Science and Resource Management
Grand Teton National Park
& John D. Rockefeller, Jr. Memorial Parkway

National Park Service
U.S. Department of the Interior

GRAND TETON NATIONAL PARK
& John D. Rockefeller, Jr. Memorial Parkway

Natural and Cultural Resources

VITAL SIGNS 2014

Science and Resource Managment
Grand Teton National Park
& John D. Rockefeller, Jr. Memorial Parkway
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Cover painting: Against the Wind by W.G. Smith. Painted 2008. Gift from the Grand Teton Association to Grand Teton National Park.

Where not otherwise indicated, photos in this report are courtesy of the National Park Service.

A bull elk watches over his harem during the fall rut.

Why We Monitor the Park's Resources

The National Park Service was established in 1916 with the mission of protecting the resources of the parks and providing for the public enjoyment of those same resources in such manner that the resources will remain unimpaired for future generations. While Grand Teton National Park was not created until 1929 (and expanded in 1950), the mission remains the same. To protect and manage the wide variety of natural and cultural resources held within the park, resource management staff monitor and study individual resources and ecological processes—vital signs—to better inform decisions made in the park. Systematic monitoring is complicated by the fact that air, water resources, and many of the animals' seasonal migrations cross the boundaries of the park where other factors influence their condition. Inside the park, plant and animal species have been introduced both accidentally and intentionally that may change or affect native species. Pressure from humans, both within Grand Teton National Park and outside, may also affect conditions in the park. Data collected on some resources may be too limited to predict significant trends, but hopefully will provide a baseline for future study. Resources summarized in this report are monitored because of their significance to or influence on this ecosystem.

Vital Signs Summaries

Grand Teton's vital signs summaries are grouped into four categories for purposes of this report. They include:

- **Climate and Environment** (air quality, climate, fire, glaciers, soundscape, and water) are primarily the result of natural processes that operate on a distinctly larger scale than the park, but can be affected by human activities both within and outside the park.
- **Natural Resources:** selected plants and animals that
  - are or have been listed under the federal Endangered Species Act (bald eagle, gray wolf, grizzly bear, and peregrine falcon).
  - have experienced declines in the park and surrounding areas or are of special concern due to the lack of data (golden eagle, great blue heron, greater sage-grouse, moose, trumpeter swan, and whitebark pine).
  - have relatively small populations in the park and are considered vulnerable (bighorn sheep, Columbia sharp-tailed grouse, common loon, and pronghorn).
  - have a significant impact on the ecosystem and park management based on such factors as their large number, size, and movement outside the park, or where they are harvested (bison and elk).
  - are considered important indicators of ecosystem health because they are especially sensitive to environmental pollutants, habitat alteration, and climate change (amphibians, fish, and osprey).
- **Cultural Resources** (archeological sites, historic structures, and museum collections) are significant representations of the human evidence in or on the park and are inventoried, protected, and monitored to ensure that these resources and the information associated with them are passed along to future generations.
- **Challenges** (nonnative plants and animals, grazing, park visitation, plant restoration, and the human-bear interface) are generally caused or largely influenced by human activity.

Comparison to Reference Conditions

The table on the following page summarizes the current status of selected resources. In most cases, a reference condition is indicated that can be used for comparison purposes. Because conditions may fluctuate widely over time in response to natural factors, the reference condition is not considered the "desired" condition unless it is one that has been specified by government regulation or a plan. In other cases, the reference condition simply provides a measure for understanding the current condition, e.g., a historical range or scientific opinion as to the level needed to maintain biological viability.

Vital Signs Summary

TBD = to be determined

Resource	Indicators	Current Condition 2014 (or latest available)	Reference Condition
Climate and Environment			
Air Quality	Basic air quality parameters at 1 site	Class I Airshed	Clean Air Act
Climate	Average min., max. daily temp. (Moose) Annual precipitation (Moose) Growing degree days (Moose)	25°F, 54°F 28.40″ 2,733 days (2012)	22°F, 52°F (1958–2014 average) 21.41″ (1958–2014 average) 2,366 (1958–2012 average)
Fire	Acres burned per year by wildfire	19,211 acres	1–9,660 (1995–2014 range)
Glaciers	Extent of 10 named glaciers	<1 km^2	TBD
Water Quality	Basic water quality parameters- 2 river sites Basic water quality parameters- 3 alpine lakes	Iron exceeds state standards naturally during spring Nitrogen in Delta Lake exceeds federal reference	State water quality standards Federal ambient water quality reference conditions
Natural Resources			
Amphibians	% of potential sites suitable for breeding	87%	TBD
Bald Eagle	Breeding pairs	11 pairs	12 pairs (2003–2013 average)
Bighorn Sheep	Teton Range herd estimate	100–125 sheep	TBD
Bison	Jackson herd winter count (includes areas outside park)	811 bison	500 bison
Common Loon	Breeding pairs	1 pair	TBD
Elk	Jackson herd winter count (includes areas outside park) Summer count (portion of park herd)	11,423 elk ≥1177 elk	11,000 elk 1600 (in park)
Gray Wolves	Wolves in Wyoming (outside of Yellowstone) Breeding pairs in WY (outside of Yellowstone)	229 wolves (44 use park) 25 pairs (1 uses park)	≥100 wolves ≥10 pairs
Great Blue Heron	Active nests	18 nests	23 nests (1991–2013 average)
Greater Sage-grouse	Active lek	8 leks (7 in park)	10 occupied leks (9 in park)
Grizzly Bears	GYE population estimate Distribution of females with cubs Annual Mortality: Adult females • Adult male • Dependent young (human-caused only)	757 18 bear management units 3% 6% <1%	≥500 grizzly bears ≥16 bear management units not > 7.6% not > 15% not > 7.6%
Moose	Jackson herd winter count	≥275 (50 in park)	TBD
Osprey	Breeding pairs	15 pairs	13 pairs (2004–2013 average)
Peregrine Falcon	Breeding pairs	3 pairs	3 pairs (2004–2013 average)
Pronghorn	Jackson Hole/Gros Ventre herd estimate	449 pronghorn	TBD
Trumpeter Swans	Occupying breeding territories (includes areas outside park) Pairs producing young	3 pairs (1 pair in park) 1 pair (4 cygnets fledged)	16 historic territories (12 in park) TBD
Whitebark Pine	Blister rust infection (% of trees in park)	35% of tree	TBD
Cultural Resources			
Archaeological Sites	Percentage of park inventoried Percentage of documented sites in good condition	4% of the park 43%	TBD TBD
Historic Structures	Percentage assessed in good condition	72%	TBD
Museum Collections	Percentage that has been cataloged	43%	100%
Challenges			
Aquatic Invasive Species	Presence of non-native species	1 widespread 10 thermally limited	0 (limit spread & effects on native sp.)
Fish	Species present	12 native 9 non-native	12 native 0 (limit spread & effects on native sp.)
Human-Bear Conflicts	Injuries, food obtained, or property damaged	15 in park	14 (2009–2014 annual average)
Invasive Plants	Species present Acres treated	22 invasive species 1190 acres	0 (limit spread & effects on native sp.)
Mountain Goats	Estimated number in park	20–35 goats (in the park)	0 (limit spread & effects on native sp)
Plant Restoration	Seeding native plants in old agricultural fields	657 acres since 2009 (238 acres in 2014)	100% of 4500 acres in the former Kelly hayfields area

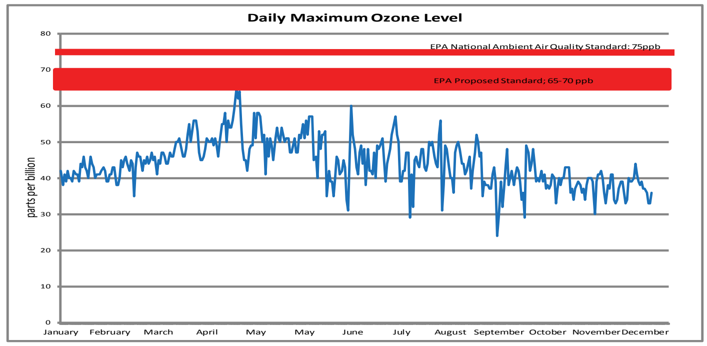
Reference condition specified by government regulation or management plan.

Air Quality

While Grand Teton National Park experiences relatively good air quality, the park is downwind of significant pollutant sources including power plants, agricultural areas, industry, and oil and gas development. Pollutants emitted from these sources can harm the park's natural and scenic resources such as surface waters, vegetation, fish, and visibility.

As a federally designated Class I airshed, Grand Teton is required to meet high standards for air quality. In 2014, Grand Teton in cooperation with the Teton Science School, operated an air quality monitoring station that measures wet and dry deposition, metrological data, ozone, and visibility. Data from this station and other scientific research indicate that the park is in compliance with federal standards for human health for ozone, sulfur dioxide, and particulate matter. However, air quality trends may be affecting other aspects of the ecosystem.

Nitrogen and sulfur compounds deposited from air pollution can harm surface waters, soils, and vegetation. High-elevation ecosystems in the park are particularly sensitive to sulfur and nitrogen deposition. Not only do these systems receive more deposition than lower elevation areas because of greater amounts of snow and rain, but short growing seasons and shallow soils limit the capacity of soils and plants to buffer or absorb sulfur and nitrogen. High-elevation lakes, especially, are sensitive to acidification from sulfur and nitrogen deposition and excess nitrogen enrichment. Acidification may cause loss of sensitive macroinvertebrates and fish, while enrichment may alter lake diversity. Alpine plant communities are also vulnerable to nitrogen enrichment, which may favor some species at the expense of others. Measurements indicate higher atmospheric nitrogen inputs to the north of the park and lower levels to the south—a gradient reflected in nitrogen concentrations in rain and snow, soils, and plants. Concentrations of ammonium in wet deposition from regional agricultural sources are elevated and increasing at sites in or near to the park. There are elevated concentrations of current-use pesticides found in park air and vegetation samples while mercury, pesticides, and other contaminants are found in high-altitude park lakes. Recent studies indicate mercury levels in high-elevation lake fish are below human and wildlife health thresholds.



Daily maximum ozone levels (parts per billion) at Grand Teton air quality station Jan. 2014 to Feb. 2014, showing the difference between current EPA 8-hour standards (red line) and proposed standards (red shaded area).

Visitors come to Grand Teton to enjoy spectacular views of the Teton Range and the Jackson Hole valley. Sometimes the park's scenic vistas are obscured by haze caused by fine particles in the air. Many of the same pollutants that ultimately fall out as nitrogen and sulfur deposition contribute to this haze and visibility impairment. Additionally, organic compounds, soot, and dust reduce visibility. In the region, average natural visual range is reduced from about 180 miles (without the effects of pollution) to about 120 miles because of pollution. The visual range is reduced to below 70 miles on high pollution days and can be even less on days with smoke. While natural fire is recognized for its ecological benefits, smoke from forest fires significantly contributes to particulate matter in the region. Periods of reduced visibility from forest fire smoke is typical in late summer and was a factor even prior to human occupation.

Good Visibility Day
Visual Range : 147 miles

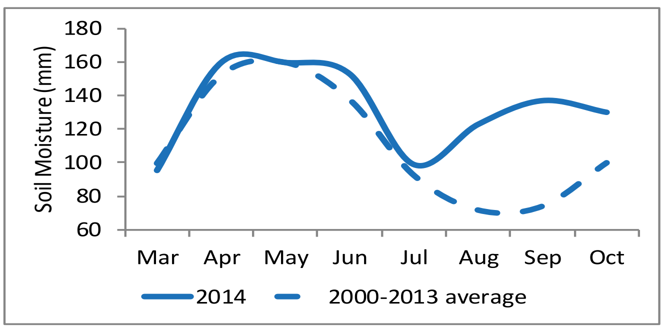
Bad Visibility Day
Visual Range : 9 miles

Climate

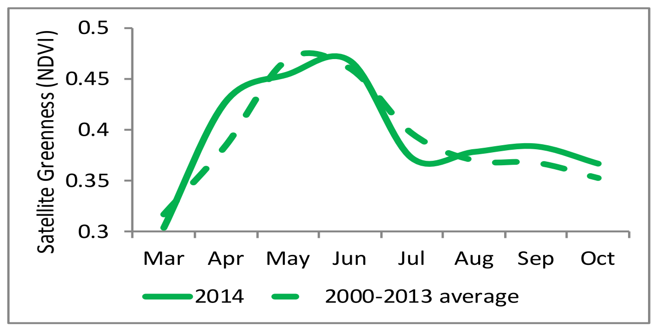
Monthly temperatures in 2014 were very close to the long term average (1980-2010); however, following two relatively dry years, 2014 was notably wetter with 8 more inches of total precipitation than the long term average. Most of the above average precipitation fell in February and March, which experienced 270% of normal. Falling before the growing season, the bulk of this additional precipitation dissipated in the spring snowmelt runoff.

In July, precipitation was below, while August and September were 175% of average—2 more inches of precipitation than is typical for that time of year. The effects of the additional precipitation are visible in satellite images. Since 2000, NASA satellites measure the Normalized Difference Vegetation Index (NDVI) every month as a means to assess vegetation condition through time. The NDVI is a measure of greenness which is related to vegetation condition. Typically August and September are the two driest months of the year; however, in 2014 the unusually wet late summer replenished soil moisture and visibly increased greenness (above average NDVI) in the sagebrush shrublands.

In 2014, the sagebrush shrublands were visibly greener than average for late summer because of abundant precipatation.



