of habitats, including shoreline/estuarine habitats of the Gulf of California and interior grassland and agricultural habitats of Mexico as well as the Central Valley and Imperial Valley (Salton Sea area) in California. In winter, Idaho curlews depend to some degree on wetlands and flooded agricultural fields for foraging (http://ibo.boisestate.edu/curlewtracking/locations). Long-billed Curlews arrive on their nesting grounds in the Yellowstone Highlands sometime in April, where males begin raucous vocal and aerial displays to establish territories and attract mates. Nest initiation timing can vary considerably depending on snowpack.

Long-billed Curlew nesting on the Henrys Lake Flat © Chris Little

Curlews nest on the ground, preferentially on flat, grazed grasslands. After hatching, Long-billed Curlew chicks move toward wetland habitats (Foster–Willfong 2003). Proximity to wetlands may influence nest site selection as chick mortality may be reduced with lesser travel distances to wetland habitats (Saalfield et al. 2010). Wetlands may also provide enhanced cover from predators.

A study evaluating multiscale habitat selection by Long-billed Curlews, across their breeding range in the US, found that curlew numbers are positively correlated with wetland habitats on a local scale and hay/pasture areas on a landscape scale. These results highlight the importance of a conservation strategy that incorporates large protected grassland landscapes, interspersed with emergent wetlands and/or irrigated hay and pasture lands (Saalfield et al. 2010).

The most important breeding habitat in the Upper Snake Watershed occurs in Henrys Lake Flat–Shotgun Valley and Teton Valley, primarily on private lands that have a combination of wet meadow/wetland habitats, open space, and livestock grazing. Maintaining these important nesting areas will require collaboration with working landowners to preserve traditional ranching practices and wetlands.

Prioritized Threats and Strategies for Henrys Lake Flat

Very High rated threats to Henrys Lake Flat in the Yellowstone Highlands

Rural housing development

Henrys Lake Flat is one of the larger blocks of private lands in island Park. Due to the natural and recreational amenities present in this landscape it has received high residential development pressure over the past 20 years.

Objective	Strategy	Action(s)	Target SGCNs
Work collaboratively with Fremont County.	Where appropriate, provide technical service on fish and wildlife issues to county leaders.	Provide timely technical service to Fremont County on potential impacts to important wetlands, SGCNs, big game migration, and calving/fawning habitat to balance county growth with wildlife and habitat protection.	Western Toad Trumpeter Swan Western Grebe Sandhill Crane Long-billed Curlew Great Gray Owl Short-eared Owl Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear Western Bumble Bee Suckley's Cuckoo Bumble Bee Monarch Gillette's Checkerspot
Protect and restore wetlands on private lands.	Improve stewardship of wetland habitat on private lands.	Support programs/efforts that facilitate partnership with willing private landowners to restore wetlands.	
	Advance ongoing easement programs for wetlands on private lands in HLF.	Work with willing private landowners interested in protecting key parcels with conservation easements. Support conservation partners, (NRCS, Teton Regional Land Trust, TNC) in securing financial resources to support conservation easement acquisitions. Support TNC in their efforts to maximize wetland function and wildlife values on the Flat Ranch Preserve.	

Target: Ungulate Migration

The Yellowstone Highlands is part of an ungulate migration complex that includes high-elevation lands of Yellowstone National Park and the Targhee National Forest, mid-elevation stopover, fawning and calving habitats found in Shotgun Valley, HLF, the south rim of the Island Park Caldera, and Teton Basin. It also includes portions of regionally significant wintering areas, specifically the Teton River Canyon System (including lower Bitch and Badger Creeks) and the Sand Creek Desert. Therefore, maintaining ungulate migration as an ecological function in the

Yellowstone Highlands is more difficult than just protecting a single "corridor." Rather, conserving ungulate migration requires coordination of conservation action that maintains habitat quality (including security) on national forest lands, recognizes and protects key seasonal ranges on private lands, and maintains permeability of highways and forest roads.

