





YELLOWSTONE
CENTER FOR RESOURCES

2008 ANNUAL REPORT



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Yellowstone Center for Resources
National Park Service
Yellowstone National Park, Wyoming

YCR-2010-05



Suggested citation: Yellowstone Center for Resources. 2010. Yellowstone Center for Resources Annual Report, 2008. National Park Service, Mammoth Hot Springs, Wyoming, YCR-2010-05.

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Cover photos: Pelicans fishing, NPS by Todd Koel; flowers at Clear Creek cabin, NPS by Brian Ertel; bull elk at Buffalo Plateau, NPS. Previous page: Mount Sheridan, NPS by Todd Koel.

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Introduction

Yellowstone's unique geological and biological resources inspired its creation as the world's first national park in 1872. The National Park Service (NPS) is legally responsible for preserving, unimpaired, the park's natural and cultural resources and values for the enjoyment, education, and inspiration of this and future generations. The Yellowstone Center for Resources (YCR) works to fulfill these responsibilities for the resources we are mandated to manage and protect.

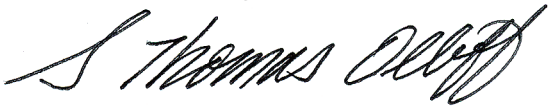
In 2008, we report on the activities of the Environmental Quality and Resource Operations programs, which were added to the YCR in 2007. The Environmental Quality Branch completed the *Wireless Communication Services Plan Environmental Assessment*, and the *Servicewide Benefits-Sharing Final Environmental Impact Statement* went through a lengthy internal review and neared completion. Science communication staff collaborated to host the 10th Biennial Scientific Conference, *The '88 Fires: Yellowstone and Beyond*, which had approximately 450 attendees and featured more than 140 presentations.

The University of Montana archeological field school surveyed several tipi ring clusters, one of which is more than 4,000 years old and thought to be one of the earliest radio carbon dates for a tipi in the Northern Plains. On June 5, park managers conducted an Intergovernmental-Intertribal Information Exchange meeting in the park, where the primary topic was bison management. With NPS Centennial Challenge funding, 70 items in the museum collection were sent off site to be professionally cleaned, stabilized, and rehoused. The number of people using the Heritage and Research Center library bookmobile increased 150% in 2008 over 2007.

In 2008, a record number of nonnative lake trout (76,136) were removed from Yellowstone Lake. The northern portion of the lake experienced a swarm of almost 900 earthquakes with magnitudes up to 3.9, which was well above typical activity but not unprecedented. Many of the 218 known, established non-native plant species continued expanding their ranges, and 841 hazardous trees were removed. The estimated population of grizzly bears in the GYE was 596 one year after the U.S. Fish and Wildlife Service removed this population from threatened status under the Endangered Species Act. Only two pairs of nesting trumpeter swans were found in the park, and their decline is cause for concern and under investigation. When the estimated 2007 summer population of 4,700 bison encountered heavy winter snowfall, a total of 1,728 bison were removed from the population, including 166 that were taken by hunters outside the park and 112 calves that were sent to quarantine. The year-end wolf population declined to 124 wolves with 6 breeding pairs.

The YCR's partnerships and agreements with other federal and state agencies, academia, and public organizations continued to be critical to our successes in stewardship. The YCR also continued to benefit from the hard work of many volunteers and cooperators. Research Permit Office staff authorized almost 200 research permits to investigators from across the U.S. and foreign countries.

For more information, readers may contact us at (307) 344-2203, visit the park's website at www.nps.gov/yell, or visit the Greater Yellowstone Science Learning Center website at www.greateryellowstonescience.org.



Tom Olliff
Chief, Yellowstone Center for Resources

PART I

Cultural Resources

The Branch of Cultural Resources helps preserve and increase knowledge of Yellowstone's resources in these areas:

- Archeology
- Ethnography
- Yellowstone History
- Archives, Library, and Museum Collections



University of Montana students excavating a tipi ring near the old frontier town of Cinnabar, Montana.

Archeology

Archeology in Yellowstone National Park is critical to understanding the precontact and historical record of the Greater Yellowstone Area. By studying the types of stone that were used and discarded, staff can track the early human residents as they lived and traveled in the park and beyond it. Because the intensity of use varies through time as environmental conditions become more or less favorable, the archeological sites and their contents also provide a means for interdisciplinary investigations of past climate and biotic change.

A program to identify artifacts that are becoming newly exposed at high altitudes because of decreasing ice and snowpack was initiated in June. An inventory in the Lake developed area identified 10 new sites and documented five previously known sites. The remainder of the Lake developed area archeological survey will be conducted in FY 2009.

The second year of the Nez Perce Trail archeological survey located the site at Otter Creek where an attack on a Helena party of 10 men occurred and several possible camp sites on Parker Peak where the Nez Perce began their flight eastward and out of the park. A total of 15 new sites were recorded, including along the Mary Mountain path of the Nez Perce. More work will be conducted next year to identify possible sites near Mary Lake.

Continuing efforts to inventory archeological sites along Native American trails in the Indian Creek drainage documented 19 new sites. More work needs to be completed along this trail system, which incorporates parts of the trails used by the Bannock as they traveled to buffalo hunting grounds to the east. Efforts to document the Bannock and Nez Perce trails are also using oral traditions and archival research.

The University of Montana archeological field school surveyed more than 1,000 acres in the boundary land area for National Register testing and documented 37 new sites with historic or prehistoric components, including several tipi ring clusters. The blacksmith shop in the former town of Cinnabar was excavated and the Henderson and Stermitz homesteads were recorded. Several tipi ring clusters were recorded, one of which is more than 4,000 years old, which is thought to be one of the earliest radio carbon dates for a tipi in the Northern Plains.

In connection with the Federal Highway Administration effort to widen and rehabilitate the Golden Gate to Norris segment of the Grand Loop Road, data recovery excavations were conducted at a site north of the Obsidian Cliff National Historic Landmark according to an excavation plan approved by the Wyoming State Historic Preservation Office. Analysis of artifacts and specimens collected from three previous data recovery excavations along this segment of road continued in preparation of the final data recovery reports.

Archeological sites assessment work continued with a crew of capable volunteers. In the past few

years Yellowstone National Park archeological staff and volunteers have completed a large number of site assessments with all of the easily accessed sites completed. The program must now work on the backcountry and high altitude sites to complete the annual quota of 10 site assessments required under GPRA (Government Performance and Results Act).

Ethnography

The goals of the Ethnography Program are to develop the programs, guidelines, and information needed to help management identify and protect culturally significant resources of peoples traditionally associated with the park, and to support relationships between the park and the peoples whose customary ways of life may be affected by park activities.

With representatives from Grand Teton National Park and the National Elk Refuge and invited tribes, Yellowstone managers conducted an Intergovernmental-Intertribal Information Exchange meeting on June 5, 2008, in Mammoth Hot Springs. In addition to the deputy superintendents of Grand Teton and Yellowstone, attendees included 25 representatives from 13 tribes. The primary topic of discussion was the role of the NPS in bison management in Greater Yellowstone. Yellowstone staff provided an update on the development of an in-park bison vaccination program and progress with the vaccination EIS. The status of Native American Graves Protection and Repatriation Act objects at the Colter Bay Museum in Grand Teton was also discussed. A potluck dinner welcoming the tribes, sponsored by the Bear Creek Council, provided an opportunity for tribal members and the community to interact and share concerns.

A cooperative effort by Yellowstone and Grand Teton national parks, the National Elk Refuge, and the Bridger-Teton National Forest is studying the use of conical timber structures known as wickiups by native peoples. A University of Montana graduate student is working on a synthesis of what is known about the passage of the Nez Perce through the park, the Bannock's use of Yellowstone's ancient trail system, and Indians' use of wickiups in the Greater Yellowstone Area.

Yellowstone History

The park historian completed the research and writing of brief histories of the Gardiner Hay Ranch, the Madison Museum, the Fort Yellowstone Jail, the school in Mammoth Hot Springs, and the West Entrance Road (for its National Register nomination). He saw through to publication articles he had written on "Byways, Boats, and Buildings: Yellowstone Lake in History" for *Points West* (Buffalo Bill Historical Center) and "Music, Song, and Laughter: Paradise at Yellowstone's Fountain Hotel, 1891–1916" for *GOSA Transactions: Journal of the Geyser Observation and Study Association*. For the Atlas of Yellowstone National Park project being spearheaded by the University of Oregon, he wrote the section on place names, reviewed the section on exploration, and helped with selection of historic maps and their captions. He assisted the museum technicians Andrew Washburn and Bridgette Guild in identifying and dating photographs in the park's museum collection. He conferred with historians about history programs in other national parks to compile a "History Program Briefing Book." He continued working with Paul Schullery on the history of wildlife of the Greater Yellowstone region, a project receiving support from the Yellowstone Park Foundation.

Historic Roads

Yellowstone National Park's historic roads are a nationally significant example of early public road construction. Cultural Resources staff make every effort to ensure that rehabilitation of these roads retains their integrity of materials, workmanship, feeling, and association through the use of natural materials and a design philosophy that calls for preservation of historical curves and blending with the natural landscape. The park's long-range program of principal road system improvements is covered under a Programmatic Agreement that meets the Section 106 requirements of the National Historic Preservation Act, as amended. The Programmatic Agreement has been in effect since January 1993, when it was signed by the NPS, the Advisory Council on Historic Preservation, and the Wyoming and Montana state historic preservation officers.

In conjunction with the reconstruction of the North Rim Drive, Recreation Fee Demonstration



Reconstructing a log retaining wall on the North Rim Drive.

funds were used to restore the trails connecting the viewing areas of the Grand Canyon of the Yellowstone as boulder-lined walks, matching the improvements made in 2007 at the Artist Point viewing area. Planning for reconstruction of the Lamar River Bridge was moved up on the Federal Highway Administration schedule due to structural problems identified during the biennial bridge inspection program. An engineering study completed in 2008 has provided the information needed for park staff to identify the most appropriate and economical means of replacing the bridge.