Monthly comparison of 2014 soil moisture in Grand Teton NP sagebrush shrublands compared to the 2000-2013 average.



Monthly comparison of 2014 satellite greenness in Grand Teton NP sagebrush shrublands compared to the 2000-2013 average.

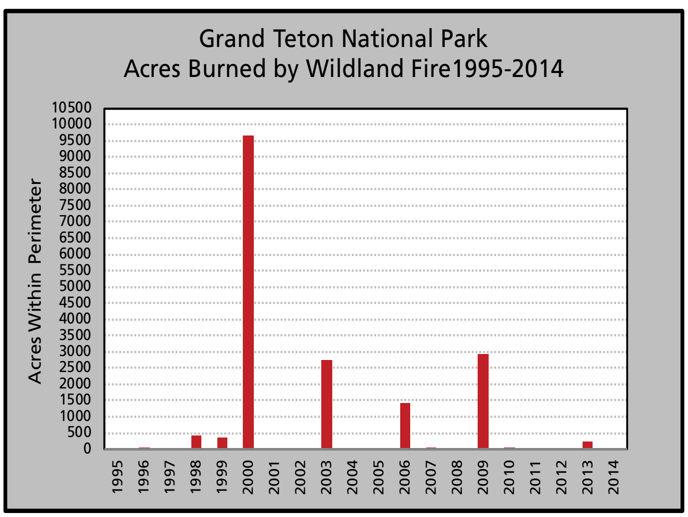
Fire

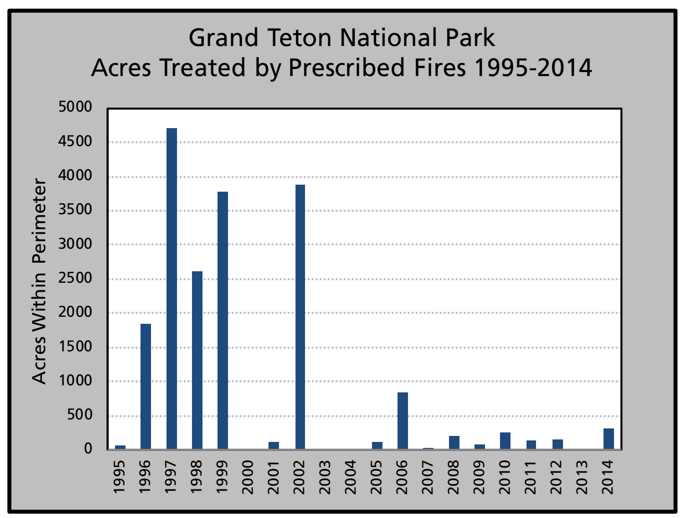
Lodgepole pine, the predominate tree species of the area, is fire adapted.

National park fire managers keep records of the number of acres burned each year, but these statistics only hint at the complex and varied effects of fire disturbances. Fires cause different patterns of ecological change on the landscape depending on severity, vegetation type, and post-fire climate conditions. Grand Teton National Park's ecosystem evolved with periodic fire disturbances, and the plant communities adapted to recover through successional stages over time. These stages create a diverse array of habitats for wildlife species of all kinds. Fire management staff evaluate each natural fire start based on location, current and predicted weather, fuel moisture, expected benefits, threats, and seasonality. In many cases, fire managers implement a combination of partial suppression, structure protection, and monitoring. Park fire staff use prescribed fire to reduce fuel loading and mimic the desirable ecological disturbances of fire in locations where it is too risky to allow lightning-caused fires to burn. Human-caused fires are always suppressed.

In Grand Teton National Park during 2014, lightning ignited only two fires and humans accidentally started another one. None of these fires grew over an acre in size. The number of fires was well below average, but rainy weather kept the grasses green and woody fuels moist for most of the summer fire season.

In the past 20 years, 218 wildland fires burned a total of 17,997 acres. Lightning caused 61% of these fires. During this period in the park, the biggest fire year was 2000, when nearly 10,000 acres burned in five large lightning-caused fires north and west of Jackson Lake. The average number of fires per year, based on the past 20 seasons, is seven lightning-caused fires and four started by human activities. Since 1995, a total of 16,429 acres were included in prescribed fire treatments.





Glaciers


Mapping the surface of Schoolroom Glacier, Sept. 2014.

Grand Teton National Park is home to 10 named glaciers, small remnants of those left during the last glacial retreat about 20,000 years ago. Glaciers provide long-term water storage and are critical contributors to aquatic systems, particularly in low flow seasons, by providing steady baseflow contributions and cold water inputs. Changes in glacial extent and volume are also significant indicators of changing climate. Recent studies show significant and rapid retreat of the glaciers in all areas of the Greater Yellowstone Ecosystem. Additionally, climate change studies indicate that high-elevation areas of the Rocky Mountains are experiencing rising temperatures, shrinking snowpacks, and earlier meltouts at a more rapid rate than the region overall. Because of these dramatic changes, the Teton glaciers are under increasing surveillance for the relationship between changing climate and the accumulation/ablation cycles that respond to changes in temperature and snowpack.

Early studies of changes in glacier volume and extent in the Teton Range showed that despite short-term advances, significant glacier retreat occurred from 1929 to 1963. In 1993, researchers conducted a winter mass balance study of the Teton Glacier to provide a baseline for future comparisons. A 2010 study documented surface area declines in three Teton glaciers ranging from 25% (Middle Teton Glacier) to 60% (Teepe Glacier). Identifying accumulation and ablation cycles in Teton Range glaciers involves use of remote sensing and historic aerial photography. Researchers are unable to connect periods of growth and retreat in glaciers and their permanent snowfields to climate trends because of a lack of high-elevation climate data. In 2012 and 2013, park staff installed temperature loggers as a test, and established photo points for Middle Teton, Petersen, and Schoolroom Glaciers.

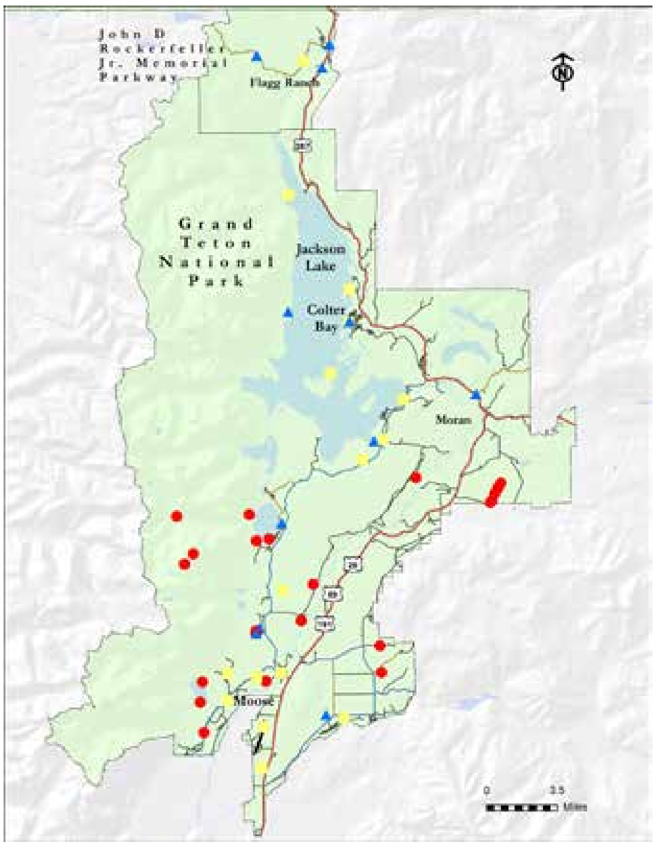
In 2014, with funding support from the Greater Yellowstone Coordinating Committee and the Greater Yellowstone Network, park resource staff consulted with glacier technicians from the North Cascades to establish the best long term monitoring methods for the three study glaciers. Because Petersen Glacier is largely a rock glacier with ice underlying frequent rockfall debris where rates of accumulation and ablation are heavily influenced by the insulating effects of the rock debris on its surface, park staff decided to monitor only meltwater discharge. The avalanche conditions on Middle Teton Glacier led to a plan of using ablation stakes to measure seasonal surface change and an elevation survey. On Schoolroom Glacier, park staff planned a baseline elevation survey, along with photo and glacial meltwater discharge monitoring. Grand Teton and Yellowstone staff worked to establish a regional temperature sensor network with consistent protocols for both glacial and vegetation studies.

Park climbing rangers aided by park resource staff completed a full elevation survey of Schoolroom Glacier in September of 2014, field testing a variety of methodologies to ensure accuracy and field safety in the process. The entire surface of the glacier was mapped with initial accuracy estimates of +/- 10 centimeters—appropriate for long term monitoring of ice elevations and volumes in the glaciers. Field methods developed by the team can be applied to the other Teton glaciers. These glacier elevation surveys in conjunction with future ablation stake installations and the use of remotely sensed imagery for mapping glacier margins (assisted by ground photo monitoring) will enable park staff to track mass balance and volume trends over time, providing an accurate history of the loss (or gain) in glacier ice in response to climate variability and trends.


Image of Schoolroom Glacier taken during the elevation survey, Sept. 2014.

Soundscape

Since 2003, a bioacoustic ecologist has monitored and researched 52 locations throughout the park in various management zones, ecological habitats, and elevations from the Snake River to the summit of Grand Teton. He collected more than 120,000 hours of digital recordings and sound levels that characterize and quantify the park's soundscape. Park managers use this information to aid in park planning and management decisions.



Sound monitoring sites in Grand Teton National Park, 2003-present. Yellow squares indicate monitoring in multiple seasons, blue triangles winter monitoring only, and red circles summer monitoring only.

A sound monitoring site in the Moose Wilson corridor of Grand Teton NP.

The soundscape of Grand Teton is composed of natural and human-caused sounds. Natural sounds include intentional sounds (singing and bugling), adventitious sounds (footsteps and wingbeats) of animals, and sounds created by physical processes (raindrops, thunder, flowing water, rockfalls, avalanches, and wind). The most widespread and numerous human-caused sounds are from surface, air, and water transportation activities. Airplanes and road vehicles are present all year; motorboats operate in the non-winter months.

The natural soundscape of Grand Teton is fully intact and functioning. However, noise from human-caused sounds affects the natural soundscape and can interfere with ecological functioning. Noise impacts on the natural soundscape tend to increase with higher visitation and administrative activity. Noise is most prominent nearest transportation corridors, but can propagate for long distances, especially when the ambient sound levels are very low. Seventy-five percent of the park is within two miles of a road or lake that allows motorboats. The National Park Service works to mitigate these impacts through education, quiet technology, and altered behaviors.

Water

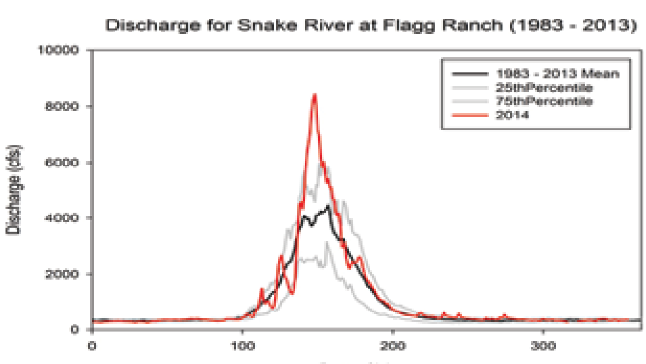
The Snake River at Schwabacher's Landing, Grand Teton NP.

Approximately 10% of Grand Teton National Park is covered by surface water. The park contains more than 100 alpine lakes, with surface areas ranging from 1 to 60 acres, and many above 9,000 ft in elevation. All surface and groundwater in the park drains to the Snake River. The Snake River is of considerable significance to the biological diversity and functioning of not only Grand Teton NP and the Greater Yellowstone Ecosystem, but also to the health and vitality of gateway and downstream communities.

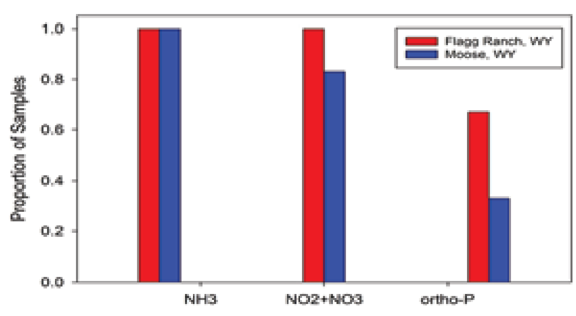
These uppermost reaches of the Snake River in Wyoming are characterized by good water quality with relatively low levels of dissolved nutrients and other anthropogenic compounds (e.g., pesticides). Good water quality and the presence of native fish, including cutthroat trout, are not surprising given that the headwaters of the Snake River includes parts of Grand Teton and Yellowstone National Parks. Maintenance of high quality waters and continued support of native freshwater assemblages are among the highest management objectives for Grand Teton National Park. The State of Wyoming also recognizes and values this important resource and has designated the upper Snake River and all surface waters within the park as Outstanding or Class 1 waters—recognized for their exceptional quality and therefore "no further water quality degradation by point source discharges other than from dams will be allowed" (WYDEQ 2001). The Snake River headwaters also received Wild and Scenic River designation by Congress (Snake River Headwaters Legacy Act, 2009), designed to preserve the quality of the Snake River headwaters' outstanding natural, cultural, and recreational values for the enjoyment of present and future generations (Wild and Scenic Rivers Act, October 2 1968).