Heavy winter snow accumulations make the Yellowstone Highlands Ecosection unsuitable for most wintering ungulates (a portion of the Moose populations are year-round residents of the Ecosection; Andreasen et al. 2014). However, these same moist conditions, relative to the neighboring sagebrush-steppe habitats, result in desirable vegetation composition and spring-fall vegetation growth, making this Ecosection high-quality transition range and spring-fall habitat for Mule Deer, White-tailed Deer, Moose, Elk, and Pronghorn. Therefore, seasonal migration is a necessity for most ungulates using this section as they winter at lower elevations outside of the Ecosection and migrate into or through the Yellowstone Highlands to take advantage of spring fawning/calving habitats and lush spring-fall forage within or adjacent to this Ecosection.

Most Elk, Mule Deer, and Moose inhabiting the central portion of the Yellowstone Highlands during the spring-fall migrate to the west and southwest into the sagebrush-steppe habitats of the Sand Creek desert to winter (Brown 1985, Andreasen et al. 2014). Most Elk and Moose inhabiting the southern portion of the Ecosection on the west slope of the Teton Range will move west to winter in the foothills and riparian bottoms of Teton Valley. Most Mule Deer inhabiting this portion of the Ecosection will move west into the canyon habitats of the Teton River, Bitch Creek, Badger Creek, and Falls River to winter. Most Elk inhabiting the northern portion of the section around Henrys Lake will move north into the Madison Valley of Montana to winter. Pronghorn summering in the northern portion of the Ecosection will also move north into Montana's Madison Valley or southwest into the sagebrush-steppe habitats of Shotgun Valley or the Sand Creek desert. Less is known about the seasonal movements of White-tailed Deer in the Ecosection, though they likely move to the riparian portions of many of the same winter habitats described above. Fall migrations out of the Ecosection typically occur in November, though the exact timing is species

Cow Elk in Yellowstone Highlands © Rob Cavallaro

and snowfall dependent (i.e., smaller ungulates like Mule Deer migrate with less snowfall than larger ungulates like Elk).

During the returning spring migration (typically during May), many pregnant females will take advantage of lush transition range habitats within the Ecosection (e.g., aspen habitats) for mid-migration parturition. Once the newborn is able to travel, the migration continues. Brown (1985) describes important Elk calving habitats (e.g., Big Bend Ridge), migration corridors, and calf-rearing habitats (i.e., summer range) within the Ecosection that are still used today. Many of these same areas are used for parturition by migrating Mule Deer and Moose.

Some migrating ungulates use this Ecosection solely as transition range as they pass through it to summer ranges in Yellowstone National Park, Teton National Park, or Wyoming. Elk migrate along the northern edge of the Ecosection from the Madison Valley of Montana into Yellowstone National Park (Hamlin and Ross 2002, Grigg 2007). Some Elk and Mule Deer migrate from the Sand Creek desert, through the south-central portion of the Ecosection north of Ashton, into the southwest corner of Yellowstone National Park (Brown 1985). Still other Mule Deer and Elk migrate out of Teton Canyon and the Teton Valley through the southern tip of the Ecosection into summer ranges in Teton National Park and Wyoming as far east as Jackson Lake.

Mule Deer moving into Bitch Creek in the Yellowstone Highlands © Rob Cavallaro

Target Viability

Good, although there are significant threats to future viability. US Hwy 20 presents a threat to connectivity, and potential expansions to the route would decrease permeability. Rural residential developments also pose current and future threats to key seasonal habitats in Teton basin, Shotgun Valley, HLF, and Ashton Hill.

Prioritized Threats and Strategies for Ungulate Migration

Very High rated threats to Ungulate Migration in the Yellowstone Highlands

Rural housing development

Most transitional and winter habitats used by big game in the Yellowstone Highlands are a mosaic of public and privately owned lands. Key habitats such as the Teton Canyon System, Teton Front, Ashton Hill/Big Bend Ridge, Shotgun Valley, and Henrys Lake Flat are all impacted by rural residential development and have the potential to be further fragmented by future development.