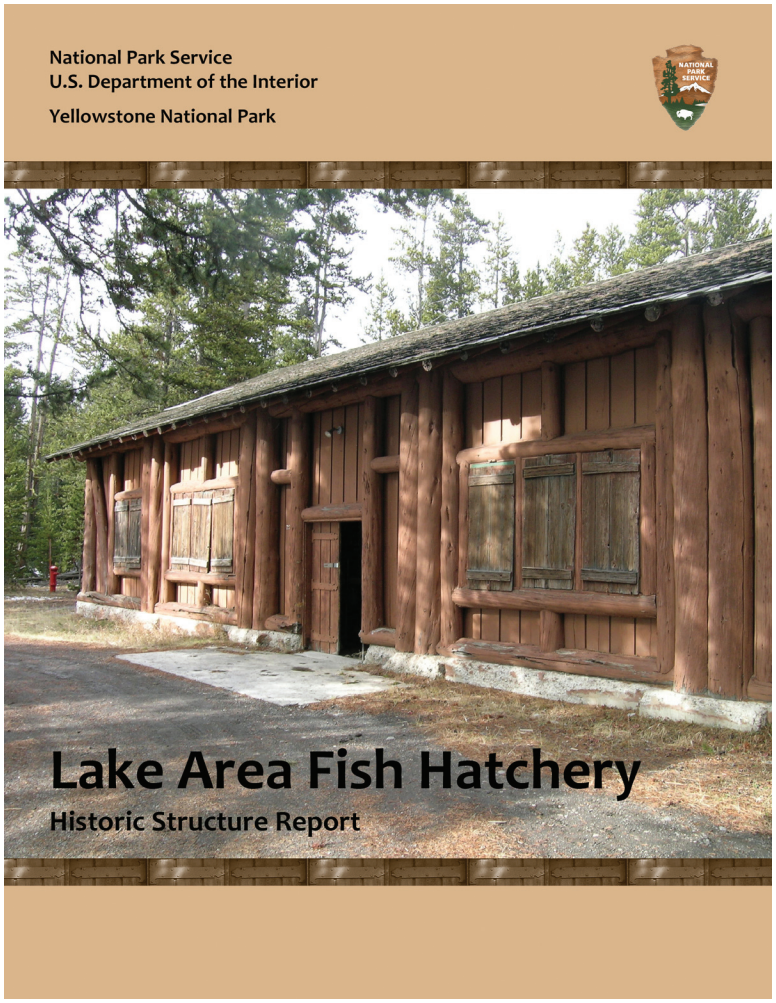
Park staff also worked with the Federal Highway Administration road and bridge design engineers to finalize the design and complete the National Historic Preservation Act consultation for the Tanker Curve re-route of a portion of the Madison to Norris segment of the Grand Loop Road. This rehabilitation and widening of the road includes repairs of the Gibbon Falls viewing area, construction of a new bridge over the Gibbon River, a much improved picnic area south of Gibbon Falls, an expanded and improved historic viewing area and interpretation at Gibbon Falls, two new viewing and picnic areas on the new alignment of the road, removal of two miles of abandoned road, and restoration of the landform along the river to its natural condition.

Historic Structures

In addition to providing facilities for visitor use and park management, many Yellowstone structures have historical, architectural, and/or engineering significance. The park's National Register designated Historic Districts include the Grand Loop Road, Lake Fish Hatchery, and Lamar Buffalo Ranch. Also on the National Register of Historic Places are the Lake Hotel, Queen's Laundry Bath House in the Lower Geyser Basin, Post Office in Mammoth Hot Springs, and six National Historic Landmarks: Fort Yellowstone and five influential examples of park "rustic" architecture—the Old Faithful Inn, Northeast Entrance Station, and Norris, Madison, and Fishing Bridge museums.

Through a cooperative agreement with the Montana Preservation Alliance, documentation of historic cabins and other structures continued for determination of National Register eligibility, and a management strategy for the park's many historic structures was completed. Progress was made on three historic structure reports: the "Mammoth Nature Store Historic Structure Report" was drafted, and reports for the Lake Fish Hatchery and the Albright Visitor Center were completed.

A cooperative agreement through the University of Montana was initiated to document the historical context of the park's Mission 66-era buildings and to draft a National Register Multiple Property Document with which to evaluate the many buildings within two years. Examination of the park's administrative record revealed that the Mission 66 program removed as many structures, some of



which were historic, as it constructed. The records also show the significance of the development of a new interpretative plan in the park that served as a template for interpretation programs at new visitor centers throughout the park, suggesting that the interpretive program may be of greater historical importance than the buildings themselves.

Working with the Wyoming State Historic Preservation Office, park staff developed a roofing plan for Mammoth Hot Springs to guide future roofing projects while protecting the historical integrity of the area and providing fire-resistant and durable roofing options. Work also began on the rehabilitation of the Mammoth Guardhouse which, in order to continue to be used as a jail, will need to have the cells replaced with modern containment areas that meet U.S. Marshall standards. Wyoming State Historic Preservation Office staff were instrumental in assisting with the design phase to ensure there will be no adverse effect to the historic structure. Rehabilitation of the Old Faithful Inn "Old House" was launched in 2008 along with planning for the rehabilitation of the Lake Hotel porch columns as research began for drafting a National Historic Landmark Nomination for the hotel.

Archives, Library, and Museum Collections

Yellowstone National Park's archives, library, and museum collections comprise several million items that document the cultural and natural history of the park. They include some of the first photographs taken of the park by William Henry Jackson; Thomas Moran's original field sketches from the 1871 Hayden Expedition; historical postcards, souvenirs, and ephemera of Yellowstone; and a rare book collection. The archives contain several thousand linear feet of records that document the history of Yellowstone since its establishment in 1872, while the library has more than 20,000 volumes related to Yellowstone's history.

The goal of the archives and museum program is to preserve and document the park's cultural and natural history, and make it available to as wide an audience as possible through on-site research, the Internet, facility tours, and temporary exhibits. The archival collection is the only one of the nine affiliates of the National Archives and Records Administration that is located in a national park. The park's permanent federal records are therefore retained in the archives instead of transferred to National Archives and Records Administration facilities. The archives also include donated historical records and collections, records of park concessioners, and an extensive oral history collection. The archives and museum collections are heavily used by park staff and outside researchers studying all aspects of park history.

The primary objectives of the Yellowstone Research Library are to document the park's history

by preserving all relevant books and papers, and to select, organize, and make accessible books and related materials that will assist park staff in the performance of their duties. The library's resources are also available to the general public; independent researchers; students; concessions employees; the local community in Gardiner, Montana; residents of the state of Wyoming; and park visitors through the Wyoming Library Database of the Wyoming Library Consortium.

Collection Conservation

Through the funding of several projects and external monetary support, numerous collections were conserved and rehoused during 2008. With NPS Centennial Challenge funding and Yellowstone Park Foundation matching funds, 70 items in the collection have been sent off site to be professionally cleaned, stabilized, and rehoused to prolong their preservation and make them accessible for exhibits. These items include Thomas Moran's diary of his 1871 trip to Yellowstone and two of his sketchbooks; drawings by several artists who accompanied early expeditions or visited the park in the early days; a volume of William Henry Jackson photographs; a set of 1876 chromolithographs of Moran's drawings; and a 1903 note found in the Old Faithful Inn. Of the 70 items, 15 have been returned to the park. The remainder will be conserved and returned during FY09.

NPS Cultural Cyclic funding enabled Barbara Cumberland, a conservator from Harpers Ferry Center, to clean more than half of the taxidermied animals at the Fishing Bridge Museum, most of which had never been professionally cleaned before. She also trained curatorial staff on cleaning techniques, tested all specimens for arsenic, and provided advice on how to conserve specimens that are not in enclosed exhibit cases. She will be returning during FY09 to complete the specimen cleaning. These funds were also used to purchase UV-coated safety glass for the exhibit cases to mitigate light damage, new flooring to replace the asbestos tiles, and conversion of the oil furnace to more energy-efficient propane. The park's research collections increased exponentially as staff worked closely with the Research Permit Office to ensure that research permittees comply with curatorial requirements for specimens they collect.

Through the Intermountain Region's Museum Management Program, Lynn Mitchell, the regional archivist, and Susan Ewing Haley, archivist and records manager at Golden Gate National Recreation Area, spent two weeks helping park staff improve the management and organization of the archives, obtain an accurate count of the park's archival holdings, and physically separate NPS records from National Archives and Records Administration records. Yellowstone Association funds enabled staff to purchase acid-free rehousing materials to improve the storage of many archival and library documents.

Funds from the Recreation Fee Program were used to purchase a four-carriage, open-shelf mobile storage unit to house part of the park's archeological collection and larger items such as firefighting equipment. Such shelving has improved the storage of these collections and made them much more accessible to researchers and easier for visitors to view



NPS conservator Barbara Cumberland cleans specimens at the Fishing Bridge Museum as part of a Cultural Cyclic project.

when on a public tour of the Heritage and Research Center. Funds from the Yellowstone Park Foundation were used to purchase eight herbarium cabinets.

Assisting Researchers and Outreach

Heritage and Research Center staff accommodated 276 on-site research visits to the archives during 2008 and responded to 254 telephone, email, and written research requests; about half of the research visits and requests were from NPS employees. The librarians assisted more than 1,000 researchers through on-site use of the library, reference questions answered via telephone or email, and interlibrary loans. Museum staff assisted more than 100 researchers with historical photographs and other collection inquiries, scanning 927 images. The librarians increased the number of stops made by the bookmobile to make the library collections and resources more accessible to employees in the park's interior; the number of people using the bookmobile increased 150% in 2008 over 2007.

About 225 people participated in tours of the facility that were offered once a week from May 28 to September 3 and helped raise public awareness of the Heritage and Research Center and its mission. In order to showcase certain parts of the collection, staff installed an exhibit in the main and upper lobbies of the Heritage and Research Center that highlighted the 1988 fires.

Volunteer Support

A total of 26 volunteers contributed 2,769 hours (over 1.0 FTE) to archives, library, and museum projects in 2008. Arranged through the University of Montana–Western, Heritage and Research Center staff hosted their third annual Elderhostel Service Program in February, during which 12 participants provided a total of almost 390 hours of volunteer assistance on much-needed projects. The archives, library and museum staff divided the participants into smaller groups that worked on cataloging, inventorying, and rehousing.