The U.S. Geologic Survey monitors flow levels of the Snake River at two locations—Flagg Ranch and Moose, Wyoming. Discharge in 2014 was relatively high with peak flows at Flagg Ranch, Wyoming, ranking as the 7th highest in the 31-year monitoring record. Snake River flows at Moose were not as high but are strongly modified by Jackson Lake Dam. NPS resource staff have monitored water quality in the Snake River at these same locations for over a decade. Results from 2014 confirm that concentrations of primary nutrients (nitrogen and phosphorus) remained low or below detection. Trace metals (i.e., arsenic, copper, and selenium) are found in the watershed and are often naturally present in measurable concentrations, but below the State of Wyoming's aquatic life criteria. In 2014, copper and selenium were generally low and below detection levels, while total arsenic concentrations increased to measureable amounts during low flow at both sites. Conversely, total iron concentrations are highest in the Snake River during spring runoff, and in 2014 concentrations exceeded State of Wyoming's aquatic life criterion (1.0 mg/L) again at both Snake River locations. However, because most of the watershed in the upper Snake River is undeveloped, scientists believe that iron and other trace metals are naturally occurring and that natural fluctuations in iron levels are driven by elevated spring discharge.

In 2006, Grand Teton park staff began a monitoring study of three alpine lakes (Amphitheatre, Delta, and Surprise Lakes). The 2014 sampling events in July and September showed that water quality varied between sampling dates. Delta Lake has consistently had the highest levels of nitrogen (2008 to 2010 average = 0.649 mg/L) compared with the other monitored lakes. In 2014, total nitrogen levels were lower than noted in previous years for Delta Lake, but this lake still had 2 to 3X the levels of Amphitheater and Surprise Lakes, respectively. Delta Lake exceeded EPA's reference condition criteria for the Middle Rockies Ecoregion for both total nitrogen and total phosphorus. The presence of glacier ice in alpine watersheds of the American Rocky Mountains has been shown to strongly influence nitrogen concentrations. Therefore, glacial contributions may help explain elevated nutrient levels documented in Delta Lake.



Summary of the average daily discharge in the Snake River near Flagg Ranch, Wyoming. River flows are presented by day of year.

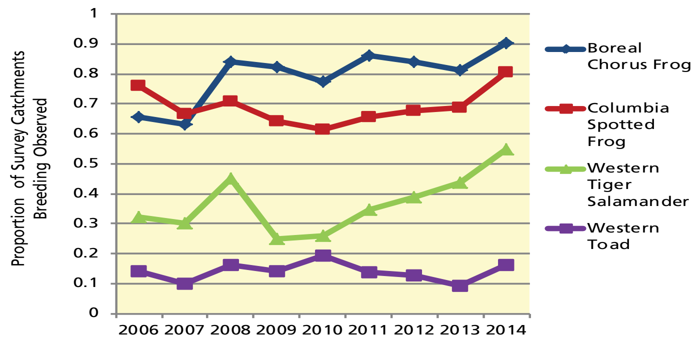


Proportion of monthly nutrient samples collected from the Snake River Flagg Ranch and Moose, WY monitoring stations that produced non-detection levels for ammonia (NH_3), nitrite + nitrate (NO_2+NO_3), and orthophosphorus (ortho-P).

Amphibians

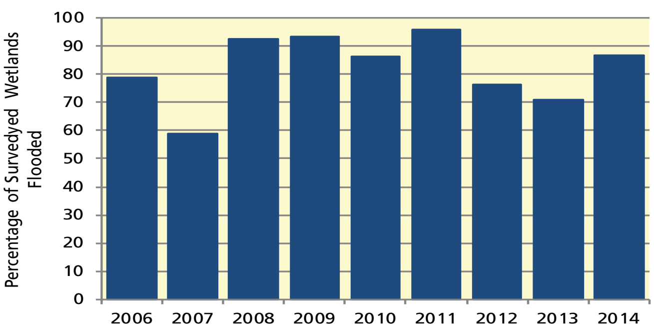
Biologists identified four species of native amphibians in Grand Teton and Yellowstone National Parks: western tiger salamander (*Ambystoma mavortium*), boreal chorus frog (*Pseudacris maculata*), western toad (*Anaxyrus boreas*), and Columbia spotted frog (*Rana luteiventris*). The boreal chorus frog and the Columbia spotted frog are the most widely distributed species each year. The western tiger salamander and western toad appear to be less widespread. The northern leopard frog was historically documented in Grand Teton National Park, but there was only one confirmed sighting since the 1950s. Spadefoot toads were documented a few times in Yellowstone's history, but their presence in Grand Teton has not been documented.

Annually since 2006, biologists in the Greater Yellowstone area monitor and document amphibian breeding activity in 31 catchments. Encompassing about 500 acres each, these catchments or watersheds are defined by topography and vary in amounts of seasonal and permanent water. In 2014, only four of the 31 catchments contained breeding evidence of all four species. These four catchments are referred to as amphibian "hotspots."



Proportion of catchments where breeding was observed for each species.

Annual variations in breeding may be tied to hydrologic fluctuations that are driven by unique meteorological conditions each year. Such annual variations alter the extent and mosaic of wetland breeding sites, which can affect amphibian reproduction. The percentage of visited wetlands that supported surface water suitable for breeding varied between 59% in 2007 and 96% in 2011; in 2014, nearly 87% of visited wetlands were flooded. All amphibians in Grand Teton and Yellowstone National Parks require wetlands for breeding, but individual habitat needs differ and may leave some species more vulnerable to changes in wetland condition (e.g., cumulative loss of seasonal water bodies or shrinkage of year-round ponds). Increasing temperatures are predicted for this region and could therefore alter wetland habitats and influence amphibian breeding.

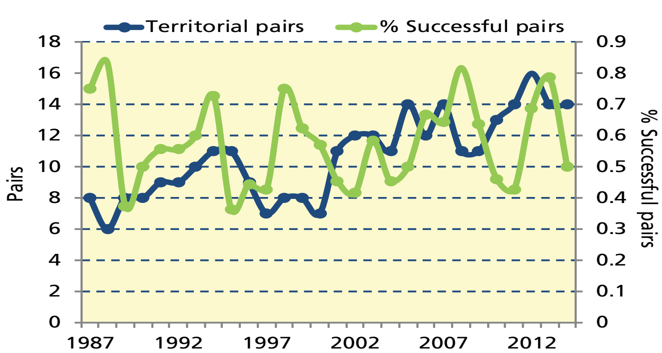


Percentage of wetlands 2006-2014 that had standing water suitable for breeding.

Bald Eagles

Bald eagles (*Haliaeetus leucocephalus*) are large, primarily fish-eating predators that generally nest in trees, close to water bodies. They also feed on small mammals, waterfowl, and carrion. Within Grand Teton, breeding sites are found along the shores of Jackson Lake, the Snake River, Two Ocean Lake, and the Gros Ventre River.

Of 19 bald eagle territories monitored in 2014, 14 pairs occupied territories and 11 nested and fledged 11 eaglets, marking another year of high production. While the number of occupied territories remained the same as 2013, the number of successful nests declined to seven (50%), which is below the ten-year average of 61%. Over the past few decades, bald eagles experienced a dramatic recovery in Grand Teton, mirroring their recovery throughout the Greater Yellowstone Ecosystem. The number of territorial pairs in the park has almost doubled over the past 25 years; however, the average number of young produced per occupied territory has not changed appreciably.



Counts of bald eagle pairs occupying territories and successfully producing young in Grand Teton NP, 1987-2014.

Bighorn Sheep

Bighorn sheep (*Ovis canadensis*), once widely distributed throughout the mountains and foothills of the Rocky Mountain west, persist today in small, fragmented populations that remain at risk of further decline and extripation. The Teton Range herd is Wyoming's smallest and potentially most isolated native sheep herd. The herd now lives year-round at high elevation along the Teton crest and in the steep canyon areas on the east and west slopes of the range. Sheep in this herd endure harsh winter weather in windblown areas above 9,500 feet due to the loss of low-elevation winter ranges to residential and recreational encroachment.

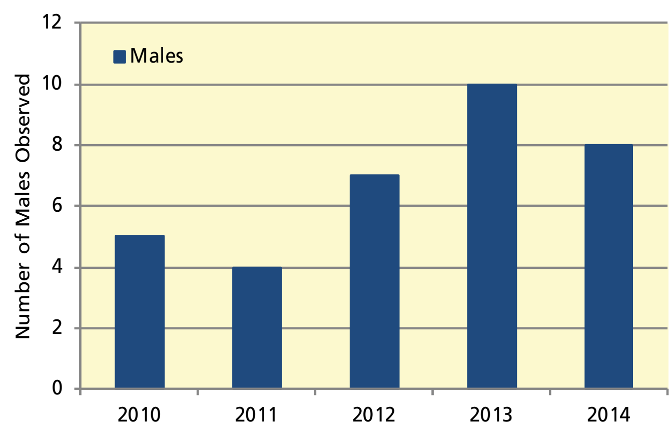
Biologists estimate the Grand Teton bighorn population contains 100–125 individuals, distributed in two segments at the north and the south ends of the range. Annual ground classification surveys started in 1990 provide composition, distribution, and trend information. The summer counts for 2014 are likely skewed because nine of the surveyed animals could not be classified as to age and sex. Since ratios derived from summer ground counts are highly variable over time, the counts primarily provide a confirmation that the herd is still reproducing and that some of the lambs survive their first year to join the herd.

Recent studies determined that the north and south segments of the herd are genetically distinct, increasing concerns for the health of the population. Avalanches and falls caused the majority of known mortalities recorded for 16 radio-collared and 7 non-radio-collared bighorn sheep in the mid-1990s; predation and starvation caused a small percentage of deaths. The herd does not migrate and is isolated from neighboring populations. While small population size, high lamb mortality, possible reduction in genetic fitness due to inbreeding, and extremely limited winter range all jeopardize the long-term sustainability of this herd, managers recognize limited winter range in avalanche-prone, high-elevation areas as the greatest potential threat. To decrease disturbance, Grand Teton closes crucial Teton Range bighorn sheep wintering areas to recreationists. No incursions into sheep winter range were reported in 2014.

Columbian Sharp-tailed Grouse

Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) are endemic to sagebrush, shrub-steppe, mountain shrub, and riparian shrub plant communities. Once found in nine states and British Columbia, Canada, this subspecies now occupies less than 10 percent of its historic range. Excessive hunting in the 19th century combined with habitat alteration and degradation contributed to local population declines and range reduction. Environmentalists petitioned twice for listing the Columbian sharp-tailed grouse under the Endangered Species Act, but each petition failed. Sharp-tailed grouse are considered a species of greatest conservation need in Wyoming.

Similar to greater sage-grouse, sharp-tailed grouse males display in the spring to attract females to breeding grounds called leks. Leks are typically positioned on elevated sites with flat, open areas. Columbian sharp-tailed grouse leks tend to have taller vegetation and more shrub cover than leks of other subspecies of sharp-tailed grouse. Little is known about the sharp-tailed grouse population in Jackson Hole. Several incidental observations of small groups of sharp-tailed grouse were recorded in Grand Teton over the last several years but no leks were found prior to 2010. Previously the nearest known lek was in Idaho along the western slope of the Tetons.



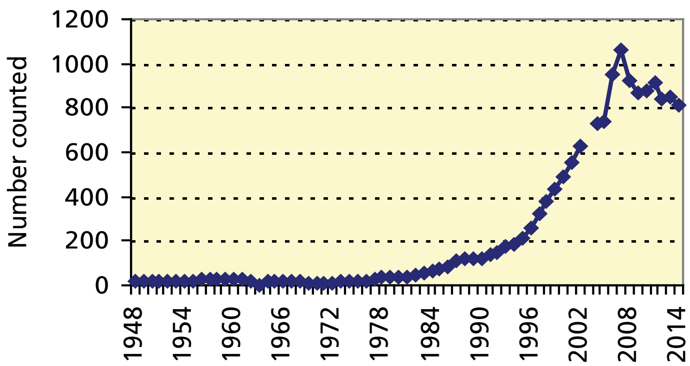
Annual counts of male Columbian sharp-tailed grouse displaying at the lek in Grand Teton National Park, 2010-2014.

In the spring of 2010, biologists located a sharp-tailed grouse lek near the southeast boundary of the park, where they observed five males displaying. This marked the first known sharp-tailed grouse lek in the park in over 40 years. In 2014, biologists observed a maximum of 8 adult males strutting at the lek, but did not see any females.

Bison

Bison (*Bison bison*), native to Jackson Hole, were extirpated from the area by the mid 1800s. In 1948, 20 animals from Yellowstone National Park were introduced to the fenced 1,500-acre Jackson Hole Wildlife Park near Moran. In 1963, after testing positive for brucellosis, all adult bison in the small herd were destroyed while nine vaccinated yearlings and calves remained. Twelve bison from Theodore Roosevelt National Park were added to the population. The herd escaped from the wildlife park in 1969 and was allowed to remain free. Present-day Jackson bison are descendants of those bison and some subsequent migrants from Yellowstone. During the winter of 1980, bison moved onto the National Elk Refuge and began using supplemental feed intended for elk. Returning annually to exploit this food source, the bison altered their natural population dynamics and distribution.

With unusually low winter mortality and no significant predation, the herd has grown steadily since the 1980s, reaching more than 1,000 by the winter of 2007. The herd is now the second largest unfenced bison herd in the United States. Although some bison began using areas east of the park and the refuge in the late 1990s, herd distribution has changed little in the past two decades. Jackson bison summer primarily in Grand Teton National Park. Depending on winter severity and native forage availability, nearly



Jackson bison herd numbers, 1947-2014.