Objective	Strategy	Action(s)	Target SGCNs
Protect core big game habitats on public lands to help minimize potential bottlenecks/impacts on adjacent private lands.	Participate in Idaho Falls District BLM Resource Management Plan Revision to protect important big game habitat on public lands.	Incorporate big game transitional, winter and other key habitats into long-range planning process.	Western Toad Northern Leopard Frog Greater Sage-Grouse Sharp-tailed Grouse Sandhill Crane Great Gray Owl Olive-sided Flycatcher Clark's Nutcracker Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear
	Participate in BLM Resource Advisory Committee.	Communicate with committee members on issues related to conservation of important big game habitats.	
	Engage with Caribou–Targhee National Forest staff.	Incorporate big game transitional, winter and other key habitats into project and long-range planning process.	
Protect regional big game migrations across a mosaic of land ownership.	Advance public/private partnership through the High Divide Conservation partnership.	Implement strategic protection and stewardship of lands between Yellowstone National Park and the Frank Church Wilderness to ensure long-term protection of big game winter, transitional, and other habitats.	Western Toad Northern Leopard Frog Greater Sage-Grouse Sharp-tailed Grouse Sandhill Crane Great Gray Owl Olive-sided Flycatcher Clark's Nutcracker Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear
Work Collaboratively with Fremont and Teton County.	Where appropriate, provide technical service on fish and wildlife issues to county leaders.	Work with Teton County to refine/update their Natural Resource Overlays as appropriate. Provide timely technical service to counties on potential impacts to important big game habitat.	Western Toad Northern Leopard Frog Greater Sage-Grouse Sharp-tailed Grouse Sandhill Crane Great Gray Owl Olive-sided Flycatcher Clark's Nutcracker Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine
Protect and restore big game habitat on private lands.	Improve stewardship of big game habitat on private lands.	Support/Initiate programs/efforts that facilitate partnership with willing private landowners to protect big game habitat.	

Objective	Strategy	Action(s)	Target SGCNs
	Advance ongoing easement programs protecting wildlife movement on private lands in HLF, Henrys Fork River, and Teton Basin.	Support land trusts working with willing private landowners interested in protecting big game winter, transitional, and other habitats with conservation easements. Support conservation partners, (NRCS, Teton Regional Land Trust, TNC) in securing financial resources to support conservation easement acquisitions.	Grizzly Bear
	Expand partner-driven big game protection program into Shotgun Valley.	Seek public-private partnership to identify willing landowners and funding to support a conservation easement program in Shotgun Valley.	

Motorized access & recreation (US, state, county, legal secondary roads)

The negative effect of roads is recognized as a major impact to wildlife populations worldwide (Eigenbrod et al. 2009). Road ecology has developed into an important discipline of wildlife management with increasing contributions to wildlife journals, books, conferences, symposia, and management guidelines (Eifgenbrod et al. 2009). In addition to direct mortality from vehicle collisions, road ecologists have identified the "road-effect zone," which is the extent of significant ecological effects from the edge of a road.

The primary vehicular access into and through the Yellowstone Highlands is US Highway 20, commonly referred to as the Yellowstone Highway. US 20 connects the communities of the Snake River Plain in east Idaho, and tourists from around the world, with West Yellowstone, Montana and Yellowstone National Park. US 20 through the Yellowstone Highlands bisects the migration routes of Elk, Moose, Mule Deer and other wildlife, and the impacts of highway crossings on regional ungulate migrations is a substantial regional concern (Andreasen et al. 2014). Other highways with implications for current and future wildlife movement are Idaho State Highways 87, 33, and 32. There are 615 mi of motorized roads on the Ashton–Island Park Ranger District and as of 1997, there were approximately 2,791 miles of existing legal roads on the Targhee National Forest. According to the Targhee National Forest Revised Plan (1997) "the current road system has created resource conflicts with wildlife, fish and watersheds" (USDA 1997).