Jay Antle returned in 2008 to complete a finding aid for the 1988 fire records that has made this archival collection more accessible to researchers. Long-time volunteer Bob Flather created finding aids for numerous photograph albums, conducted research for park archeologist Ann Johnson, and continued to inventory the maps and oversized documents in the archives. Judy Hermanson staffed the Heritage and Research Center information desk for the entire summer and completed a multitude of projects, including organization of Volunteer Angler Cards from the Aquatic Resources Program, culling the library's vertical files, organizing reference prints for the historic photograph collection, and assisting with inventorying the museum collection. The creation of the Reference Print Collection, organized by subject, will provide easier access for researchers to almost 2,500 of the collection's most popular historical photographs. George and Heather Rinkel, who spent a month as library and museum volunteers, cataloged and completed finding aids for historic photograph albums and assisted with the library's vertical files project. Cynthia Kaag, head of Science Libraries at Washington State University,





Summer interns and seasonals created an exhibit in the Heritage and Research Center lobby to commemorate the 20th anniversary of the 1988 fires.



Volunteers work on cataloging historic postcards as part of a week-long Elderhostel Service Program at the Heritage and Research Center.



Jack and Jeane Atkins of Cody rehouse archives collections as part of the week-long Elderhostel Service Program.

assisted the librarians with standardizing author headings and developing an acquisitions wish list to fill gaps in the library's thesis collection.

Noteworthy Accessions

Museum accessions in 2008 included several photograph albums documenting early trips to Yellowstone, a rare Calfee stereoview entitled "Group at Giant Geyser" (ca. 1880), and several stereoviews (ca. 1875) by Bozeman photographer J. Crissman.

Archival accessions included the papers of Herma Albertson Baggley, one of the first botanists in the park; photographs of park buildings documented as part of the Historic American Buildings Survey; fire weather history records from the Fire Cache; Research Permit Office files; and files from the former park ethnographer's office.

Through the Yellowstone Association, the library purchased 38 items for the collection and accessioned 785 items in 2008. A significant donation from Tom Murphy included nine books that are an important addition to the library's rare book collection.

PART II

Natural Resources

The Branch of Natural Resources helps preserve and increase knowledge of Yellowstone's resources in these areas:

- Air Quality
- Water Quality
- Aquatic Resources
- Geology
- Vegetation
- Bears
- Birds
- Mid-sized Carnivores
- Ungulates
- Wolves



The Oxbow Creek pack.

Air Quality

Yellowstone participates in a nationwide interagency air quality monitoring network designed to determine levels of air pollutants, trends in air quality, and compliance with National Ambient Air Quality Standards. YCR staff collect samples and data on atmospheric deposition and wet and dry atmospheric deposition at the Tower Ranger Station, visibility (fine particulates) and gaseous pollutants (ozone and sulfur dioxides) at the Lake water tank, and carbon monoxide and fine particulates at Old Faithful and the West Entrance. The samples and raw data are sent to various national programs for analysis.

The NPS Air Quality Division's most recent Annual Performance and Progress Report, which presents data collected from 1998 through 2007, indicated that no measured Clean Air Act standards were exceeded in Yellowstone. However, as at many monitoring sites in the West, a statistically significant increase of ammonium in precipitation has been found in the park. The reason for this increase has not been determined, but it may be related to agricultural activities, coal-fired power plants, or oil and gas development. Increases such as these can be of concern because of the potential ecological effects (e.g., acidification of surface waters and nutrient enrichment that disrupts natural systems). On a national level, the NPS continues to work with the Environmental Protection Agency and state air quality agencies to better understand the sources of the increased ammonium and the causes and effects of nitrogen loadings, and to explore options for protecting ecosystem health.

Winter Air Quality

Most of the air quality monitoring in Yellowstone pertains to winter use at the West Entrance and Old Faithful. The combination of fewer snowmobiles entering the park and reduced emissions by snowmobiles meeting the Best Available Technology requirement has greatly reduced carbon monoxide and particulate matter concentrations since 2003. However, although air quality at Yellowstone meets EPA standards to protect human health, CO levels are sometimes above natural regional background levels in areas near vehicle routes, especially during the winter. There is a high degree of uncertainty in the relationship between changes in winter traffic at the West Entrance and Old Faithful and changes in recorded air quality measurements. Weather and traffic density at a given time are important factors in the daily and hourly variations in ambient air pollutant concentrations. The highest CO level at the West Entrance in the winter of 2007–08 was 6.1 parts per million (ppm), compared to a typical summer maximum of 0.8 ppm. Winter inversion layers, which impede dispersion of pollutants by trapping the cooler surface air, are a major factor in the difference between summer and winter air quality.

GYA Clean Air Partnership

The Greater Yellowstone Area Clean Air Partnership includes representatives from Yellowstone and Grand Teton national parks, Gallatin, Custer, Beaverhead, Shoshone, Bridger-Teton, and Targhee national forests, Red Rock Lakes National Wildlife Refuge, the Idaho National Environmental and Energy Laboratory, the Bureau of Land Management, and the Montana, Idaho, and Wyoming departments of environmental quality. Its primary purposes are to advise the Greater Yellowstone Coordinating Committee on air quality issues and coordinate air quality monitoring among federal agencies. The group is focused on addressing the four main air quality threats in Greater Yellowstone: (1) urban and industrial emissions, (2) oil and gas development in southwest Wyoming, (3) prescribed and wildfire smoke, and (4) snowmobile emissions. The 12th annual meeting, held in Pinedale, Wyoming, in October 2008, focused on gas and oil development in the Upper Green River basin and southwestern Wyoming and the potential for significant impacts on air quality in the Greater Yellowstone Area. Approximately 3,500 producing gas wells and 450 producing wells are currently operating in the Upper Green River basin. The BLM Pinedale Resource Management plan anticipates more than 7,000 more wells in the foreseeable future. Although ozone formation was previously thought of as a summer phenomena, Wyoming Department of Environmental Quality, which began monitoring ozone in 2005, reported air quality standard exceedances in the Pinedale area in the winters of 2005, 2006, and 2008.



NPS water quality technician Joe Skorupski sampling Yellowstone Lake.

Water Quality

Water quality monitoring of Yellowstone National Park's major surface waters is done by Fisheries and Aquatic Sciences Section staff in cooperation with the Greater Yellowstone Network's Inventory and Monitoring Program. Water temperature, dissolved oxygen, pH, specific conductance turbidity, and total suspended solids are monitored monthly at 11 stream and 7 lake sites. Data on water chemistry is collected on samples from 10 stream sites, including anions (sulfate, chloride, bicarbonate, and carbonate), cations (calcium, magnesium, sodium, and potassium), and nutrients (total phosphorus, orthophosphate, nitrate, nitrite, and ammonia). Aquatic invertebrates are collected at five locations near stream sites as another means of assessing water quality. As is typical of mountain streams with minimal sediment contribution, water clarity usually remains very good throughout the year, with more turbid conditions observed during snowmelt and after rainfall.

Statistics for core water quality parameters indicate trends in 2008 very similar to those observed from 2002 to 2007. Although six of the monitored stream sites did not meet EPA and/or state standards for pH, turbidity, or temperature in at least one monthly sampling, all but one of these incidences are likely the result of natural rather than anthropogenic factors. Low pH and high turbidity values

were most likely due to natural seasonal variation within the watersheds, and some stream sites receive thermal inputs which contribute greatly to the overall acidity of the water and affect water temperature. Analysis of water quality data is underway to better understand the natural variation of Yellowstone's surface waters and increase our ability to detect changes caused by anthropogenic sources.

Park staff continued to monitor proposed and ongoing reclamation projects associated with the New World Mining District and the McLaren mine tailings outside the park. Environmental cleanup of historical mining impacts in the New World Mining District adjacent to the Northeast Entrance is proceeding. The U.S. Forest Service has completed most of the major restoration work and is developing a long-term plan which includes revegetation, trail restoration, and monitoring of the New World Waste Repository and associated surface water and groundwater quality. As a result of elevated metal concentrations from the McLaren mine tailings near Cooke City and within the Soda Butte Creek floodplain, the state of Montana has listed the water quality of Soda Butte Creek upstream of the park's Northeast Entrance as "impaired." Arsenic, copper, iron, and selenium in the water and sediment of Soda Butte Creek are measured at the park boundary during its annual high and low flow periods. Although the metal concentrations appear negligible, the water is at risk from upstream contamination during an extreme flood event. The Soda Butte Creek site exceeded EPA/state standards for dissolved iron during a September 2008 site visit. In 2009 park staff will increase water sampling at the creek to better monitor possible impacts of the removal process.

Aquatic Resources

The top priorities for the park's Aquatic Resources Program are the preservation of Yellowstone cutthroat trout (YCT) in Yellowstone Lake and restoration of fluvial populations of native trout, many of which have been lost because of nonnative species introductions.

Yellowstone Cutthroat Trout Preservation

YCT Population Monitoring. Long-term monitoring of the Yellowstone Lake ecosystem indicates a substantial decline in the number of YCT since 1988. By 2007, the number of upstream migrating YCT in Clear Creek, one of the largest spawning tributaries to Yellowstone Lake, had declined from 54,928 to 538. Because of damage to the Clear Creek fish trap during high spring flows in June 2008, a complete count of the cutthroat trout spawning run could not be conducted. YCT in Yellowstone Lake have been monitored annually through fall gillnetting since 1969. In 2008, an average of 9.2 YCT were captured per gill net, the largest number since the 9.9 average in 1998. Although approximately 38% of the 2008 catch consisted of fish greater than 330 mm in total length (the minimum length at which cutthroat trout in the lake system are thought to mature), what has been missing in recent years is the pulse of 200–250 mm range fish continuing into adulthood.



Removing lake trout from a gill net.



Molly Payne, Chelsey Young, and Phil Doepke remove fish from gill nets aboard the NPS Freedom.

Lake Trout Suppression. Efforts to reduce the population of nonnative lake trout in the lake, which began in 1995, got underway later than usual this year because of cold spring weather. Nonetheless, a record number of lake trout (76,136) were removed during 2008, including the largest lake trout from Yellowstone Lake on record, a 10.89 kg (24 lbs 6 oz) 12-year-old female, 982 mm in total length. Gillnetting, which continued to be the primary removal method, was done from June 3 until October 21, with up to 10 miles of nets set at a time. Almost 350,000 lake trout have been removed from Yellowstone Lake through gillnetting since their presence was confirmed in 1994.



Stuart Brown with a record-size lake trout caught in a gill net in Yellowstone Lake.