Bison calves are born with a reddish coat that darkens after the first months.

the entire herd moves to the refuge for the winter, where they remain until April or May. In some years, individuals or small groups remain in the park all winter. During the winter of 2014, 786 bison used the National Elk Refuge feedlines and adjacent areas. Twenty-five bison foraged on native winter range mainly in the Elk Ranch area of the park. The herd-wide total of 811 continues the slow downward trend from the population high of 2007.

A joint Bison–Elk Management Plan approved in 2007 allowed bison hunting on the National Elk Refuge in an effort to maintain the herd at about 500 animals. The refuge hunt also helps disperse the herd. While the expanded hunt area helped increase the number of legal harvests and brought the herd closer to a sustainable population given available forage, research suggests that only consistently high hunter harvests focused on cows will bring the population to the desired level. Of 312 known bison mortalities in 2014, 96% resulted from legal harvest outside the park, while other causes included 11 vehicle strikes, 1 winter kill, and 1 that fell into the window well of cabin on a park inholding.

Common Loons

Common loons (*Gavia immer*) are long-lived birds with a prolonged period of maturation and low reproductive rates. Arriving shortly after lakes become ice free in the spring, loons breed on freshwater lakes throughout the northern U.S. and migrate to coastal areas for winter. Loons that nest in Grand Teton

V. Spagnuolo

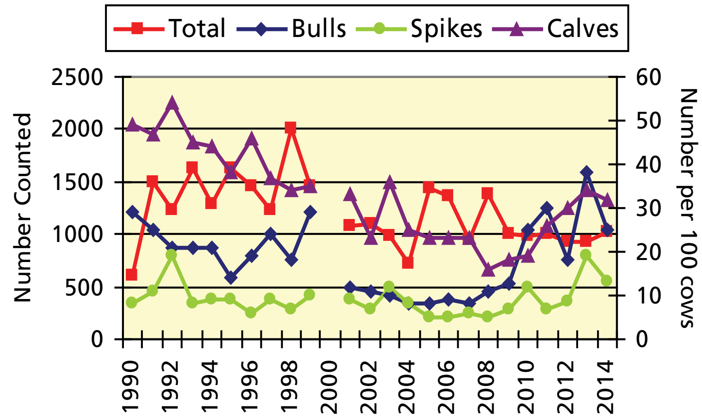
National Park reside at the southernmost extent of the species' range in the interior mountain west. The Wyoming population is small and appears isolated from other breeding populations. Long-term monitoring shows reductions in the number of territorial pairs and chicks fledging in the Greater Yellowstone population. The State of Wyoming lists loons as a species of greatest conservation need primarily because of the small size of the nesting population and its restricted distribution.

In 2014, one loon pair nested on Arizona Lake (just outside the park boundary), and unpaired adults were observed on Emma Matilda Lake and Jackson Lake. The individual on Emma Matilda exhibited territorial behavior early in the breeding season but was never observed with a mate. No loons were observed during surveys of Leigh or Jenny Lakes. The Arizona Lake pair fledged two loonlets.

Elk

Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway support a migratory Rocky Mountain elk (*Cervus elaphus*) population that is part of the larger Jackson elk herd. Elk summer throughout the parks and occur at relatively high densities in low-elevation open sagebrush, willow, and forested habitats. Most of the elk migrate to winter range on the National Elk Refuge near Jackson, but a small number winter in the eastern portion of the park. Other portions of the herd migrate through the park/parkway between the National Elk Refuge and summer ranges in Yellowstone and the Bridger-Teton National Forest. The Jackson elk herd is the largest in North America. Its migratory routes cross multiple jurisdictional boundaries as elk travel between seasonal ranges. As Grand Teton's most abundant ungulate, elk have significant effects on park ecology. Their grazing and browsing may affect plant productivity and, as prey and carrion, elk provide sustenance to carnivores and scavengers. They are also popular with park visitors.

Park biologists surveyed and classified 1,023 elk in 2014 during the annual summer survey, when slightly more elk were counted compared to 2013. Overall numbers have been remarkably consistent the last 6 years. Herd ratios and composition in the standard survey area were 25 mature bulls, 13 spike bulls, and 32 calves per 100 cow elk. After five consecutive years of increase,



Grand Teton mid-summer elk count and classification, 1990–2014.

calf ratios declined slightly this year. In general, calf ratios were lower in areas north of Moose and in the Willow Flats and highest in the Snake River bottoms south of Moose and around Lupine Meadows. The Snake River area south of Moose had calf ratios with 65 calves per 100 cows, almost three and a half times the number observed in Willow Flats. The distribution of elk among count blocks remained similar to that observed in 2013. In total, biologists counted at least 1,177 elk in the park. Elk that summer in Grand Teton represent roughly 30% of the total wintering on the National Elk Refuge.

In 2014, the Jackson herd numbered 11,423 elk, very close to the 11,000 objective set by the Wyoming Game and Fish Department. Estimated at above 19,000 during the early-mid 1990s, the Jackson herd is reduced by annual harvest on the national forest and the refuge, in addition to an elk reduction program in the park (authorized by Congress in 1950 to help manage the herd when necessary). Non-harvest mortality (e.g. from winterkill) averages an unusually low 1–2% of the herd. The total annual harvest for 2014 numbered 1,746 elk, 15% of the Jackson herd. The park reduction program accounted for 12% of that total and numbered 208 elk. The reduction targets the reproductive segment of the herd and thus permits no bull or "trophy" hunting. About 1,600 Jackson elk occupy summer range in Grand Teton, close to the objective described in the 2007 Bison–Elk Management Plan for Grand Teton National Park and the National Elk Refuge.

The velvet covering supplies the growing antler of the bull elk with blood and nutrients.

Golden Eagles

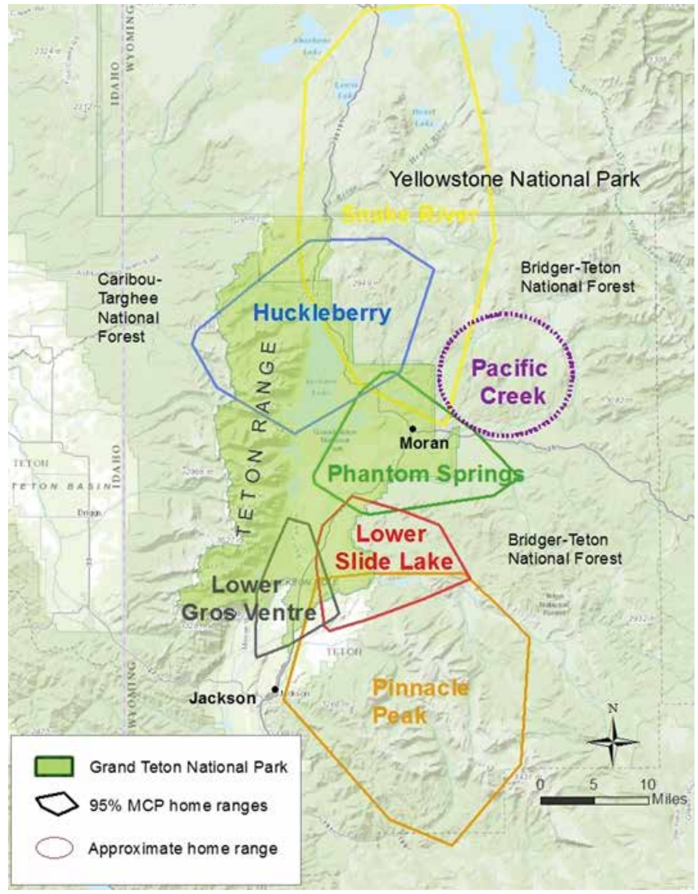
Golden eagles (*Aquila chrysaetos*) are large aerial predators well suited to the Teton Range, with its abundance of cliff faces for nest sites and diversity of prey found in the canyons. In the 1980s, biologists located golden eagle nests in Death, Avalanche, Cascade, and Webb Canyons. Concerns about golden eagle populations throughout the western U.S. have arisen, primarily because of loss and alternation of their native habitats. Like many raptors, golden eagles are sensitive to disturbance around their nest sites.

In 2014, no surveys for golden eagles were done and no nests or occupied territories were documented. Data on area golden eagles is limited. Biologists want to develop more baseline information to better assess the population.

Gray Wolves

After the U.S. Fish and Wildlife Service and National Park Service reintroduced gray wolves (*Canis lupus*) into Yellowstone National Park in 1995–96, wolves dispersed to Grand Teton National Park and surrounding areas. In 1999, a wolf pack denned in Grand Teton and produced a litter of pups—the first in the park in over 70 years. Since then, wolves continue to live and reproduce in the Jackson Hole area, including Grand Teton and the John D. Rockefeller, Jr. Memorial Parkway. The reintroduction of wolves restored natural predator-prey relationships absent since humans eradicated wolves from the ecosystem in the early 20th century.

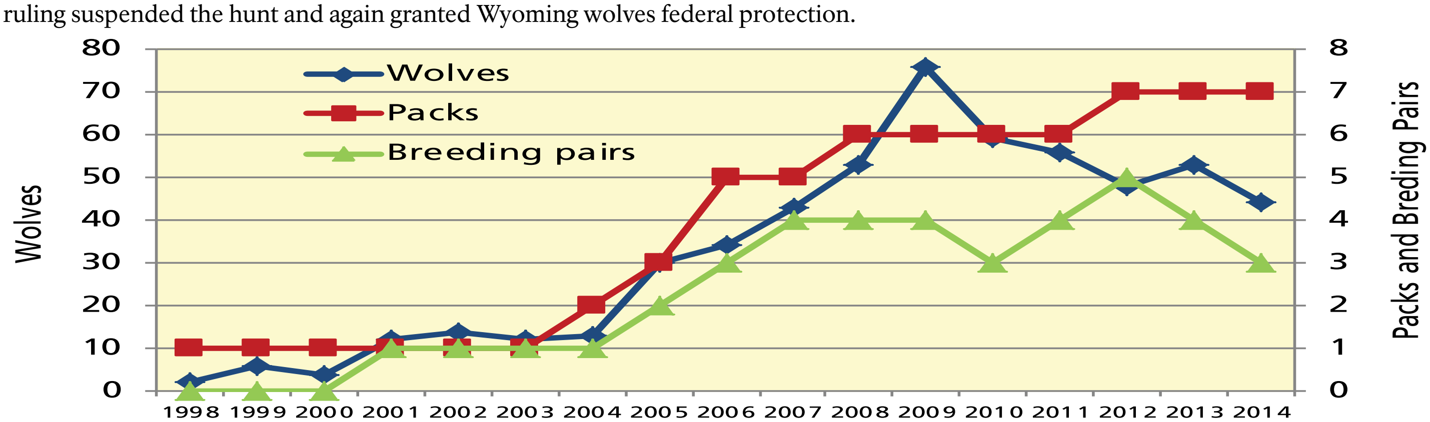
At the end of 2014, a minimum of 44 wolves in 7 packs were resident in the Jackson Hole area. These seven packs have persisted since 2012. The known wolf population grew from 6 to 76 wolves between 1999 and 2009, but declined to 48 animals in 2012. Pack size in 2014 ranged from 2 (Lower Slide Lake) to 13 (Snake River) wolves. In 2014, three of the Jackson Hole packs produced 11 pups that survived at least until the end of the year: Lower Gros Ventre (2), Pinnacle Peak (5), and Snake River (4). Only the Lower Gros Ventre pack denned within the park. Two wolves dispersed from their packs in 2014; a male from Pinnacle Peak traveled south and a female from Phantom Springs joined the Huckleberry pack. At least 5 adult wolves from the Jackson Hole area died in 2014. Two were legally shot outside the park and three died from unknown causes.



Distribution of Jackson area wolf packs, 2014. (MCP- Minimum convex polygons are home ranges based on locations of collared pack members.)

The return of wolves to Grand Teton and the surrounding area presents researchers with an opportunity to study the complex relationships of an ecosystem with an intact suite of carnivores and ungulates. Wolves and other predators affect prey populations and behaviors. In a five-year study, biologists found that in the winter when elk densities are relatively low, wolves prey primarily on elk (71%) and moose (26%) while feeding on deer and bison infrequently (3%). In the summer, when elk densities in the park are high, wolves prey almost exclusively on elk with yearlings representing more than half of the kills.

Wolves also prey on other species, including livestock, which bring wolves into conflict with humans. A long history of controversy surrounds wolf management and the effects of wolves on ungulates and livestock. Wolves in Wyoming were removed from the federal list of threatened and endangered species on September 2012. Wyoming classified wolves as trophy game (managed through regulated public harvest) in the northwest portion of the state outside the parks, parkway, National Elk Refuge, and Wind River Indian Reservation; and as predators (allowing unregulated take but requiring notification and information be provided) in the rest of the state. Although wolf hunting remained prohibited inside Grand Teton National Park, most wolves with territories in Jackson Hole use substantial areas beyond park boundaries, and state management may influence the dynamics of the valley's wolf packs. On September 26, 2014, a court ruling suspended the hunt and again granted Wyoming wolves federal protection.