Objective	Strategy	Action(s)	Target SGCNs
Maximize permeability of highways for ungulates in the Yellowstone highlands.	Collaborate with the Idaho Transportation Department (ITD) and other partners to incorporate best practices for wildlife crossing into highway planning and construction.	Work with ITD, Fremont County, and the Henrys Fork Legacy Partnership to develop strategies and actions that enable improved function of ungulate migrations across US Highways 20 and 87 in Island Park. Work with ITD and Teton County to enable improved function of ungulate migrations across US Highways 32 and 33.	Wolverine Grizzly Bear

Objective	Strategy	Action(s)	Target SGCNs
Maintain adequate security habitat for important seasonal big game habitats on public lands.	Work with the appropriate land and road management agencies to ensure adequate security habitat during the development of road and trail projects.	Balance road density standards with the amount of secure habitat. Identify and evaluate for each project proposal and the cumulative effects of all activities, including past, current, and future projects. Continue to provide input into the planning process for all roads and new construction. Recommend that roads, trails, other infrastructure, etc., be located to avoid habitat components important to seasonal wildlife use (e.g., wintering Sharp-tailed Grouse, migrating Mule Deer and Elk, etc.) Recommend that roads that are not compatible with area management objectives and are no longer needed be restricted or decommissioned. Where appropriate, recommend seasonal closures and/or vehicle restrictions based on seasonal wildlife use.	Western Toad Northern Leopard Frog Greater Sage-Grouse Sharp-tailed Grouse Sandhill Crane Great Gray Owl Olive-sided Flycatcher Clark's Nutcracker Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear

Target: Grizzly Bear

Grizzly Bear was listed as threatened under the Endangered Species Act (ESA) in 1975 due to population declines that limited Grizzlies to 2% of their historic range south of Canada. In 2007, the FWS designated Grizzlies in the Greater Yellowstone area as a Distinct Population Segment (Yellowstone DPS) and removed them from the federal list of endangered and threatened wildlife (FWS 2007). According to the FWS,

> *The Yellowstone grizzly bear population is no longer an endangered or threatened population pursuant to the Endangered Species Act of 1973, as amended, based on the best scientific and commercial data available. Robust population growth, coupled with State and Federal cooperation to manage mortality and habitat, widespread public support for grizzly bear recovery, and the development of adequate regulatory mechanisms has brought the Yellowstone grizzly bear population to the point where making a change to its status is appropriate (Federal Register 2007).*

In this action, the FWS recognized recovery in the Yellowstone DPS, while maintaining ESA protection for the remaining Grizzly Bear populations in the contiguous US (FWS 2007). In 2009, a federal district judge overturned the delisting ruling, placing Grizzly Bears back on the threatened species list claiming: "(1) the Conservation Strategy that guides management after delisting was unenforceable and nonbinding on state and federal agencies, and (2) that the FWS did not adequately consider the impacts of the potential loss of whitebark pine nuts, a Grizzly Bear food source." An appeals court upheld this ruling in 2011.

In 2013, the Interagency Grizzly Bear Study Team (IGBST) published Response of Yellowstone Grizzly Bears to changes in food resources: a synthesis (IGBST 2013) to address concerns over the impacts of potential loss of whitebark pine nuts as a food source. In 2013, the Yellowstone Ecosystem Subcommittee accepted the findings in this report and recommend that Grizzly Bears be removed from their ESA Threatened status.

The Grizzly Bear Recovery Plan was established in 1993 and revised in 2006 and established the goal of sustaining the Grizzly Bear population at or above 500 bears in the GYE. The current minimum population estimate for the Yellowstone Grizzly DPS is 714 (IGBST 2014). Another indication of recovery is that annual population growth of Grizzlies in the Yellowstone DPS has slowed (Van Manen et al. 2015). A study of vital rates of Grizzly Bears in the Yellowstone DPS found that the slowing population growth of Grizzly Bears is most strongly associated with increasing Grizzly Bear density and likely indicates that the population is at or approaching carrying capacity (Van Manen et al. 2015).