In August, park managers convened 15 fisheries experts to evaluate the lake trout suppression program. They concluded that despite the efforts made to reduce the lake trout population, the cutthroat trout population in Yellowstone Lake has continued to decline and remains in peril with little time to turn the situation around. They recommended bolstering current removal efforts with additional gill and trap netting of lake trout and conducting research on lake trout movement, habitat use in Yellowstone Lake, and innovative removal techniques.

Native Trout Restoration

Westslope Cutthroat Trout. Following the removal of nonnative fish from the historically fishless High Lake in 2006, introduction of westslope cutthroat trout (WCT) began there in 2007 and continued in 2008 using the two known genetically pure WCT populations in the park (an aboriginal population in Last Chance Creek and descendants



Dr. Bob Gresswell of the U.S. Geological Survey delivers findings and recommendations to NPS personnel from the Scientific Review Panel Evaluation of the National Park Service Lake Trout Suppression Program in Yellowstone Lake that took place August 25–29, 2008.



A fish trap at Clear Creek is used to monitor spawning cutthroat trout.



Chelsey Young weighs a cutthroat trout.

of a population apparently stocked in the Oxbow/Geode Creek complex in the 1920s) and Upper Missouri River brood stock from the Sun Ranch Hatchery. In July, more than 3,000 eggs, brought by horseback from Last Chance Creek and by helicopter from the Sun Ranch Hatchery, were placed in remote site incubators, and 890 WCT of various age-classes were flown in from the Oxbow/Geode Creek complex. Subsequent monitoring indicated initial success of the 2008 stocking efforts: an abundance of fry were visible in the inlet streams and various locations around the lake margin, and adult fish were seen cruising the littoral zone feeding on aquatic invertebrates. Campers in the area reported a family of otters inhabiting the lake, indicating the presence of fish-dependent wildlife in the area.

To prevent upstream movement into East Fork Specimen Creek by nonnative fish, a barrier was completed in August 2008. Hazard trees left by the Owl Fire were removed from the site to mitigate safety concerns, and tools and supplies were brought by several helicopter sling loads and 93 stock loads. Dozens of people, including park staff from almost every division and members of the Montana Conservation Corps, who did much of the manual labor, helped complete a double-walled log structure nearly 6 feet tall and more than 40 feet wide at the top. The barrier channels water over the middle of the structure through a set of weir notches and onto a concrete splash pad.

An EPA-approved piscicide (rotenone) was used to remove nonnative fish and hybridized WCT between the fish barrier and High Lake. At the end



A wetland surveyed near the confluence of Slough Creek and the Lamar River had larval blotched tiger salamanders lacking most skin pigments.

of the treatment area below the fish barrier, the rotenone was neutralized using potassium permanganate dispensed from a volumetric feeder. Monitoring of sentinel fish placed in cages in the stream indicated the success of both the piscicide treatment and the neutralization.

Given the inherent difficulty of achieving a complete removal of nonnative fish from such a large area, the piscicide treatments will be repeated in 2009. If the treatments and fish barrier prove to be effective in eliminating fish from East Fork Specimen Creek, plans to stock the stream with WCT will be initiated in 2010.

Arctic Grayling. Competition from introduced fish species eliminated the fluvial Arctic grayling that were native to park waters by the 1950s, and the lower reaches of Grayling Creek, where grayling



The presence of rainbow trout genetic material has been confirmed in the first meadow and in the canyon above the first meadow of Slough Creek.

were most abundant, were submerged by the completion of the Hebgen Dam. The uppermost reaches of Grayling Creek, considered a potential site for fluvial grayling restoration, are currently occupied by brown trout and hybridized cutthroats. Interagency efforts continued in 2008 to survey the stream headwaters and collect high-resolution fish composition, distribution, and genetic data.

YCT Restoration on the Northern Range. In anticipation of future YCT restoration efforts on the northern range, additional sampling and preparations focused on Rose Creek, the Elk Creek Complex, and Reese Creek. The absence of marked fish captured upstream of the lower Elk Creek cascades in 2008 provided additional evidence that the feature serves as a fish barrier. Dale White, U.S. Forest Service Fish Barrier engineer, made site visits to determine the feasibility of constructing a fish barrier in lower Rose Creek for a proposed restoration area and the efficacy of the cascades at Ice Box Canyon on Soda Butte Creek as a fish barrier. Information obtained from the 2008 fieldwork will be used to prepare the NEPA documents necessary to move forward with specific restoration projects.

Nonnative Fish Invasions. Several invasions of large historically YCT waters by nonnative fish have been discovered on the park's northern range in recent years. An intensive effort by Montana Fish, Wildlife and Parks, in cooperation with the U.S. Forest Service and park staff, to remove the brook trout from Soda Butte Creek appears to be working, but now its YCT population is also threatened by introgression with rainbow trout from an unknown source. The source of rainbow trout found in Slough Creek has also not been determined. A reliable source has reported brown trout in the Yellowstone River near Tower, as much as 17 miles upstream of the 16-foot Knowles Falls, previously believed to be

their upstream extent. However, the size, flow characteristics, and inaccessibility of the river in this area make sampling extremely difficult. If a brown trout population did become established above Knowles Falls, it would threaten 36 miles of the Yellowstone River, more than 23 miles of the Lamar River, Lower Slough Creek, Lower Soda Butte Creek, and thousands of miles of other tributaries.

Aquatic Nuisance Species. In addition to nonnative fish, two other nonnative species are having a significant detrimental effect on the park's aquatic ecology: the New Zealand mud snail and the parasite that causes whirling disease in fish. There is also a concern about the potential for Eurasian water milfoil as well as zebra and quagga mussels arriving in the park on visitors' boats or fishing gear. Resource management staff educate visitors about the problem and have identified locations for inspection and cleaning stations throughout the park. Lake, Grant Village, and West Yellowstone now have cleaning stations, and a mobile pressure washer can be sent to other locations. The Bridge Bay Ranger Station and the Grant Village Backcountry Office now have inspection stations, and both the Bridge Bay Marina and the Grant Village Yellowstone Park Service Station have the infrastructure to accommodate a cleaning station. In 2008, a handout was designed to be given to all boaters that shows what they have to do prior to launching.

Fisheries for Fishing

Angling. An estimated 47,223 people, or about 1.5% of all park visitors, landed nearly 700,000 fish in the park in 2008, of which they released more than 95%. These data are derived from volunteer angler response cards that are issued with fishing permits and from interviews conducted with visitors as they leave the park. Native cutthroat trout remained the most sought after and caught fish species, comprising 51% of all fish caught. Native fish species (cutthroat, whitefish, and grayling) comprised 55% of all fish caught. Yellowstone Lake remained the most popular destination for fishing, accounting for about one of every seven anglers in the park. The estimated angler catch of lake trout in Yellowstone Lake decreased by almost 15,000 in 2008 to 32,981 fish. However, lake trout in the 14–16" size class were reportedly caught much more frequently than in any previous year.

Madison River Sampling. With assistance from the U.S. Forest Service, in October 2008 park staff sampled 36 km of the Madison River from the confluence of the Firehole and Gibbon rivers to Bakers Hole Campground on the park's west boundary. This was the first fisheries assessment since 1989 of the Madison River within the park, where it is managed as a "wild trout enhancement area," limited to fly-fishing and requiring release of mountain whitefish, brown trout, and rainbow trout. The assessment was intended to estimate the abundance of those species during their spawning run, the upstream extent of movement of these species during their spawning migrations, the age structure of the populations, and the genetic makeup of the rainbow trout population. Fish were collected using a 15-foot raft outfitted with electrofishing equipment. One mark and one recapture run were made in each of three sections of the river approximately three days apart. Captured fish of the three species were measured, weighed, and clipped for identification purposes. Scale samples were taken from up to 10 fish in each 20-mm size category for each species. Tissue samples for genetic analysis were taken from 30 rainbow trout. Fish marked with a tag or clip by Montana Fish, Wildlife and Parks during their weir operations were noted. Survey results indicate healthy populations of the three species. Rainbow trout were the largest fish captured, averaging 369.9 mm in total length.

Geology

Protection and monitoring of the park's geothermal resources remains the focal point of the park's geology program.

Montana Water Rights Compact

The Montana Water Rights Compact, established in 1994 between the state of Montana and the NPS, protects Yellowstone's geothermal features by limiting groundwater withdrawal in a designated area north and west of the park. In 2008, the NPS funded $168,000 under the Montana Bureau of Mines and Geology Cooperative Agreement for monitoring and database maintenance of this controlled groundwater area, and $23,000 to the Montana Department of Natural Resources and Conservation for oversight of permits and water meters for the area. The geology staff discussed geothermal monitoring of the



Aerial photo of Norris Geyser Basin.

controlled groundwater area with the compact's Technical Oversight Committee and provided an update on the geothermal monitoring effort.

Yellowstone Volcano Observatory

A partnership set up by the U.S. Geological Survey with the NPS and the University of Utah, the Yellowstone Volcano Observatory (YVO) monitors volcano and earthquake hazards in the park using a network of 26 seismic and 13 GPS leveling stations. In a continued effort to improve its volcanic and seismic monitoring capability, the YVO upgraded equipment at existing locations and installed equipment at new locations, as described in the *Volcano and Earthquake Monitoring Plan for the Yellowstone Volcano Observatory, 2006–15* (http://pubs.usgs.gov/sir/2006/5276/).

2008 Seismic Activity. Compared to a range of 872 to 3,172 earthquakes per year during the 1995–2007 period, 2,317 earthquakes were detected in the park in 2008. No geyser-basin scale changes were noted. The Old Faithful eruption interval remained at 90 to 91 minutes and Steamboat Geyser did not have a major eruption. Hydrothermal explosions occurred at Biscuit Basin, Ferris Fork Hot Springs, and the Mushpots in Pelican Valley. From late December to early January, the northern portion of Yellowstone Lake experienced a swarm of almost 900 earthquakes with magnitudes up to 3.9. This swarm was well above typical activity in the park but is not unprecedented in the last 40 years of monitoring.

Data from GPS ground stations and the European Space Agency's Envisat satellite indicate that parts of the Yellowstone caldera rose as much as 7 cm per year from 2004 to 2006. The largest uplift has been recorded at the White Lake GPS station, inside the caldera's eastern rim, where the total uplift from 2004 to October 2007 was about 17 cm. Given the area's geologic history, YVO scientists think that the current period of uplift will likely cease and be followed by another cycle of subsidence. Norris Geyser Basin, which uplifted 12 cm from 1996 to 2004, has subsided 6 cm since 2004.