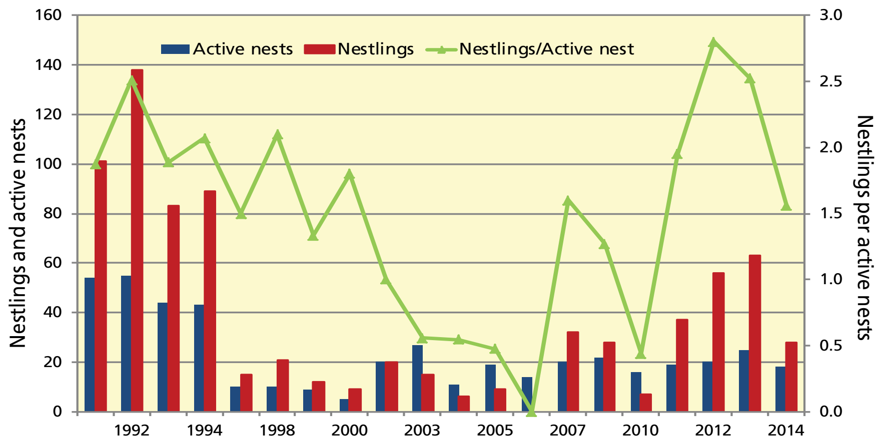
Population growth of Jackson area wolves, including those in and adjacent to Grand Teton National Park, 1999-2014.

Great Blue Herons

Great blue herons (*Ardea herodias*) are colonial water birds dependent on wetlands for feeding, nesting, and habitat security. Colonial nesters are highly vulnerable to human disturbance. Human activities near heron colonies (heronries) may influence heron occupancy, disrupt nesting behaviors, change foraging behavior, increase predation, or lead to heronry abandonment. Monitored since 1987 in Grand Teton National Park, heron occupancy and reproductive success varies widely with overall productivity declining. Over the last decade herons abandoned several historic heronries.

Herons have eight known historic colonies located in or adjacent to the park plus a new site on the Buffalo Fork. Of these sites, only the Arizona Lake colony was active in 2014. At Arizona Lake, the nests are clustered in north and south groups. The herons of the lake produced 30 nestlings from 18 active nests. All but 2 of the young survived to 80% of fledging age. The number of nests at the Arizona Lake heronry increased from 10 to 20 since 2009. In 2014, the average number of nestlings per active nest (1.6) was slightly higher than the historic average, but the total number of nestlings (30) was less than the average recorded from 1991-2013 (39.0).

The new Buffalo Fork colony, active in 2013, was abandoned in 2014. This colony may be related to another historically known heronry on the Buffalo Fork that is also abandoned. Heronries are vulnerable to predation. Bald eagles in particular can have devastating impacts on the survival of young herons. Biologists do not know if bald eagles nesting nearby led to the demise or displacement of these heronries.



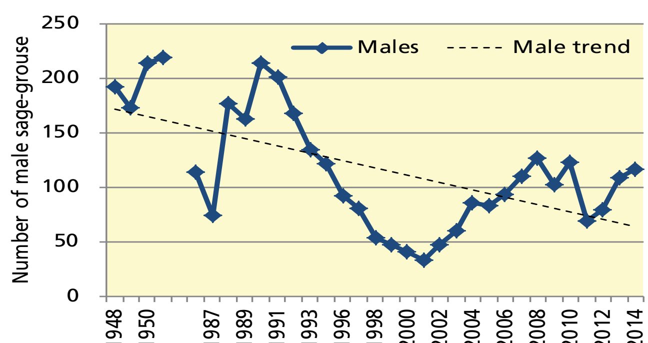
Great blue heron productivity in Grand Teton National Park,1991-2014. The Arizona Lake heronry, located just outside the park's boundary, was discovered in 2007 and has been included in the park's monitoring program since 2009. Monitoring of park heronries was not conducted in 1996, 1997, 2002, or 2008.

Greater Sage-grouse

Historically, the greater sage-grouse (*Centrocercus urophasianus*) ranged across nearly all of Wyoming and much of the American West using sagebrush habitat. Sage-grouse populations declined throughout their range during the past 50 years, most likely due to a combination of factors including increased livestock grazing, farming, residential development, invasive plants, and oil and gas development. The Jackson Hole sage-grouse population also declined, despite occurring in an area with a high density of public lands and protected habitat.

Sage-grouse congregate on display areas, or leks, during their breeding season each spring. Lek sites are usually open areas such as rocky slopes, burned areas, or gravel pits. Males perform a unique strutting display on these areas to attract females for breeding. Monitoring sage-grouse leks in Grand Teton National Park began in the 1940s, to document population trends.

Of the 10 historically known leks (9 within the park boundaries and 1 outside), sage-grouse consistently occupied 6 leks throughout the breeding season with substantial male attendance in 2014 (Airport, Moulton, Bark Corral, RKO, Spread Creek, and Timbered Island leks). Biologists observed sage-grouse at the Airport Pit lek on only two survey days early in the breeding season, suggesting it served as a staging area or a satellite lek. The North Gap lek on the National Elk Refuge was active with 21 males observed early in the breeding season. Three other historically occupied leks (active in the last 10 years) were inactive in 2014.



Total counts of male sage-grouse on Grand Teton National Park leks 1948–2014.

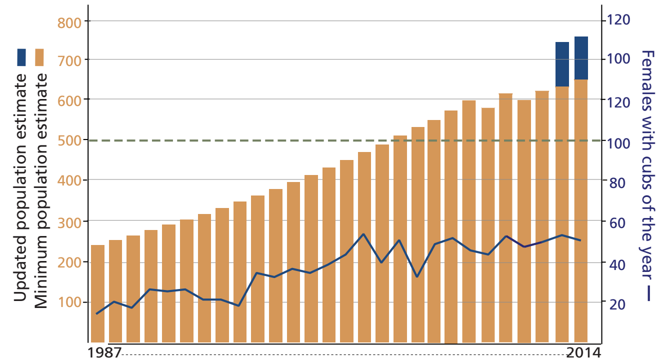
The total maximum count of 117 male sage-grouse in 2014 was slightly above the 10-year average. Male counts at Moulton and Airport leks were above the 10-year average while all other leks were below. While this data provides useful information on general trends of sage grouse attendance at leks, the relationship of these numbers to the local sage grouse population is not known.

Grizzly Bears

Predator eradication programs eliminated grizzly bears (*Ursus arctos*) from most of the western U.S. by the 1950s. Due to its isolation, the Greater Yellowstone Ecosystem (GYE) became one of the last refuges for grizzly bears south of the Canadian border. Throughout the region, garbage became a significant food source for bears in the first half of the 20th century. To return bears to a diet of native foods, garbage dumps in the GYE were closed in the 1960s and 1970s. Following the dump closures, human-caused mortality increased significantly and the population declined from an estimated 312 grizzly bears, prior to the dump closures, to 136 bears in 1975. That same year the grizzly bear was federally listed as a threatened species.

Intensive conservation efforts over the next 33 years allowed grizzly bears to make a remarkable recovery. For 2014, the GYE grizzly population was estimated at 757 bears. There are more grizzly bears today, occupying a larger area (19,305 mi^2), than there were in the late 1960s prior to the closure of the garbage dumps (312 bears occupying 7,813 mi^2). Grizzly bears now occupy areas where they were absent for decades including all of Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway. Cub survival significantly exceeds human-caused mortality. Despite continued growth in area visitation, bear attacks on people and incidents of bears damaging property remain low. The high visibility of bears foraging on native foods in roadside meadows makes Grand Teton National Park a popular bear viewing destination.

Whitebark pine, a preferred fall food for grizzly bears, has declined over the last decade due to an increase of mountain pine beetle-caused tree mortality, raising concerns for the bears' future. Although no one can predict for certain how declines in whitebark pine will affect grizzly bear population demographics, grizzly bears are well suited to adapt to changes in the abundance of individual foods. Since whitebark pine is a masting species that does not produce a seed crop every year, past poor seed production years provide an indication of what bears might rely on in the fall if whitebark pine becomes functionally extinct. GYE grizzly bears currently consume more ungulate meat, roots, and false truffles during years with poor whitebark pine seed production. Studies are ongoing to determine how whitebark pine seed production influences grizzly bear reproduction and survival. Recent research documents at least 266 known grizzly bear foods in the GYE, 39 of which are used frequently. After careful consideration of the research from this and other studies, the U.S. Fish and Wildlife Service may propose to delist GYE grizzly bears from their federal status as a threatened species in the lower 48 states in 2015.

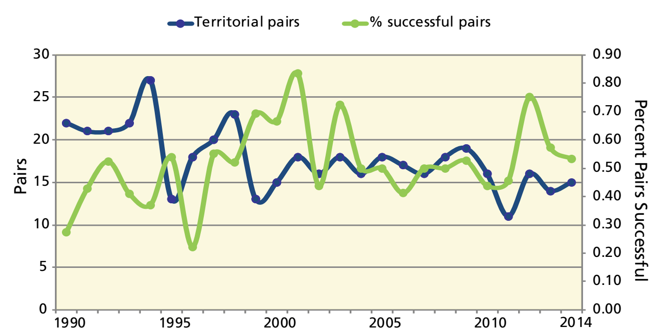


Counts of grizzly bear females with cubs of the year and total population estimate within the USFWS-designated Yellowstone Ecosystem Suitable Habitat, 1987–2014. One recovery criteria is a population of at least 500 grizzly bears. The updated population estimate is made using the latest calculation model developed by the Interagency Grizzly Bear Study Team. This graph shows the difference in the two modeling methods.

Osprey

Osprey (*Pandion haliaetus*) are medium-sized hawks that prey almost exclusively on fish. The population of osprey in Grand Teton is migratory and research documents that osprey from the park migrate as far as the Mexican gulf coast and Cuba for the winter. Park monitoring of occupied osprey nests began in 1972. Initially only 6-8 nests were occupied on average each year. More recently, 16 territories have been occupied annually. Generally, nests are found near the low-elevation lakes in the park, along the Snake, Gros Ventre, and Buffalo Fork Rivers and their tributaries.

In 2014, osprey occupied 15 (83%) of 18 monitored territories. Breeding activity occurred at all 14 of these sites and 8 pairs successfully fledged a total of 11 young. The number of territorial pairs declined since 1990, while the number of young produced per occupied territory slightly increased. The decline in the number of occupied territories coincides with an increase in the number of territorial bald eagles. Compared to bald eagles, osprey populations recovered relatively quickly following the banning of DDT and now that eagles are more prevalent on the landscape, osprey populations may be responding by stabilizing at a lower level.

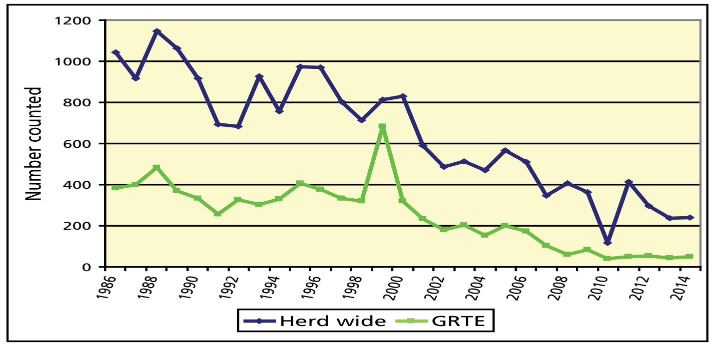


Territorial and successful osprey pairs, Grand Teton National Park, 1990-2014.

Moose

Moose (*Alces alces*) were rare or absent from Grand Teton National Park prior to 1912, but became numerous by 1950. They are better adapted to survival in deep snow than other ungulates in the Greater Yellowstone Ecosystem. Except during the rut, moose are usually found alone or in small family groups. Grand Teton moose are part of the Jackson moose herd which encompasses animals in areas outside the park boundaries. The estimated size of the herd declined from a high of over 4,000 in 1990 to less than 1,000 since 2008. This partially migratory herd moves between distinct but overlapping summer and winter ranges. The Wyoming Game and Fish Department makes an annual winter estimate of herd size based on the number of moose counted in aerial surveys. The count for 2014 totaled 241 moose (50 within Grand Teton), producing a Jackson herd estimate of 450 animals. Ratios were estimated at 33 calves and 96 bulls per 100 cows.

The moose herd decline likely results from a combination of interacting factors. The ecological landscape of today is dramatically different than the turn of the 20th century when moose populations expanded. At that time, large-scale predator reduction programs were ongoing throughout the west, wildfire suppression was widespread, and restrictions on moose hunting were in effect. Today, grizzly and wolf populations have increased, large-scale wildfires affected portions of the herd unit in 1988 and 2000, and hunting is currently at very low levels. Studies suggest that nutritional quality of moose forage in areas burned in 1988 is significantly lower than in unburned areas. Individuals summering in these areas have lower pregnancy and calf survival rates. Conversely, winter habitat availability does not appear to be limiting the growth of the Jackson moose population. Moose have narrow temperature tolerances. Temperatures above 57 degrees trigger moose to seek cooler locations. Many of the shady mature forests bordering the riparian forage areas preferred by moose remain absent after large fires. Additionally, warming temperatures associated with climate change may be affecting moose, by altering their feeding and other activities, potentially affecting food intake. Biologists are also studying parasites, like ticks and carotid artery worms, to evaluate their effects on moose populations.

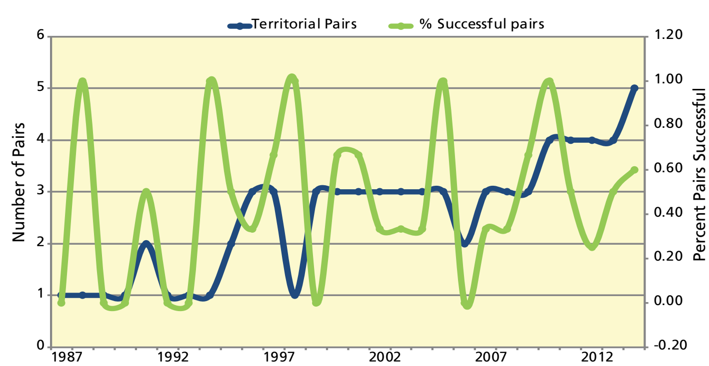


Jackson moose herd mid-winter counts, 1986-2014 (data from Wyoming Game and Fish Department).