Grizzly Bear Information sign on the CTNF © Rob Cavallaro

Despite population recovery of Yellowstone Grizzly Bears, they remain a conservation reliant species (Schwartz et al. 2009). According to Scott et al. (2005), a species is conservation reliant when the threats to its persistence cannot be eliminated, but require continuous management to maintain population levels. The primary threat facing Grizzly Bears in the Yellowstone DPS is human-caused mortality; and a primary management challenge is managing and monitoring this mortality. This may be a particular challenge in the Yellowstone Highlands of Idaho where hazards affecting Grizzly Bear survival are elevated relative to other areas of the Yellowstone DPS (Schwartz et al. 2009). Schwartz et al. (2009) completed a risk assessment model for Yellowstone Grizzlies and identified the two most important predictors of survival as 1) the amount of secure habitat within a bear's home range and 2) road densities outside of secure habitat. Island Park within the Yellowstone Highlands is identified as a high risk landscape for Grizzly Bear mortality in this model (Schwartz et al. 2009).

Due to the robust Grizzly population and presence of anthropogenic threats, reducing and resolving human-bear conflicts will be an important management activity in the Yellowstone Highlands. Conflicts are incidents where bears injure people, damage property, obtain

anthropogenic foods, kill or injure livestock, damage beehives, or obtain vegetables or fruit from gardens or orchards (Gunther et al. 2004). The Idaho portion of the Yellowstone DPS has had a generally increasing trend of Grizzly Bear-human conflicts since 2005 (IGBST 2014). In 2014, 2 Grizzlies were killed, one illegally by a hunter and a second in a management response resulting from livestock depredation (IGBST 2014). In 2015, 2 Grizzlies were killed in management actions that resulted from conflicts related to bears seeking anthropogenic food sources and subsequently threatening human safety.

The IGBST has proposed designation of a Demographic Monitoring Area (DMA; Fig. 8.4) to monitor and manage Grizzly Bear mortalities in the future across state and administrative boundaries. The DMA is drawn from suitable habitat defined by the FWS (2007), expanded to include adjacent potential mortality sink areas to facilitate mortality management in a scope appropriate to long-term conservation (IGBST 2012). Most of the DMA in Idaho lies within the Yellowstone Highlands and adjacent areas of the Henrys Lake Mountains, Centennial Range, Shotgun Valley, and Teton Valley.

Upon delisting, management of Yellowstone Grizzlies in Idaho will be guided by the Yellowstone Grizzly Bear Management Plan (2002), prepared by Idaho's Yellowstone Grizzly Bear Delisting Advisory Team. The recommendations in the table below are derived from this plan.

Target Viability

Good. The Grizzly population in the Yellowstone Highlands has likely reached its biological and social carrying capacity.