Borehole Strainmeters. Five borehole strainmeters were installed in the park during 2008. The instrumentation, which includes a downhole seismometer and tiltmeter, provides real-time data for volcano and earthquake monitoring.

Hazard Plan. In November 2008, YVO representatives hosted a meeting in Bozeman, Montana, to discuss concepts for a hazards plan with representatives from the states of Wyoming, Idaho, and Montana. The plan will outline the YVO's response to earthquakes and volcanic events, the thresholds that trigger different levels of response, and other agencies available to provide assistance.

Other Geothermal Collaborations

A key aspect of geothermal monitoring are projects carried out through the Rocky Mountains Cooperative Ecosystem Studies Unit by Montana State University and Utah State University's Remote Sensing Services Laboratory. The NPS also worked with U.S. Geological Survey and University of Utah scientists to determine the age of thermal and nonthermal groundwaters at Norris Geyser Basin with the hope of better delineating recharge areas for the basin's geothermal features.

Assistance to Other Agencies and Park Divisions

The geology staff discussed options for Beryl Springs Bridge with a consultant hired by the Federal Highways Administration, worked with law enforcement, maintenance, and trails crews on providing safe visitor access at Artist Paint Pots, reviewed plans for delineation of underground hydrocarbons in the Old Faithful developed area, and assessed hydrothermal gases in the Safety Office. They prepared internal reports to document Orange Spring Mound on Upper Terrace Drive, hydrothermal gases at the Safety Services Office and Blacksmith's Shop in Mammoth Hot Springs, temperature data along the



LISA BARIL

A released willow stand along upper Slough Creek.

Artists' Paintpots trail, Mt. Everts debris flow and the damming of the Gardner River, aerial reconnaissance of a forceful vent at Pelican Creek, reconnaissance of the Terrace Spring area, and a preliminary analysis of hydrothermal activity at Ferris Fork Hot Springs. They were co-authors for a Geologic Society of America special publication on geothermal systems and monitoring hydrothermal features.

Geothermal Resource Protection

Resource management staff monitored 81 areas in the geyser basins weekly and used custom-made hand tools to remove the thousands of items that had been thrown or dropped in the thermal features, from cigarette butts to articles of clothing. A geothermal resource protection and visitor safety flyer was developed and distributed parkwide at seasonal orientation training and to park concession employees. As part of a cooperative program with the U.S. Geological Survey monitoring geothermal activity, staff assisted with the collection of water samples at 11 locations throughout the year.

Vegetation

The vegetation in Yellowstone reflects the physical environment—climate, geology, soils, elevation, and aspect—as influenced by natural disturbances and human activities. Preserving native vegetation communities and associated processes while minimizing human influences has great value for wildlife habitat, wilderness, cultural landscapes, and scientific research. However, there are situations, such as in the case of hazard trees or fire, in which park visitors and staff must be protected from the dangers associated with the ecological processes of vegetation.

YCR's vegetation group helps carry out the NPS's responsibilities for the protection, perpetuation, and restoration of Yellowstone's vegetation communities and their enjoyment by the public, management of threatened or endangered plant species, mitigation of human-induced effects, and assessment of threats from external sources.

Plant Inventories

The vascular plant flora of Yellowstone includes 1,350 species. Park staff have met the servicewide inventory and monitoring goal of documenting at least 90% of the park's vascular plant species and incorporating the information into the NPSpecies biodiversity database.

Rare Plant Surveys. To prevent negative impacts on rare plant populations, park staff conduct surveys prior to construction projects, trail re-routes, and other activities that will disturb the soil. In addition to complying with statutory requirements, these

surveys collect valuable data: 250 additional sites were documented during 2008 for the GIS layer of Wyoming species of special concern and plants that are rare in the park. Summer fieldwork for Federal Highways projects took place primarily in the Old Faithful area, where 473 sites containing rare species have now been documented; plant communities with species of special concern occupy habitats that include thermally heated sites, wetlands, and barren black obsidian sand. Also surveyed for wetlands or rare plants was the area around several backcountry cabins, the Grant Village area, various construction projects, and several backcountry trails where major reconstruction was being planned.

Bryophyte Survey. Bryophytes (mosses, liverworts, and hornworts) represent an under-sampled and relatively poorly understood component of the ecosystem. With funding provided by Canon U.S.A., Inc., through the Yellowstone Park Foundation, Judy Harpel began a two-year survey in 2006 to prepare a comprehensive bryophyte species list for the park. During the 2008 field season, an additional survey was initiated in the Bechler Canyon and Three Rivers area to document the bryophyte flora in one of the wettest places within the park. The survey resulted in 347 collections representing 101 species. Identifications are still pending on several problematic specimens, but it is likely that the fieldwork resulted in at least one native species being documented for the first time in the park.

Nonnative Species. No new nonnative species were reported in the park in 2008, but many of the 218 known established nonnative species continued expanding their ranges. From early June through mid-October, park staff, interns, and volunteers surveyed approximately 3,000 acres, of which more than half were infested with nonnative plants. Within this infested area, 38 species at 1,425 locations (totaling 100.6 acres) were treated using chemical or mechanical means.

Yellowstone Herbarium. The Yellowstone National Park Herbarium houses approximately 9,500 specimens that have been curated and entered into a database. The specimens are used by NPS personnel and outside researchers to identify vascular plant taxa as well as the bryophytes, fungi, and lichens that occur in the park, and to document the presence, variation, and distribution of native species, and the arrival and spread of nonnative species. During the 2008 field season, 185 vascular plant specimens were collected for addition to the herbarium to document the native flora in under-collected portions of Yellowstone and nonnative species. Park staff made significant inroads on the specimen backlog, with more than 1,000 specimens in the process of being labeled, mounted, and added to the NPS's Automated National Catalog System database.

Vegetation Research and Management

Insect Infestations. The primary cause of tree mortality in the park is native bark beetles. Although both Douglas-fir beetle and Engelmann spruce beetle activity have declined since 2000, mountain pine beetle activity in high-elevation whitebark pine forests remains at epidemic levels. An effort to determine what, if any, influence insect infestations may have on landscape-level fire patterns and vice versa continued in 2008 through agreements between the Rocky Mountains and Great Lakes cooperative ecosystem studies units and three university-affiliated researchers (Dr. Dan Tinker, University of Wyoming; Dr. Monica Turner, University of Wisconsin–Madison; and Dr. William Romme, Colorado State University).

In cooperation with the U.S. Forest Service, resource management crews deployed well over 100 pheromone traps for gypsy moths throughout the park; unlike in previous years when some moths were found, none were detected in 2008.

Woody Vegetation. The controversies surrounding the status of woody vegetation on the northern range (aspen, willow, and cottonwood) as it has been affected by changing elk population levels and wolf reintroduction continued to support diverse research opportunities in 2008, including:

- the last year of a three-year study of bird species diversity in willow communities of varying structure and size, with Dr. Andrew Hansen of Montana State University;
- the last year of a two-year study of temperature influences on willow growth and phenolic production in areas with varying wolf and elk densities throughout Greater Yellowstone by Dr. Don Despain (U.S. Geological Survey, retired) and Dr. Rex Cates (Brigham Young University);
- ground-based willow mapping of selected stream drainages to complement previous mapping efforts, with Robert Stottlemyer

(USGS-Biological Resources Discipline, Fort Collins Science Center) and Mike Tercek (University of Colorado);
- the second year of a study on the influence of hydrology and herbivory on cottonwood establishment and persistence, with Dr. David Cooper and graduate student Josh Rose, Colorado State University; and
- the continued monitoring of elk use and aspen performance in 113 established aspen clones across Yellowstone's northern range in conjunction with Dr. Eric Larsen (University of Wisconsin–Stevens Point) and Dr. William Ripple (Oregon State University).

Fire Management. The LeHardy Fire, which originated when winds blew a tree over a power line, was responsible for nearly all of the approximately 10,381 acres that burned in the park during 2008. Suppression activities were undertaken on the heel of the fire near its origin, but the head of the fire across the Yellowstone River was allowed to burn into natural barriers. The vegetation management specialist assisted in aerial mapping and monitoring of the fire, made long-term fire behavior risk projections, and briefed management staff and field crews on expected fire behavior. The LeHardy Fire was one of seven fires with human origins in 2008; only the Aster Fire, which burned less than one acre, was lightning-caused.

Hazard Tree Management. To protect people and property, potentially hazardous trees in areas of high visitor and employee use must be identified and removed. As part of the Hazard Tree Management Plan, the vegetation management specialist participated in training resource management staff in hazard tree identification, assisted with tree assessments, and maintained records of tree removals. During 2008, 841 trees were removed parkwide.

Vegetation Education

In addition to identifying plant species upon request for other park staff, outside researchers, and the public, the vegetation staff participated in more formal education efforts during 2008, including:
- weed identification for the Northern Rocky Mountain Exotic Plant Management Team, Yellowstone resource management personnel, Montana Conservation Corp, and Gallatin National Forest;



Hazard tree falls across a tent pad at Norris Campground.

- field seminars for various university, international, and media groups on topics including northern range/woody vegetation issues, fire ecology, forest insect activity, and disturbed lands restoration;
- more than 24 national and international media requests regarding the 20th anniversary of the 1988 fire season;
- rare plant and vegetation overviews for the Division of Interpretation, the Montana Native Plant Society, and the Bozeman chapter of the American Association of Retired People; and
- a course on Yellowstone wildflowers through the Yellowstone Association Institute.

Bears

Grizzly Bear Status

The estimated population of grizzly bears in the Greater Yellowstone Ecosystem (GYE) increased from 136 in 1975 to 596 in 2008, one year after the U.S. Fish and Wildlife Service removed this population segment from threatened status under the Endangered Species Act. The government agencies with jurisdiction over the grizzly bears have approved a conservation strategy for managing them. There were no human-caused grizzly mortalities in Yellowstone National Park in 2008. Of the 44 grizzly mortalities known to have occurred in the GYE in 2008, 14 were hunting-related (mistaken for black bear or in self-defense); other deaths were in defense of life or property (13), from natural causes (7), malicious killings (2), capture-related (2), a road accident (1), and undetermined causes (5).