Peregrine Falcons

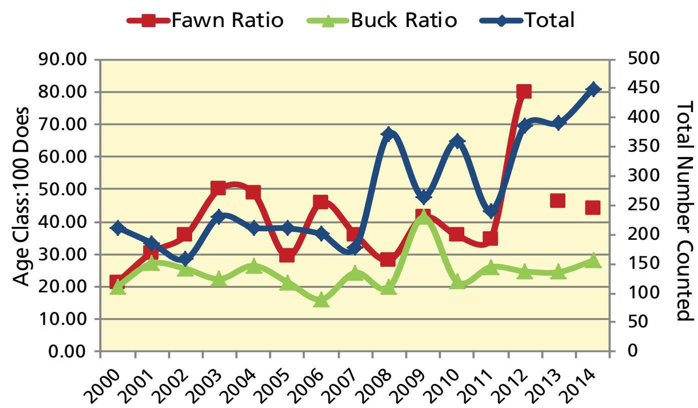
Peregrines (*Falco peregrinus*) are cliff-nesting falcons that mainly eat other birds. The lower elevations of the major Teton Range canyons provide peregrines with excellent cliff-nesting and diverse foraging opportunities. Decimated by DDT, peregrine falcons were extirpated from the Greater Yellowstone Ecosystem by the 1960s. Between 1980 and 1986, 52 fledgling falcons were released at several sites in Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway. Peregrine falcons first attempted nesting in 1987 at Glade Creek and successfully fledged young the next year. To date, peregrines use territories in Garnet Canyon, Cascade Canyon, Webb Canyon, near Glade Creek, and Blacktail Butte.

In 2014, five peregrine falcon eyries were occupied and nesting was confirmed at three locations. Four young peregrines fledged from the Cascde Canyon eyrie, three young fledged from the Garnet Canyon eyrie, and one fledged from the Webb Canyon eyrie. With the addition of the Blacktail Butte site in 2014, the number of peregrine falcon pairs occupying territories in Grand Teton and the parkway increased to five for the first time. The percent of successful pairs is highly variable and appears to be influenced by breeding season weather events. Over the past decades when at least three eyries were occupied consistently, there was only one year of complete reproductive failure (2006) and in most years, greater than 33% of nests were successful. Peregrines, once listed as threatened under the Endangered Species Act, were delisted in 1999.



Territorial and successful peregrine falcon pairs, Grand Teton NP, 1987-2014.

Pronghorn

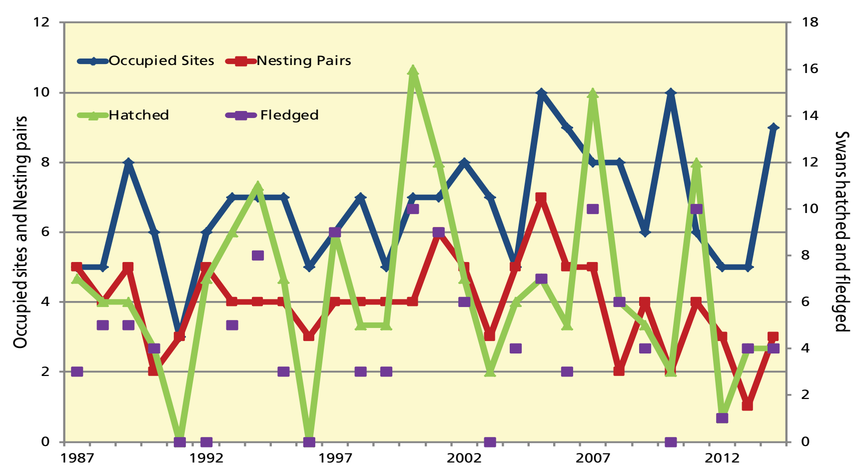


Pronghorn count and age/sex ratios during late summer classification counts, 2000-2014 (data from Wyoming Game and Fish Department).

The pronghorn (*Antilocapra americana*) that summer in Grand Teton National Park are part of a herd that undertakes one of the longest terrestrial mammal migrations in the Western Hemisphere. In the fall, these fleet-footed animals cover up to 30 miles a day on a roughly 150-mile route that follows the Gros Ventre River to its headwaters, and down to winter range in the Green River drainage. Pronghorn bones found at the Trappers' Point archeological site support that these animals have been using this narrow pathway for at least 6,000 years. Development around the southern end of their migration route has made it increasingly difficult for pronghorn to reach their winter grounds.

Using aerial line transects during June 2014, biologists counted 183 pronghorn (134 in the central valley of Jackson Hole and 49 in the Gros Ventre River drainage). Based on this count, biologists estimated the herd size at 449, an increase from 2013. Based on a late summer classification count by Wyoming Game and Fish Department personnel, ratios were estimated at 44 fawns and 28 bucks per 100 does. The reproduction rate in this herd segment is typically low, but varies widely. Low pronghorn fawn counts are often seen following a severe winter or a cool, wet spring. Fawn ratios returned to average after reaching the highest level seen in more than a decade in 2012. In general, a ratio of 25 bucks per 100 does is needed to maintain a good reproductive rate for the population.

Trumpeter Swans



Trumpeter swan productivity at territories in and adjacent to Grand Teton National Park, 1987-2014.

Nearly exterminated in the contiguous 48 states by the turn of the 20th century, trumpeter swans (*Cygnus buccinator*) made a comeback after intensive captive breeding programs, habitat conservation measures, and protection from hunting. Despite these efforts, swan population growth is low in the tri-state region (the Greater Yellowstone Ecosystem and surrounding areas in MT, ID, and WY). Many factors likely inhibit recovery, including competition with migratory flocks of swans, marginal winter range, variable reproduction rates, limited and low-quality nesting habitat, and high cygnet mortality. Monitored since 1987, Grand Teton provides important nesting habitat for swans.

Biologists monitor 16 historic nesting territories: 12 within the park and 4 outside but adjacent to park boundaries. In 2014, swan pairs exhibited breeding behavior at 3 territories, but only produced young at Pinto Pond where 4 cygnets fledged. The number of occupied swan sites, nesting pairs, and young hatched and fledged fluctuated widely over the 26 years since monitoring began. In 2014, occupied territories, nesting pairs, and productivity were all below average. Swan pairs have disappeared from some traditional park nesting sites that were occupied for decades. Substantially decreased water levels due to drought and other undetermined causes likely led to abandonment of some sites while increased human activity and predation may affect occupancy and productivity at other sites.

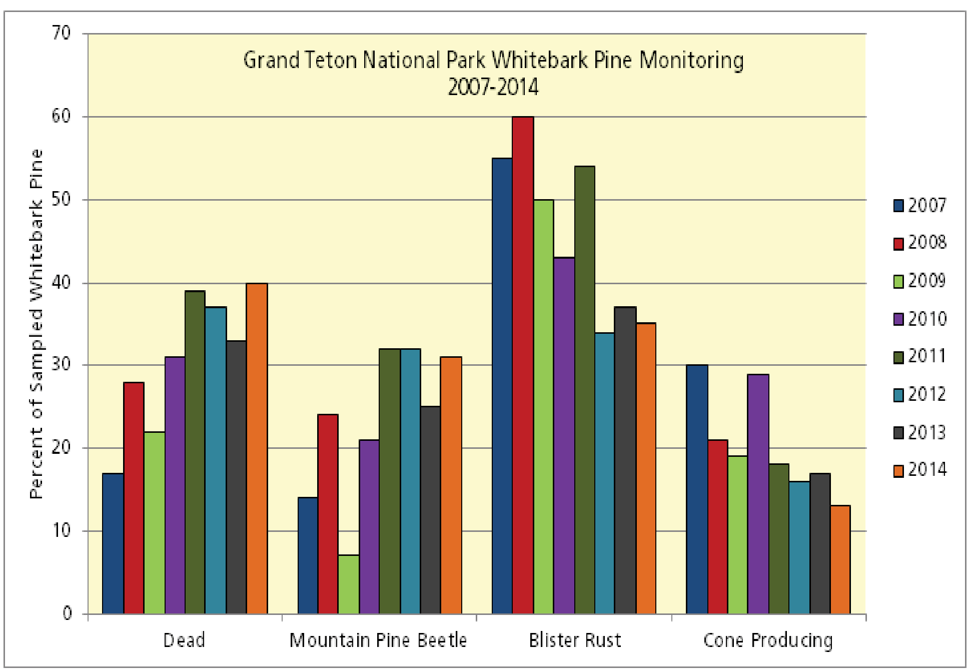
Whitebark Pine

Whitebark pines at high elevations often are sculpted by conditions, Greater Yellowstone Ecosystem.

Whitebark pine (*Pinus albicaulis*) is a slow growing, long-lived pine, often the only conifer species capable of establishing and surviving on high-elevation sites with poorly developed soil, high winds, and extreme temperatures. As a keystone species with a disproportionately large ecological role compared to its abundance, whitebark influences biodiversity and forest structure. These trees maintain water quality by trapping snow, regulating snowdrift retention and melt, and preventing erosion of steep sites while producing seeds that are an important food source for grizzly bears, Clark's nutcrackers, and other wildlife. Whitebark pine is experiencing unprecedented mortality due to the native mountain pine beetle, the nonnative white pine blister rust, and altered climate conditions. Overflights of the Greater Yellowstone Ecosystem in 2009 found visible beetle activity in 90% of all watersheds containing whitebark pine. Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway have a total of 28,500 acres of whitebark pine forests–18,775 acres mixed with other conifers and 9,726 acres dominated by whitebark pine. In addition, white pine blister rust is found throughout the park and parkway causing extensive damage to cone-bearing branches, seedlings, and saplings, which reduces the likelihood that seedlings will survive to maturity.

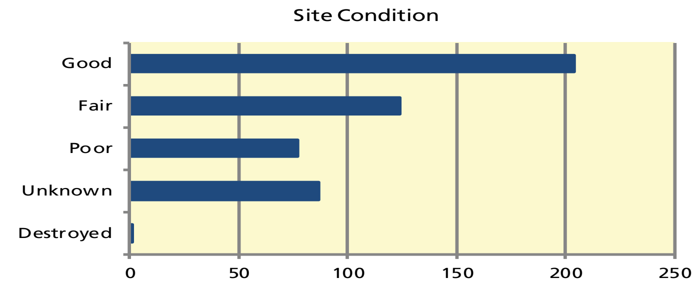
Grand Teton's annual whitebark pine monitoring, initiated in 2007, indicates that whitebark mortality, beetle activity, blister rust severity, seedling regeneration, and cone production vary by location. Whitebark pine is a masting species, meaning that trees produce sporadic large cone crops (generally every 3 years, but not necessarily so) though they also produce a small number of cones nearly every year. The data from Grand Teton suggests that cone production is decreasing over time; however, longer studies are needed to determine if this is a significant trend or just normal variability.

Overall mountain pine beetle activity has decreased since 2011, although areas of intense activity remain. Rust is present in nearly all sampled areas; the number of trees affected and severity of infection appears to be increasing annually. Among whitebark sampled in 2014, 40% were dead, 31% were attacked by beetles, 35% were infected with blister rust, and 13% produced cones. Blister rust was present in 80% of the sampled transects. Whitebark regeneration was 97.8% rust-free with a seedling density ranging from 360 to 1,920 per hectare. Beetle activity and blister rust severity was greater at elevations less than 9,500 feet and on south aspect transects; blister rust severity was also greatest on larger diameter whitebark pines. Individual whitebark with greater rust severity had significantly higher incidence of mountain pine beetle attack.



Distribution by status of individual whitebark sampled in Grand Teton National Park 2007-2013.

Archeological Sites



Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway contain 493 identified archeological sites. These sites range from prehistoric base camps, lithic quarries, and scatters, which date to as early as 9,000 years before present, to historic homesteads, roads, trails, irrigation ditches, and trash dumps dating from the late 19th century and early 20th century. Since archaeological work began in 1970, cultural resource staff surveyed approximately 4.5%, or 14,980 acres, of the 334,000 acres within Grand Teton and the parkway. Archeologists continue to find and record new sites every year.

The majority of sites within Grand Teton are identified and recorded through project planning. Archeologists survey the area for cultural resources before project construction activities begin. In 2014, the park completed ten field surveys and inventoried a total of 647 acres. Surveys occurred before hayfield restoration, water and wastewater infrastructure improvement, and several large planning projects. Through these surveys, archeologists identified 14 new sites which include historic homesteads, irrigation features, trash scatters, and prehistoric lithic scatters.

If significant sites are located within a project area, archeologists assess the extent and integrity of the site to determine if the project will cause any damage. Using subsurface testing at a Jenny Lake site in 2014, archeologists determined that the project could damage the site. Because of this potential, archeologists are developing appropriate mitigation measures to remedy or offset these impacts. This includes, but is not limited to, data recovery, burying the site under fill, and developing educational media.

Throughout the process of recording, testing, and mitigating, Grand Teton consults with 24 traditionally associated American Indian tribes. The consultation creates effective collaboration and informed decision-making. In 2014, Grand Teton conducted four consultations in person, seven in writing, and one via teleconference.