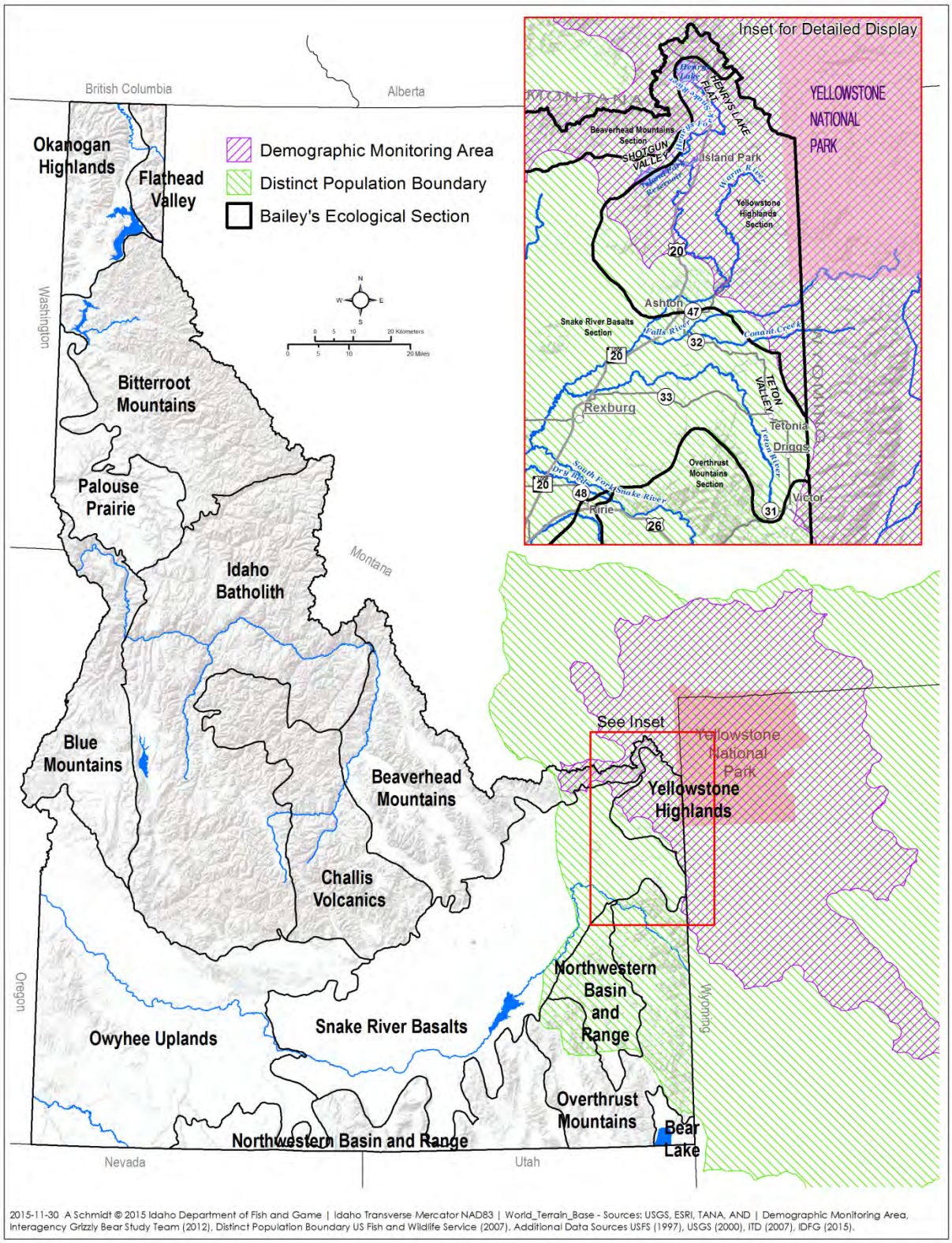


Fig. 8.4 Proposed Grizzly Bear Demographic Monitoring Area (DMA) Map

Prioritized Threats and Strategies for Grizzly Bear

High rated threats to Grizzly Bear in the Yellowstone Highlands

Human–wildlife conflict

The primary threat facing Grizzly Bears in the Yellowstone DPS is human-caused mortality; and a primary management challenge is managing and monitoring this mortality. This may be a particular challenge in the Yellowstone Highlands of Idaho where hazards affecting Grizzly Bear survival are elevated relative to other areas of the Yellowstone DPS (Schwartz et al. 2009). Schwartz et al. (2009) completed a risk assessment model for Yellowstone grizzlies and identified the two most important predictors of survival as 1) the amount of secure habitat within a bear's home range and 2) road densities outside of secure habitat. Island Park within the Yellowstone Highlands is identified as a high risk landscape for Grizzly Bear mortality in this model (Schwartz et al. 2009).

Due to the robust Grizzly Bear population and presence of anthropogenic threats, reducing and resolving human-bear conflicts will be an important management activity in the Yellowstone Highlands. Conflicts are incidents where bears injure people, damage property, obtain anthropogenic foods, kill or injure livestock, damage beehives, or obtain vegetables or fruit from gardens or orchards (Gunther et al. 2000). The Idaho portion of the Yellowstone DPS has had a generally increasing trend of Grizzly Bear–human conflicts since 2005 (IGBST 2014). In 2014 two grizzlies were killed, one illegally by a hunter and a second in a management response resulting from livestock depredation (IGBST 2014). In 2015, two grizzlies were killed in management actions that resulted from conflicts related to bears seeking anthropogenic food sources and subsequently threatening human safety.