The Interagency Grizzly Bear Study Team (NPS, U.S. Forest Service, U.S. Geological Survey, U.S. Fish and Wildlife Service, and the states of Idaho, Montana, and Wyoming) continues to monitor population numbers, distribution, habitat use, reproduction, and mortality. About 10% of GYE grizzly bears are radio collared; in 2008, 30 bears were captured for purposes of collaring. Another 36 grizzly bears were captured for purposes of relocation or removal because of conflicts with human activities; none of these bears were residing in the park.

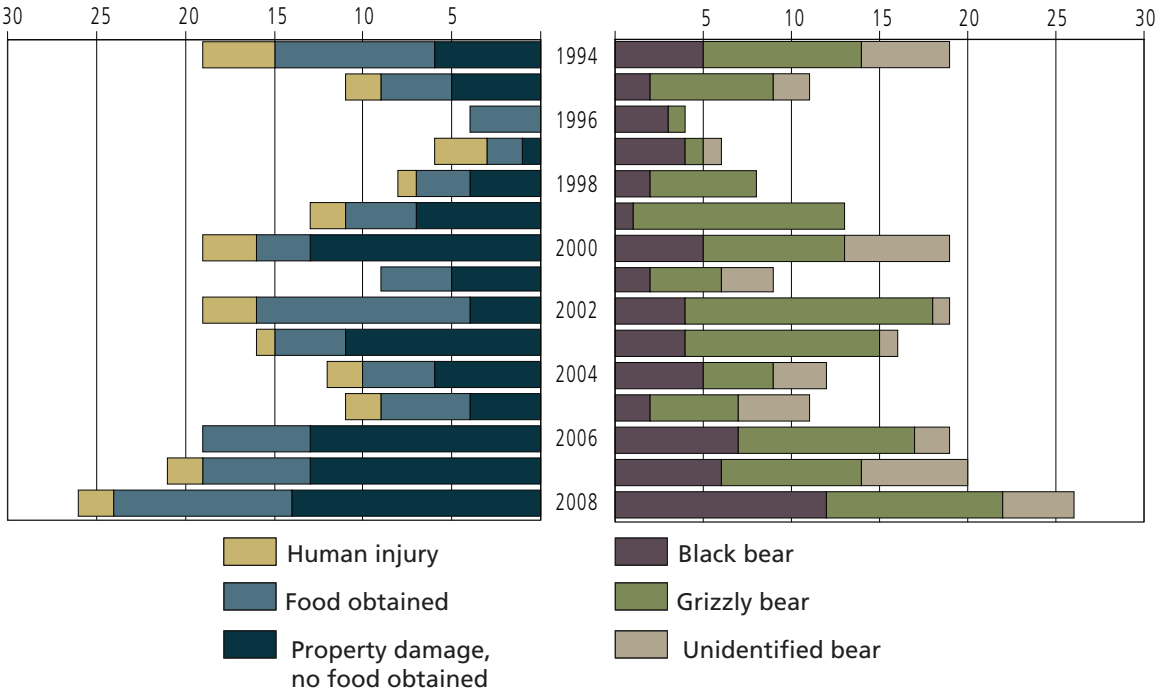
Bear Foods Monitoring

Park staff monitor the availability of some key grizzly bear food sources: winter-killed carcasses, spawning cutthroat trout, and whitebark pine seeds. In 2008, a total of 116 ungulate carcasses were documented along 266 km of survey routes during April and May. Although an estimated 68 grizzly bears were known to prey on spawning cutthroat trout in at least 36 tributary streams of Yellowstone Lake in the 1980s, the decline of the cutthroat trout population as a result of predation by nonnative lake trout and whirling disease has reduced the number of spawners to negligible levels. No evidence of grizzly bear or black bear fishing activity was observed on trout spawning streams in the Lake and Grant areas during the 2008 surveys.

As part of an annual survey, cone counts were conducted at 26 whitebark pine transects in the GYE. Cone counts on the 10 transects in the park averaged 3.86 cones per tree in 2008. This was below the long-term (1987–2007) average of 15.54 cones per tree per year for all park transects. More than half of the trees on the 19 original GYE transects that were alive in 2002 have died, primarily as a result of infestation by the native mountain pine beetle. Whitebark pine communities are also surveyed for the presence of the exotic pathogen white pine blister rust, which infects an estimated 25% of whitebark pine throughout the GYE.

Bear–Human Conflicts

Bear–human conflicts are defined as incidents in which bears damage property, obtain human foods, or injure people. Of the 190 grizzly bear–human conflicts that were reported in the GYE in 2008, 10 occurred in Yellowstone National Park. Including black bears and bears of unidentified species, a total of 26 conflicts were reported in the park. This compares to an average of 10.9 conflicts a year during 1994–2007. In 14 of the 2008 incidents, property damage occurred, but no food was obtained; in 10 incidents, food was obtained. The other two incidents, both involving grizzly bears, resulted in minor human injuries, one to a firefighter and the



Types of bear–human conflicts and species of bear involved, Yellowstone National Park, 1994–2008.

other to an electric utility employee. Bear-inflicted injuries during 1994–2007 averaged 1.5 per year.

Park staff continue to emphasize prevention of bear-caused property damages and human injuries, and human-caused bear mortalities through public education, enforcement of food and garbage storage regulations, management of bear jams, hazing of habituated bears, monitoring of bears using radiotelemetry, and trail closures when necessary. Two black bears had to be captured and euthanized in July 2008 because they had become aggressive after obtaining human food. The last bear-caused human fatality in Yellowstone occurred in 1986.

Bears Moved Into the Park

Five yearling grizzly bears that had been frequenting residences north of the park were captured in the fall of 2008, radiocollared, and relocated into the park. The first two yearlings, which had been orphaned the previous fall when their mother was shot by a hunter on the Gallatin National Forest, were captured by the state of Montana outside the park and released at Charcoal Bay on Yellowstone Lake; they eventually wandered south into the Bridger-Teton National Forest. The other three yearlings were captured with their mother, who was more than 20 years old, in poor health, likely responsible for the mauling of several hunters, and had been relocated into the park twice. Because of the dangers associated with capturing an aggressive female bear with young in a residential area, park staff provided assistance in setting traps inside the park's north boundary. The mother was euthanized and the yearlings were collared and released in the park interior; within two days, the yearlings were seen near the park's north boundary.



Travis Wyman and Kerry Gunther moving an orphaned black bear cub from a captive hibernation pen to a denning box for spring release.

Birds

Park staff censused bald eagle nests, osprey nests, trumpeter swans, and Molly Islands colonial nesting birds using fixed-wing aircraft supplemented by ground observations. Peregrine falcon eyries were located and monitored using ground surveys. The low numbers of bald eagle nests and peregrine eyries found in 2008 compared to those of recent years can be attributed to a change in personnel conducting the surveys and insufficient documentation of prior nest locations. Bald eagle pairs may reuse the same nest for many years and favorable eyrie sites are often used repeatedly. To improve future results and reduce search time, GPS coordinates were recorded for all bald eagle and osprey nests detected in 2008 and eyrie locations were photographed.

Bald Eagle

The U.S Fish and Wildlife Service removed the bald eagle from the list of threatened species in 2007. Surveys conducted in the park during 2008 via fixed-wing aircraft and supplemented by ground observations located 19 bald eagle nests, 10 of which contained eggs or young; a total of 7 eaglets fledged. This was considered an incomplete count as a result of staff turnover. However, decreased reproductive success has been observed in recent years for eagles nesting in the Yellowstone Lake area, possibly due to reductions in cutthroat trout abundance, human disturbance, climate change, or unidentified variables. Weather conditions were also unfavorable, with cold, wet conditions persisting into June, possibly affecting recruitment.

Osprey

Surveys for osprey located 42 nests, 23 of which were active and fledged a total of 17 young in 2008, compared to 31 active nests and 25 fledglings in 2007. Reproductive measures for osprey have decreased since consistent records began in 1987, with the most acute decreases occurring at Yellowstone Lake; other nest locations have shown increases since 2003. The decline at Yellowstone Lake is likely

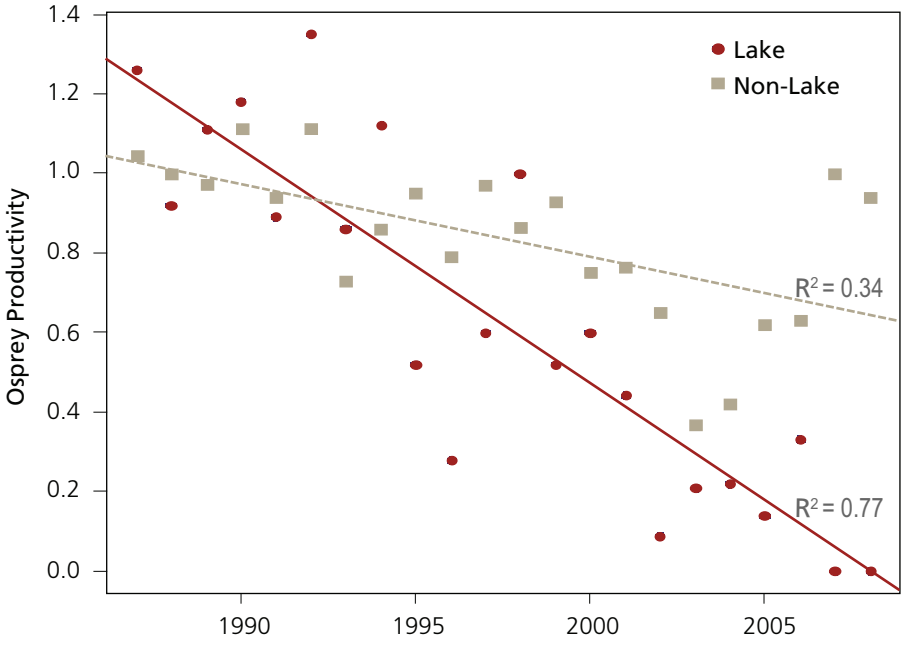


Aerial view of a bald eagle nest with eaglets.

related to reduced abundance of their primary food, cutthroat trout, as a result of predation by nonnative lake trout. Osprey nest success also appears to be related to proximity to Yellowstone Lake campsites. Nests in other areas of the park are generally located in inaccessible areas, such as the Grand Canyon and Tower Falls.