Park Service archeologists also assess the condition of previously discovered sites. By the end of 2014, archeologists determined 204 sites are in good condition; 124 sites are in fair condition; 77 sites are in poor condition; 1 site has been destroyed; and a total of 87 sites are lacking data/site condition is unknown. Of the 493 archeological sites within Grand Teton and the parkway, 180 sites are listed on or eligible for the National Register of Historic Places, 255 sites are considered ineligible for the National Register, and 58 sites are unevaluated for eligibility.

Historic Structures

Volunteers replacing the roof on the TA Moulton Barn on Mormon Row.

Grand Teton National Park has 695 historic resources listed on or determined eligible for the National Register of Historic Places. The majority of these buildings, structures, objects and sites are within one of the 44 historic districts of Grand Teton National Park. These districts exemplify the historic character of Jackson Hole defined by homesteading, farming, dude ranching, conservation, recreation, and tourism. Cultural landscape inventories (CLIs) have been completed for eight of the districts. Two sites are designated National Historic Landmarks: Murie Ranch, for its association with the conservation movement, and Jackson Lake Lodge as the first example of modern architecture within a national park. All 695 structures have been assessed and documented in the NPS List of Classified Structures. These assessments, based on historic integrity and not functionality, show that 72% of the park's historic structures are in good condition, 14% in fair condition, and 14% in poor condition.

The cultural resources program in Grand Teton focuses on planning and implementing preservation efforts to ensure that the historic buildings are maintained. Preservation projects completed during 2014 in the Mormon Row Historic District included stabilization of seven buildings by volunteers with guidance from an architectural conservator and fence stabilization and reconstruction around the John Moulton Barn by the Youth Conservation Program. A University of Pennsylvania preservation field school spent two weeks in Grand Teton stabilizing a sleeping cabin at the historic Bar BC Dude Ranch by pulling the building plumb, repairing the roof, and replacing sill logs.

Grand Teton, in accordance with the National Historic Preservation Act of 1966 evaluates park properties for historic significance and integrity and assesses how park activities will affect historic properties. In 2014, the CLI completed for the Moose-Wilson Road corridor reaffirmed that the corridor was eligible for listing in the National Register of Historic Places. Currently in draft, the Historic Properties Management Plan will assist the park in future management decisions. Although more than half of the park's historic properties are in good condition and three-quarters are actively used with an assigned purpose, a comprehensive plan will provide more direction for treatment and use of key properties in the foreseeable future.

CULTURAL RESOURCES

Museum Collection and Archives

One of the over 1000 photographs from the Harrison Crandall collection, donated to Grand Teton National Park.

Grand Teton's museum collections reflect the dynamic landscape for which the park was established and include an array of materials including archeological artifacts, ethnological materials, historical items, artwork, and natural history specimens. Three-dimensional artifacts include the David T. Vernon Collection of American Indian Art, a stunning ethnographic collection and the most celebrated portion of the park's collection. The collections also include archeological artifacts from various excavations throughout the park beginning in the 1970s; geological samples; historic vehicles; historic furnishings representative of regional furniture makers; and items that represent the regional history of homesteading, ranching, and climbing. Unique collections such as original Thomas Molesworth furniture, iconic western motif furniture, made by a Cody, Wyoming furniture maker beginning in the 1930s, and a collection of Kranenberg Furniture, made by local Jackson residents Bob and Jack Kranenberg in the 1930s–1950s, are some other collection highlights.

The museum also encompasses archival collections that document the complex history of Grand Teton National Park. The archives—the two-dimensional paper based materials—include reports, photographs and maps documenting subjects ranging from land management, natural & cultural resources including historic landscapes & structures, and the Teton's extensive climbing history. Grand Teton holds a unique collection of early summit registers that are comprised of original items left atop peaks documenting first ascents of climbers like Jim Langford, who ascended the southeast ridge of the Grand in 1957. In addition to the summit registers, Grand Teton also has a collection of mountaineering records that document climbing activities in the Teton Range beginning in 1898, which provides information including number of climbers in the party, climbers' names, climbing dates, and which peaks were to be climbed.

While Grand Teton National Park does not have a designated museum to exhibit the collections, 89 pieces from the David T. Vernon Collection are displayed in two of the park's visitor centers. Other items from the museum collections are on exhibit outside of the park in local museums such as the Jackson Hole Historical Society's Museum and the Teton Valley Museum. Some materials are held in repositories maintained by other institutions outside the park, such as the Midwest Archeological Center in Lincoln, Nebraska, where a large percentage of the park's archeological collection is stored. As of 2014, nearly 45% of the one million item collection is processed and cataloged. In 2013, the park curator completed a full 100% inventory of the collection; updates to the collections management database are still in progress. The Scope of Collections Statement defines what should be included in the museum collection as the best representation and documentation of Grand Teton's natural and cultural history, taking into consideration the expense of curation and preservation. Items that fall outside of that scope are deaccessioned and offered to other public institutions.

CHALLENGES

Livestock Grazing

Grand Teton National Park along with several dozen other national park units, allows livestock grazing because of traditional land use prior to the park's establishment. When Grand Teton National Park (created in 1929) expanded in 1950, five ranches on inholdings in the park were legislatively allowed to retain their grazing allotments while another 26 ranches were granted grazing privileges for the lifetime of immediate family members. These provisions allowed livestock grazing and trailing on about 69,000 acres (22% of the park). Over time this acreage has been substantially reduced through attrition and the park's acquisition of inholdings through purchase or donation.

To address concerns about grazing impacts on riparian vegetation and minimize the potential for cattle depredation in 2009, park managers moved the largest remaining cattle allotment off open range and onto cultivated, irrigated Elk Ranch pasture lands in existence prior to creation of the park.

Today about 5,000 acres are still used for livestock grazing and trailing in the park by four ranches: two on park inholdings (the Pinto Ranch with 290 yearling steers and the Moosehead Ranch with 60 horses); one concessioner operating a historic dude ranch on park land (the Triangle X Ranch with up to 120 horses); and a ranch outside the park that operates under an agricultural use lease dating to the 1940s (the Teton Valley Ranch with approximately 30 longhorn cattle). In addition, the State of Wyoming has a 614-acre inholding that is leased for grazing.

Aquatic Invasive Species

Stomach contents of an American bullfrog found in Kelly Warm Spring show they are displacing and eating native species, like this rodent.

Federal, state, university, and private partners contribute to aquatic invasive species prevention and monitoring efforts in Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway. Only a few aquatic invasive species have been documented, including New Zealand mudsnails (*Potamopyrgus antipodarum*) in the northern region of the park, and a suite of thermally limited, warm water species in Kelly Warm Spring and Savage Ditch including red-rimmed melania (*Melanoides tuberculata*), the American bullfrog (*Lithobates catesbeianus*), and multiple tropical and warm water fishes.

New Zealand mudsnails invaded geothermally warmed waters in Greater Yellowstone as early as 1994. Their current distribution includes Polecat Creek, Marmot Creek and the Snake River near Flagg Ranch. In 2001, University of Wyoming researchers found densities as high as 483,000 individuals per square meter in Polecat Creek, but densities have fluctuated greatly over the last 13 years. Studies indicate that the New Zealand mudsnail can alter stream nutrient cycling and outcompete the endemic Jackson Lake springsnail (*Pyrgulopsis robusta*). No population-level effects on fish were detected.

A multi-agency team led by Grand Teton National Park is developing eradication and suppression strategies for the Kelly Warm Spring area. The park is also working with Wyoming's Aquatic Invasive Species Program to prevent further spread of these established aquatic invasive species and to prevent the introduction of new aquatic invasive species—especially zebra and quagga mussels (*Dreissena polymorpha* and *D. rostrifromis bugensis*, respectively) with their large ecological and economic impacts. Other aquatic invasive species of concern that are established nearby in the Greater Yellowstone Ecosystem are Eurasian watermilfoil (*Myriophyllum spicatum*), curly pondweed (*Potamogeton crispus*), and the parasite that causes whirling disease (*Myxobolus cerebralis*). Tools for preventing the spread and introduction of aquatic invasive species include (1) educating visitors to prevent spread, by decontaminating water crafts and fishing gear, (2) mandatory water craft inspection stations, and (3) implementing an early detection monitoring program.

Mountain Goats

Remote motion-sensing camera photo of nanny goat and kid, Grand Teton NP.

Mountain goats (*Oreamnos americanus*) are native to some rugged mountains of the American West, however not to the Greater Yellowstone Ecosystem. The closest native mountain goat population exists in the Lemhi Range of Idaho, roughly 125 miles northwest of Grand Teton National Park. From 1969 to 1971, the Idaho Department of Game and Fish released goats into the Snake River Range south of the park for the benefit of hunters. Presumably from this stock, mountain goats moved into the Tetons by 1977. Over the years, sightings became more frequent, with mixed-age and mixed-sex groups of mountain goats seen. Since 2008, park managers confirmed consistent reports of mountain goats, including repeated sightings of nannies with kids which strongly suggest the establishment of a breeding population in the park. While a biologist spotted a single mountain goat in Webb Canyon at the northern end of the park, the majority of observations come from the vicinity of Cascade Canyon. In 2014, park managers received 98 reports of mountain goat sightings. This surge in sightings, more than twice the number documented in the last decade, is likely due to improved efforts to collect sighting information and not a dramatic change in population size.

The main concern about establishment of a viable nonnative mountain goat population in the Tetons is that it could displace, outcompete, or transmit diseases to the native bighorn sheep population. Park managers are already concerned about the long-term prospects of the bighorn sheep herd, due to its small size, isolation, and restriction to marginal winter habitats. As mountain goats and bighorn sheep share similar habitats and forage, the potential competition among the species in the park could pose additional threats to the precarious sheep population and the alpine community on which they depend.

In 2014, Grand Teton park managers and biologists initiated development of a mountain goat management plan to address the park's goat population. This plan will examine several alternatives to mountain goat management in the park, including no action, monitoring, and a range of removal strategies.

Fish

Grand Teton National Park is home to 12 species of native fish along with 9 nonnative fish (4 trout species and 5 warm or tropical species). Two distinct looking but genetically undifferentiated cutthroat trout (*Oncorhynchus clarkii*), the Snake River fine-spotted and Yellowstone cutthroat, are native to the park. Other native species include mountain whitefish; Utah chubs; redside shiners; Paiute and mottled sculpins; bluehead, mountain and Utah suckers; and speckled and longnose dace. Historically the Wyoming Game and Fish Department stocked both the easily accessible valley lakes and the remote backcountry lakes with nonnative game fish: lake, brook, brown and rainbow trout. With strong support from the park, the last nonnative fish stocking ended in 2006. The state manages the recreational fishing licenses and catch limits of both native and nonnative fish within the park, with input from the National Park Service.

Nonnative aquarium species found in Kelly Warm Spring, include swordtails, convict cichlids, tadpole madtoms, goldfish, guppies, bull frogs, and red-rimmed melania (snail). In 2014, park staff conducted education programs at the warm spring for 365 local students to teach them about the ecosystem threats caused by aquarium dumping. Additionally a wayside exhibit was erected to educate visitors. Resource managers are considering restoration efforts to bring the spring closer to its natural state.

The potential impacts of nonnative trout species are not the only threats to native fish in Grand Teton National Park. Fish passage in three park waterways was impeded by irrigation diversion structures that acted as fish barriers. In recent years, two of the three were removed, reconnecting fragmented fish habitat. Removal of the Spread Creek diversion dam, in the fall of 2010, opened up more than 50 miles of stream habitat. The removal of the Newbold diversion dam, on the Gros Ventre River in 2013, opened more than 100 miles of habitat for fish migration. In the falls of 2013 and 2014, local seventh graders participated in a Trout Unlimited program implanting transmitters in cutthroat trout of the Gros Ventre River. The students continue following the trout in the classroom where tracking information from the biologists shows the native fish moving freely in the river, unimpeded by barriers.

One of several goldfish dumped in Kelly Warm Spring. Measuring almost six inches this goldfish followed irrigation ditches out of the spring and was found moving toward the Gros Ventre River.

The remaining barrier, Jackson Lake Dam, adds 40 vertical feet of water to the natural lake (equaling 847,000 acre feet of water) for irrigation purposes in Idaho's Snake River Plains. Managers of the dam's flow at the Bureau of Reclamation attempt to mimic a spring flush while still meeting water user needs downstream. Studies show that regulated systems can reduce habitat complexity and can affect cues used by fish for spawning events.

Irrigation ditches in the park have entrainment issues (trapping fish in ditches away from the natural waterway which typically leads to the fish's demise) and occasionally dewater natural streams. Historic water rights and prevailing attitudes about water usage make solutions to these issues complicated. While park managers face a variety of challenges, they continue working to maintain wild waterways for future generations of humans and for their value to native species and processes.

River otters, like this one basking in the winter sun, prey on fish year-round, surfacing through holes in the ice to consume their catch.

Human-Bear Interface

Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway provide habitat for healthy populations of black (*Ursus americanus*) and grizzly (*Ursus arctos*) bears. Both bear populations are free-ranging and naturally regulated. Grand Teton receives nearly 3 million visitors per year, most of whom visit during the peak summer season (June through September). Consistently high levels of human recreation in prime bear habitat create a high potential for human-bear interactions.

In an effort to decrease conflicts, park staff strictly enforce food storage regulations and all park facilities (including employee housing, concession areas, and visitor campgrounds) have bear-resistant garbage receptacles. The park delivers a "Be Bear Aware" message to the public through a variety of formats, in addition to providing annual bear safety training to park and concession employees. The primary focus is to keep human foods away from bears. Since 2008, the park with generous support from the Grand Teton National Park Foundation, installed a total of 482 new bear-resistant food storage lockers in park campsites and picnic areas toward that goal.