Objective	Strategy	Action(s)	Target SGCNs
Minimize/manage conflicts with rural communities, recreationists, and livestock producers in Grizzly Bear country.	Develop, implement, and disseminate a coordinated information and education program to minimize human–Grizzly Bear conflict.	Provide education programs through schools, community presentations, news releases, etc. Continue to cooperate with Federal Resource Management agencies to provide safety literature at trail heads and offices in Grizzly Bear habitat. Support local efforts that develop "Bear Smart Communities." Coordinate with other agencies to develop bear education programs for specific user groups (hunters, anglers, campers, etc.)	Grizzly Bear
	Work with county planners in bear country to consider Grizzly Bear–human safety in county planning.	Provide technical service during community planning related to strategies for avoiding potential human/bear conflicts.	Grizzly Bear
	Respond in a timely and	Work with the public and agency partners to remove or mitigate the source of conflict.	Grizzly Bear

Objective	Strategy	Action(s)	Target SGCNs
	efficient manner to nuisance bear conflicts.	Remove bears from the population when they present an imminent public safety risk or will be an ongoing source of livestock depredation.	
Reduce anthropogenic factors that promulgate Grizzly Bear mortality.	Advance easement programs to minimize potential human/bear conflicts.	Support land trusts working with willing private landowners interested in protecting rural lands with conservation easements in the Yellowstone Highlands.	Western Toad Northern Leopard Frog Trumpeter Swan Greater Sage-Grouse Sharp-tailed Grouse Sandhill Crane Long-billed Curlew Great Gray Owl Short-eared Owl Silver-haired Bat Hoary Bat Little Brown Myotis Wolverine Grizzly Bear
	Work with the appropriate land and road management agencies to ensure Grizzly Bear security considerations during the development of road and trail projects.	Balance road density standards with the amount of secure habitat. Identify and evaluate for each project proposal and the cumulative effects of all activities, including past, current, and future projects. Continue to provide input into the planning process for all roads and new construction. Recommend that roads, trails, other infrastructure, etc., be located to avoid habitat components important to Grizzly Bears. Recommend that roads that are not compatible with area management objectives and are no longer needed be restricted or decommissioned. Where appropriate, recommend seasonal closures and/or vehicle restrictions based on Grizzly Bear or other resource needs.	

Yellowstone Highlands Section Team

An initial version of the Yellowstone Section project plan was completed for the 2005 Idaho State Wildlife Action Plan. In 2014, a small working group developed an initial draft of the Section Plan (see Miradi v. 0.9), 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 Southeast Regional office, Pocatello in January 2015 (this input captured in Miradi v 0.14). Subsequent to that workshop, team leads hosted a 1-day meeting in February 2015 with key US Forest Service staff to seek their input. Since then, we have continued to work with key internal and external stakeholders to improve upon the plan. Individuals, agencies, and organizations involved in this plan are listed in Table 8.3.

Table 8.3 Individuals, agencies, and organizations involved in developing this plan [a]

First name	Last name	Affiliation
Rob	Cavallaro* [b]	Idaho Department of Fish and Game, Upper Snake Region
Matt	Pieron*	Idaho Department of Fish and Game, Upper Snake Region
Rita	Dixon	Idaho Department of Fish and Game, Headquarters
Mark	Arana	Bureau of Reclamation, Snake River Area Office
Tom	Bassista	Idaho Department of Fish and Game, Upper Snake Region
Sabrina	DeRusseau	US Forest Intermountain Region (R4), Caribou–Targhee National Forest
Tammy	Fletcher	US Forest Intermountain Region (R4), Caribou–Targhee National Forest
Lee	Mabey	US Forest Intermountain Region (R4), Caribou–Targhee National Forest
Nisa	Marks	US Fish and Wildlife Service
Chris	Murphy	Idaho Department of Fish and Game, Headquarters
Liz	Davy	US Forest Intermountain Region (R4), Caribou–Targhee National Forest
Ryan	Newman	Bureau of Reclamation (US)
Kathy	Rinaldi	Greater Yellowstone Coalition
Shane	Roberts	Idaho Department of Fish and Game, Upper Snake Region
Quinn	Shurtliff	Gonzales–Stoller Surveillance, LLC
Tamara	Sperber	Teton Regional Land Trust
Matthew	Ward	The Nature Conservancy in Idaho

[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.