Trumpeter Swan

Aerial censuses for trumpeter swans were conducted in mid-winter and autumn of 2008 in the park, in Paradise Valley, and on Hebgen Lake, and the swans were monitored during the breeding season to determine territory occupancy and the number of non-breeders and nests hatching young. The mid-winter survey, which is conducted when migrants from further north are present, located a total of 321 swans, including 65 adults and 7 cygnets in the park. The autumn survey, which is conducted after the migrants have left and cygnets have fledged, located a total of 28 swans, including 8 adults and 2 cygnets in the park. Two pairs of nesting swans were found in the park during the breeding season: a pair on Riddle Lake fledged two cygnets, while the nesting attempt of the pair on Grebe Lake failed during the incubation stage. The decline in nesting trumpeter swans in the park and successful nest attempts, which reached its most recent peak of 10 in 1989, is cause for concern and currently under investigation.



Osprey productivity for Yellowstone Lake, and ospreys nesting elsewhere in Yellowstone National Park, 1987–2008.

Peregrine Falcon

The peregrine falcon was removed from the federal list of threatened and endangered species in 1999. Since the 1980s, when 36 peregrines were released in several hack sites in and near the park, the number of nesting pairs in the park has increased steadily from one pair in 1984 to 32 pairs in 2007. Two of the three peregrine eyries that were located in 2008 produced a total of five fledglings; the third attempt failed. However, overall measures of peregrine reproduction are increasing

throughout the park and are higher than the national average.

Molly Islands Colonial Nesting Birds

The highest lake levels observed since 1997 flooded much of the islands and washed out many of the nests during the height of the breeding season in 2008. High water levels coupled with a late ice-off date resulted in a short nesting season. Nesting attempts by Caspian terns and California gulls, which have fluctuated since records began in 1989, have declined since 2004, with neither of these species initiating nests during 2008. However, the nesting success of double-crested cormorants (16 fledglings in 2008) and American white pelicans (13 fledglings) appears to be stable despite large year-to-year variability in weather and lake water levels.

Breeding Bird Survey

The breeding bird survey was established in 1966 as a joint effort between the Patuxent Wildlife Research Center of the U.S. Geological Survey and the Canadian Wildlife Service's Research Center to monitor the status and trends of breeding birds throughout North America. Park staff have surveyed three routes (Mammoth, Yellowstone, Northeast Entrance) annually since 1982. The results of the June 2008 surveys, which were consistent with those of past years, counted a total of 4,429 birds and identified 72 species; a total of 360 species has been observed on these routes since the surveys began. The survey data is available at www.mp2-pwrc.usgs.gov/bbs.

Willow Songbird Study

Montana State University continued a collaboration with the NPS to examine possible responses of songbird populations to recent height increases in willow in some locations across the northern portion of the park and to establish a long-term dataset. These songbird species are often indicators of climate change effects.

Mid-sized Carnivores

The mid-sized carnivores found in Yellowstone include the American marten, cougar, coyote, river otter, and red fox, as well as two less common species, the wolverine and the Canada lynx. The wolverine and Canada lynx are rarely seen because of their small numbers and affinity for boreal forests and alpine habitats, but they carry strong aesthetic and existence values for the public. The mission of the mid-sized carnivore program is to improve the information available to resource management, planning, and interpretation staff in the park. The program also provides data that supports the NPS's responsibility to consult with the U.S. Fish and Wildlife Service concerning the effect of park management activities on endangered species.

Cougars

In the mid-1980s an increase in cougar sightings prompted the Hornocker Wildlife Institute, and later the Wildlife Conservation Society, to begin the first cougar research in Greater Yellowstone. This research monitored 80 cougars from 1987 to 1996 and 83 cougars from 1998 to 2006 to document population dynamics and dispersal, home range and habitat requirements, and competition for prey with other carnivores. During the second phase of the study, elk comprised 74% of the known or probable cougar kills and wolves interfered with or scavenged more than 22% of the cougar-killed ungulates. Active monitoring has ended and all remaining radio collars have been removed, but years of data are still being analyzed.

Yellowstone's northern range currently supports a population of 14–23 adult cougars and numerous kittens. While disease and starvation are occasional causes of cougar deaths, inter- and intra-specific competition and human hunting (during legal seasons outside protected areas) are the main causes of cougar mortality. Habitat fragmentation and loss are the main long-term threats to cougar populations across the western United States.

Coyotes

In 1989 researchers began to investigate the ecological role of coyotes on Yellowstone's northern winter range by radiocollaring and observing them directly. Along with obtaining basic information about coyote behavior, disease ecology, pack structure, population dynamics, predatory habits, and movements, this research has documented changes in coyote populations in response to the 1988 fires and the restoration of wolves. No negative effects of the fires on coyote demographics (e.g., birth and death rates) were identified. However, the coyote

population on the northern range declined as much as 50% as a result of competition with wolves for food, attacks by wolves, and loss of entire territories to wolves. Recent trends in the Lamar Valley, however, indicate that the coyote population has stabilized and is increasing.

Coyotes are still abundant and well-distributed throughout the park, and pup survival has increased. Coyotes may be killed by disease and vehicle-strikes as well as by other carnivores. Park staff monitor coyotes along roadsides and use adverse conditioning (e.g., pepper spray or crackershells) to deter their habituation to humans and use of developed areas.

While wolves have had a direct impact on the coyote population, the far reaching implications are only beginning to be understood as the GYE shifts into ecological patterns similar to those in place before predator control programs altered the abundance and distribution of many carnivores. Comparing coyote population and behavioral data from before and after wolf restoration provides important insight into another piece of the park's ecological puzzle. The decline in the coyote population has meant competitors such as the native red fox will likely have less competition for small prey, and this species seems to be filling in some of the space left behind by the coyotes that previously constrained fox numbers.

Lynx

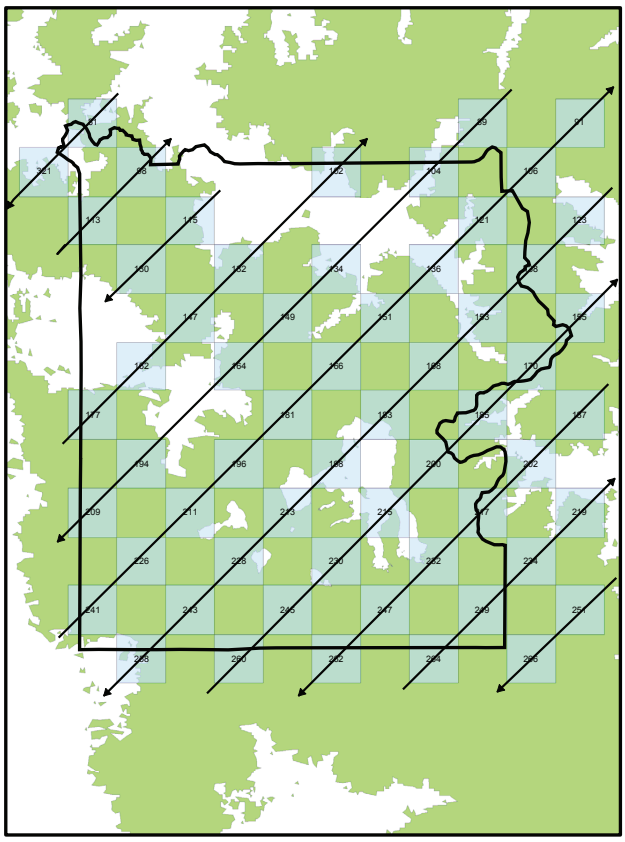
The distribution of Canada lynx, which is common in the boreal forests of Alaska and Canada, extends more sparsely southward into other areas of the United States, including parts of the Rocky Mountains. It is rare in Greater Yellowstone, where its distribution is generally limited to conifer forests above 7,700 feet. Lynx home ranges in the GYE are therefore larger than those farther north, with lynx traveling long distances between foraging sites. Available data are insufficient to estimate numbers or trends for lynx in the GYE, but their apparent scarcity and distance from other Rocky Mountain populations contribute to their tenuous state.

In 2000, the U.S. Fish and Wildlife Service listed the lynx as threatened in the contiguous United States, and in 2009, designated critical habitat for lynx in five regions, including a 6.1 million acre area in the GYE. This designation includes much of the eastern and northern portion of Yellowstone. The Endangered Species Act prohibits actions by a federal agency that adversely modify designated critical habitat. Standards set by the Lynx Conservation and Assessment Strategy and National Forest Plan amendments should help improve or at least maintain existing conditions for the species by protecting its denning habitat and the habitat of its primary winter prey, the snowshoe hare, which is most abundant in forests with dense understories. Silvicultural or fuel reduction treatments that cut back on horizontal cover are detrimental to hares and may reduce potential lynx denning sites. Radio-collared lynx from Colorado, where 218 have been released since 1999 to reestablish the species, have occasionally been documented in the GYE. Dispersers from Canada and northwest Montana may also help sustain lynx in the GYE.

Wolverine

The wolverine, the largest member of the weasel family, has become a species of concern for land managers in the Rocky Mountains because of its low population density and reproduction rate, large home ranges, genetic fragmentation, and possible sensitivity to human disturbance. Although illegal in Idaho and Wyoming, the trapping or shooting of wolverines by licensed hunters is permitted in Montana, removing about five annually.

Although the U.S. Fish and Wildlife Service has rejected previous petitions for listing because of a dearth of information about the wolverine's life history and ecological requirements, the species is likely to eventually receive protection under the Endangered Species Act. With the continued support of the Yellowstone Park Foundation, in 2008 the Absaroka–Beartooth Wolverine Project completed its third winter season of efforts to live-trap wolverine in order to document information about the species' status and ecology in the eastern half of Greater Yellowstone. Participating in this project with Yellowstone National Park are the U.S. Forest Service, the Rocky Mountain Research Station of the U.S. Department of Agriculture, Montana Fish, Wildlife and Parks, the Wyoming Game and Fish Department, and the Rocky Mountains Cooperative Ecosystem Studies Unit. To date, the project has captured and radiocollared only four wolverines, suggesting that few wolverines are present in this region. The project is also helping to monitor two



Map showing aerial transects for detecting wolverine tracks. In April 2008, the first year that an aerial survey was conducted, project staff detected three sets of wolverine tracks, the distinctive pattern of which can be identified from a helicopter when snow conditions are favorable.

wolverines that were captured and collared by the Wildlife Conservation Society in a study underway in suitable habitat west and north of the park.