Human-bear confrontations are incidents when bears approach or follow people, charge or otherwise act aggressively toward people, enter front-country developments, or enter occupied backcountry campsites without inflicting human injury. Human-bear conflicts are incidents when bears damage property, obtain anthropogenic foods, injure or kill humans, or are injured or killed by humans.

In 2014, park staff recorded 143 human-bear confrontations and 15 human-bear conflicts (respectively a 93% and 36% increase from the previous year). All of the conflicts involved black bears, including 11 incidents in which a black bear received a food reward, 3 incidents in which a black bear damaged personal property (e.g., ripped tent, bit water bottle), and 1 incident where a black bear was killed in a motor-vehicle collision.

Eighty-six percent of the food reward and property damage conflicts in 2014 occurred in the park's frontcountry. Almost 50% of these conflicts involved one black bear and occurred in the String Lake area or in the Jenny Lake Campground. Two other black bears also exhibited nuisance behavior. In February, a week after getting caught in and released from a garbage dumpster, a two-year-old female was captured in a recycling garage. Because the bear was in extremely poor condition, emaciated, and exhibiting food-conditioned behavior, it was euthanized. In early June, a cinnamon colored black bear grew progressively bolder in attempts to access human food, eventually tearing into and entering a cabin's screened porch. This adult male was captured, collared, and relocated near Grassy Lake Road. He returned to the Jenny Lake area within 20 days and continued to exhibit nuisance behaviors—approaching large groups of people and sniffing packs. This time the bear was trapped and euthanized.

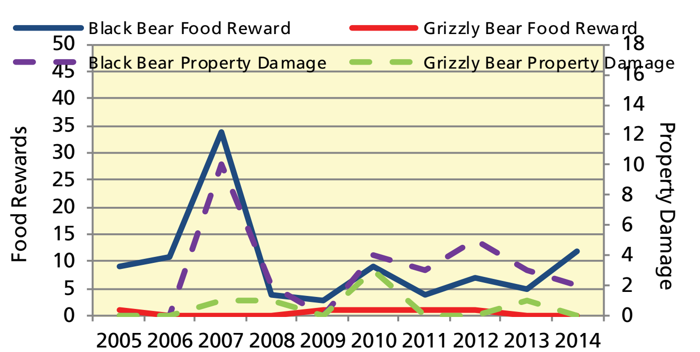

J. Jewell

A black bear mother and cub looking for food at String Lake, Grand Teton NP.

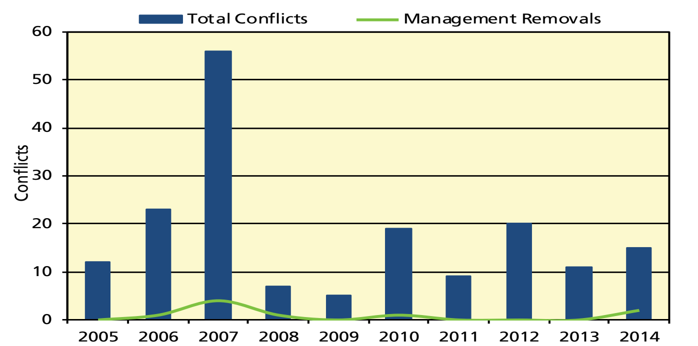
Park staff work diligently to prevent bears from developing nuisance behaviors. It is often when humans fail to secure their food that bears develop this unwanted behavior. In an effort to discourage bears from frequenting developed areas and roadways, trained staff follow an established protocol of hazing. Hazing can involve making noise (yelling, using horns, sirens, or cracker shells), throwing rocks, using a sling shot, and/or firing bean bags or rubber bullets at the bears. Grand Teton staff documented 44 bear hazings in 2014.

In 2014, three black bears and one grizzly cub were found dead in the park. Biologist believe the grizzly cub, found in the spring, died of natural causes the previous fall. In June, a black bear cub was found floating in Jackson Lake. And in October, two adult female black bears were killed and consumed by a grizzly bear in separate incidents.

Since 2007, Grand Teton employs the Wildlife Brigade, a corps of paid and volunteer staff, to manage traffic and visitor congestion that occurs at roadside wildlife jams, promote ethical wildlife viewing, patrol developed areas to secure bear attractants, and provide bear information and education material. In 2014, they recorded a minimum of 522 wildlife jams including at least 122 grizzly bear jams, 103 black bear jams, 57 jams for bears of unknown species, 146 moose jams, and 94 jams for other species such as bison, elk, and coyotes.



Bears receiving human-food rewards or causing property damage in Grand Teton.



Bear conflicts and removals in Grand Teton.

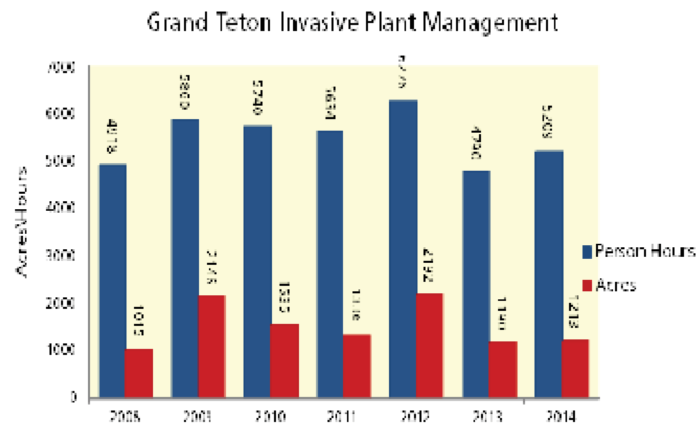
Invasive Plants

Nonnative, invasive plants displace native vegetation communities and may change animal distribution and foraging activities. Homesteaders planted exotic ornamentals and crops before the park was established and some of those species still persist. Today people inadvertently transport seeds on their vehicles, clothing, shoes, in livestock feed, and in construction sand and gravel. Areas particularly vulnerable to invasive plants include disturbed areas along roads, pathways, utility corridors, and building sites.

Grand Teton biologists prioritize invasive plant species according to the threats posed to park resources and the prospects for successful treatment. Some infestations can be eradicated if the species is treated when the outbreak is still small; other species are so common that stopping them from spreading is the primary goal. “Noxious weeds” are nonnative invasive plants considered detrimental to agriculture, native plant communities, fish and wildlife habitat, and/or public health. Park staff focus their efforts on finding and using the best treatments to address these most aggressive species. Listed with their primary invasive species, sites where park staff treated and managed noxious weeds successfully over the past five or more years include: Moose-Wilson Road corridor (musk thistle and yellow toadflax), Gros Ventre River corridor (spotted knapweed), Bradley-Taggart trailhead and meadow (yellow toadflax), and Kelly hayfields (musk thistle and smooth brome).

Biological technicians, including a backpack spray crew; backcountry horse crew; truck, tractor, and UTV sprayers; along with the Rocky Mountain Exotic Plant Management Team and volunteer groups treated 1,213 acres in 5,209 person hours in Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway during the summer of 2014. Areas treated include roadsides, pathways, developed areas, backcountry trails, horse trails, hayfields, and front country heavy use areas. Through a cooperative agreement, Teton County Weed and Pest treated along the park’s main highways, Teton Park Road and US 26/89/191. The park treats 25 major invasive species which are listed on the Wyoming Noxious Weed List, as well as cheatgrass (*Bromus tectorum*) which is listed by Teton County, and smooth brome (*Bromus inermis*) as part of the ecological restoration of the Kelly hayfields.

Technician and horse team using a pack sprayer for invasive plant treatment.



Annual record of the hours spent and acres treated for invasive plants.

Plant Restoration

Plant community restoration and revegetation are both processes of managing vegetation in disturbed areas in a manner that encourages native plant species and discourages nonnatives. Revegetation seeks to rapidly establish native plants and initiate vegetation recovery, while restoration is intended to restore the native plant community and ecosystem that existed before disturbances occurred. A primary goal of vegetation management in Grand Teton National Park is to restore disturbed ecosystems to provide critical forage and habitat for the diverse wildlife species that inhabit the park. A second goal is to support the National Park Service policy which states that the service shall leave the natural landscape unimpaired for future generations. In order to achieve these goals, all revegetation and restoration conducted in Grand Teton is accomplished with plant materials that originate within the boundaries of the park. Research confirms that using native locally occurring plant materials adapted to the environment translates into greater success of restoration and revegetation efforts.

In 2014, crews worked on 24 separate projects (totaling 32 acres) associated with revegetating disturbances resulting from park infrastructure improvements such as replacement of waterlines, road improvements, and building repairs. These areas were reseeded with 22 plant species from 415 pounds of native seed that originated from materials hand collected and processed by park staff. Park collection efforts totaled more than 390 person hours and yielded approximately 700 pounds of bulk material. Native seed for restoration and revegetation projects is generated by one of two methods, collection or increase. Seed increase is the process where hand-collected seed is planted and grown in a field or agricultural setting, to harvest a greater quantity of seed directly from fields. In this way, large quantities of native seed can be produced in a controlled setting. The park has interagency agreements for the increase of seed with the Natural Resources Conservation Service's Plant Material Centers in Aberdeen, Idaho; Bridger, Montana; and Bismarck, North Dakota. Additionally, park vegetation staff began a three-acre seed increase field within the boundaries of the park. This relatively unique undertaking in the National Park System has the possibility to provide seed that is both genetically appropriate and free of nonnative plant seed that can contaminate seed grown in agricultural fields located outside the park.

Using prescribed fire in old hayfields to restore native vegetation, 2014.

Park staff led a volunteer group in decommissioning social trails at the Colter Bay swim beach, 2014.

Restoration efforts include removing social trails in important wildlife habitats to reduce habitat fragmentation, minimize the spread of invasive plant species, reduce soil erosion, and decrease negative effects on water quality. In 2014, contractors and volunteers helped park crews remove and revegetate 19 miles of trails. Since compacted trails and roadbeds can be persistent barriers to plant establishment and root penetration, loosening soil in the trail tread prior to seeding increases success. Following soil decompaction, crews seed with a native seed mix by hand dispersal and with a rangeland seed drill. Crews also treat the project areas for invasive species that can compromise native plant establishment.

Park revegetation crews continue the long term effort to restore 4,500 acres of historic hayfields in the Antelope Flats area to the native sagebrush steppe community which provides important habitat for elk, bison, antelope, and sage grouse. Restoration of these lands may include prescribed fire, herbicide applications, and finally native seeding. In 2014, crews sprayed herbicide to remove smooth brome on 238 acres and seeded it with 2,800 pounds of native seed mix. They treated invasive plant species on 515 acres and used prescribed fire on 317 acres. Cumulatively in the last nine years, crews treated more than 865 acres of the hayfields restoration area and seeded 660 acres with 7,900 pounds of native plant seed.

Since 2012, park staff collaborate with the Greater Yellowstone Inventory and Monitoring Network staff to monitor sagebrush steppe ecosystems. This monitoring provides information on the current condition of intact sagebrush communities and collects baseline data for evaluating long-term changes to these communities. In 2014, park staff collected sagebrush monitoring data in 14 study plots totaling 140 hectares. Grand Teton's revegetation efforts are crucial in reestablishing healthy plant communities.

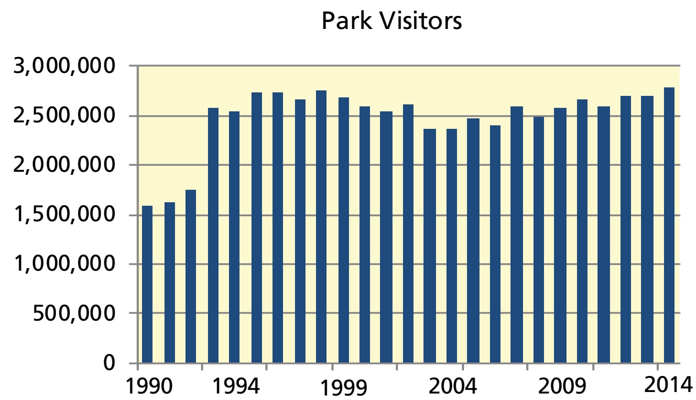
Visitor Use

Use of the park by visitors is both a primary reason for the establishment of Grand Teton National Park and a factor influencing resource condition. Visitor activities and associated infrastructure affect many park resources, including:

- air quality, water quality, and the natural soundscape;
- wildlife habitat, distribution, and habituation;
- the condition of historic structures and archeologic sites; and
- the spread of nonnative plants, diseases, and aquatic organisms.

Since 1993, recreational visits to the park have fluctuated between 2.4 and 2.8 million a year. In 2014, the park received more than 2.79 million recreational visits with a total of 549,941 overnight stays. Frontcountry camping ranked first in visitor accommodations accounting for 55% of the overnight stays, followed by lodging with 39%. While almost half of the park (44%) is considered backcountry, only 5.4 % of the overnight stays were in backcountry campsites. Although there are no day-use limits, lodging and campgrounds in the park are limited by available space, and on some summer nights, one or more forms of accommodation are full.

Daily visitation during July 2014 averaged 22,136 visitors. While about 78% of the park visitation occurs in the warmer months—from June through September— visitation during the cooler months has been growing. In October 2014, visitation more than doubled the number of park visitors in the same month of the previous year.



Annual Grand Teton visitation 1990–2014.