Ungulates

Bighorn Sheep

In Yellowstone, sheep are organized into 10–13 bands with periodic movements and gene flow among groups. Counts were 400–500 sheep during the 1970s, but an outbreak of infectious keratoconjunctivitis (i.e., "pinkeye") in winter 1982 resulted in the mortality of at least 60% of these sheep. Counts did not increase significantly during the next 15 years and reached a low of 134 sheep following the severe winter of 1997. Since that time, however, counts by the Northern Yellowstone Cooperative Wildlife Working Group have gradually increased to 353 sheep in 2008.

Bison

Park staff participated for the eighth year in the Interagency Bison Management Plan with the state of Montana and the Animal and Plant Health Inspection Service and U.S. Forest Service of the U.S. Department of Agriculture. The plan is designed to manage the risk of brucellosis transmission from bison to cattle, conserve the bison population, and allow for gradually increased tolerance of bison outside the park on national forest land. The number of mortalities that occur as part of boundary control operations near Gardiner and West Yellowstone, Montana, reflects annual fluctuations in winter bison movements out of the park. When the estimated 2007 summer population of 4,700 bison encountered a winter of heavy snowfall, hazing efforts along the north boundary became ineffective because of the large groups making repeated attempts to cross it. A total of 1,728 bison were removed from the population, including 166 that were taken by hunters outside the park and 112 calves that were sent to a quarantine project being carried out by the state of Montana and Animal and Plant Health Inspection Service.

Elk

The Northern Yellowstone Cooperative Wildlife Working Group, which includes park staff along with representatives from Montana Fish, Wildlife and Parks, the U.S. Forest Service, and the U.S. Geological Survey–Northern Rocky Mountain Science Center, conducted its annual survey of the northern Yellowstone elk population. The winter count, which was approximately 17,000 in 1995, has ranged between 6,000 and 9,000 elk during 2003–08. The decline has been attributed to predation by reintroduced wolves, a growing bear population, hunter harvest, and possibly drought-related effects on pregnancy and survival. The state of Montana has reduced the number of antlerless permits issued in recent years so that hunting has little impact on population size.

Pronghorn

There have been concerns about the long-term viability of Yellowstone pronghorn since counts declined from 536 to 235 during 1992–95. Causes of this rapid decrease remain unclear, but fawn survival has remained low due to coyote predation.

Development of private lands outside the park has reduced available winter range to a relatively small, isolated area. Much of the land in the park currently used by pronghorns as winter range is former agricultural land that is infested with exotic vegetation of low nutritional quality. The pronghorn count, which remained relatively constant during 1996–2006, at approximately 196–235, reached 291 in 2007–08, the highest since 1993.

Mountain Goats

A population of mountain goats that were introduced into Montana during the 1940s and 1950s has increased in the Absaroka and Gallatin mountains since the late 1980s, leading to colonization of the northeast and northwest portions of the park in the 1990s. Systematic aerial counts of mountain goats inside or within one kilometer of the park by the Northern Yellowstone Cooperative Wildlife Working Group increased from approximately 25 to 160 during 1997–2007. Based on these surveys, the number of goats in and adjacent to the park is estimated to be 175–225, with the highest densities occurring along the Gallatin Crest Divide on the northwest boundary and Cutoff Mountain, Barronette Peak, and The Thunderer near the northeast boundary. The surveys confirmed that mountain goats were present southeast of the Soda Butte Creek drainage, a place where previously they had rarely been reported.

Through a cooperative agreement with Idaho State University, Dr. Ken Aho began a three-year NRPP-funded project to evaluate potential impacts of the mountain goats on alpine vegetation in the northeast portion of the park. The project will establish and sample replicated plots to compare alpine vegetation of areas with low and high goat density and use a chronological sequence of remotely sensed images to investigate changes in bare ground since the approximate time of the first in-park goat sightings. During the 2008 field season, Dr. Aho resampled transects that he had established during his dissertation work in 2000 and 2003, and began establishing additional transects on peaks along the park's east boundary. Park staff conducted three aerial surveys to monitor the abundance, distribution, and demographics of mountain goats to provide the information needed for evaluating management alternatives and developing an adaptive management plan to protect the alpine ecosystem.



Mule deer.

Mule Deer

The Northern Yellowstone Cooperative Wildlife Working Group has conducted a spring helicopter survey of mule deer on their winter range (Yankee Jim Canyon to Mammoth) since 1986. The intent of the survey is to obtain a total count of mule deer and to classify a large sample of deer to estimate recruitment. A total of 2,414 mule deer were observed during the 2008 spring survey, which was similar to the last survey in 2005 and the highest count in 12 years.

Wolves

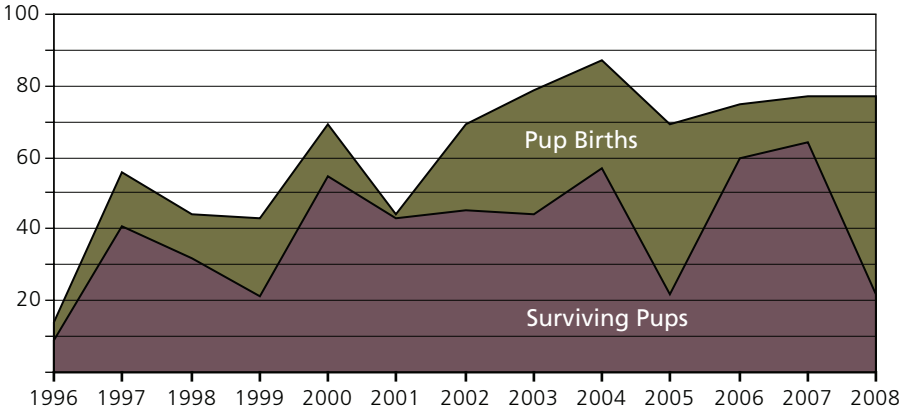
Population Monitoring

The year-end wolf population declined from 171 wolves with 10 breeding pairs in 2007 to 124 wolves with 6 breeding pairs in 2008. However, the U.S. Fish and Wildlife Service goal of 30 breeding pairs in the Northern Rocky Mountain recovery area has been met and the gray wolf will be removed from the endangered species list in Idaho, Montana, and Wyoming after the U.S. Fish and Wildlife Service accepts the states' wolf management plans. Three of the packs present in 2007 dissolved and four new packs formed, but the average pack size was 9.3, compared to 14.2 in 2007 and the long-term average of 10. The largest pack, Gibbon Meadows, had 25 wolves.

To prevent human disturbance, the area around one den site was closed until July; three other den areas were closed coincidental to closures for bear management in the park. However, in 5 of the 11

packs that had litters, none of the pups survived; only 29% of the known pups survived until early winter. As in 1999 and 2005, the probable cause of poor pup survival was disease, likely distemper.

At year end, 32 (26%) of the wolves in the park wore VHF or download GPS radio collars, including 28 wolves that were captured and collared in 2008. As in previous years, the primary cause of death among collared wolves was intraspecific strife (10 out of 17 deaths). Two of the other deaths were the second and third known cases of malnutrition since reintroduction.

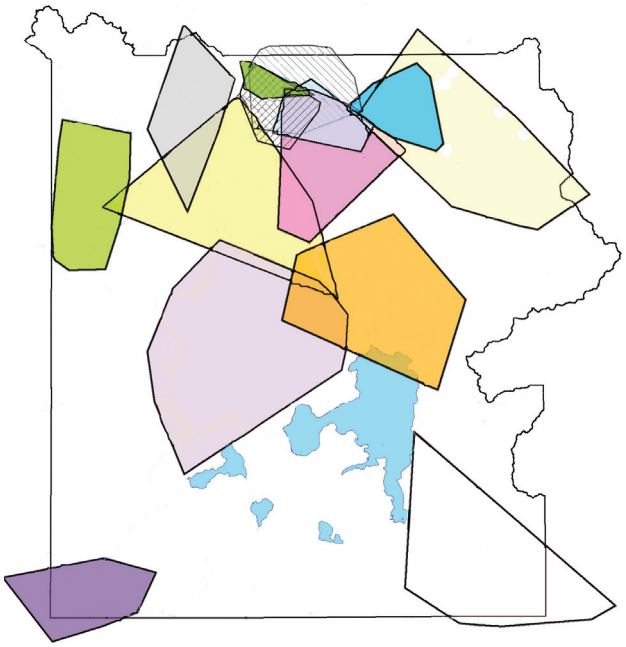


Number of recorded pup births in Yellowstone wolf packs and number of pups surviving at year end.

Wolf Management and Research

Habituated Wolves. In June, two Druid Peak wolves in Lamar Valley that had exhibited fearless behavior around people were hazed with rubber bullets, after which they were not seen again near people. In the interior, the Canyon pack showed fearlessness of vehicles along the road when people drove up along side of them. The Hayden Valley pack had previously exhibited similar behavior in the same area, where blowdown and regenerating lodgepole pine may funnel the wolves along the road corridor. This is unlike the situation along the northern highway in the park where there are many off-road travel options for wolves, which tends to keep them apart from people. Attempts to haze the Canyon wolves were unsuccessful because they could not be located by park staff with hazing equipment while showing habituated behavior.

Predation. Park staff detected 576 definite, probable, or possible kills made by wolves in 2008, including 463 elk (80%), 23 bison, 19 deer, 13 coyotes, 11 wolves, 5 pronghorn, 3 moose, 3 grouse, 2 bighorn sheep, 2 ravens, 1 each of beaver, golden eagle, grizzly bear, cougar, red fox, and otter, and 26 unidentifiable animals. The composition of elk kills was 27% calves (0–12 months), 16% cows 1–9 years old, 15% cows ≥10 years old, 32% bulls, and 10% elk of unknown sex and/or age. Bison kills included 7 bulls, 4 calves, 3 cows, and 9 adults of unknown sex.



Yellowstone National Park wolf pack territories, 2008. Cross hatching indicates two packs that dissolved (Leopold and Oxbow Creek).

The number of elk killed per wolf on the northern range during winter study periods declined from an average of 1.8 in 1995–2000 to 0.9 in recent years. The decrease has been attributed to changes in prey selection (shift to bull elk), an increase in scavenging on winter-killed ungulates, and a possible decrease in the number of vulnerable prey available to wolves. However, consumption rates (the amount of food eaten per wolf) have not declined, probably because of the increase in the number of bull elk killed.

In collaboration with Michigan Technological University, Wolf Project staff continued to try to

learn more about wolf predation during the summer. This is more difficult than winter predation studies because the packs are more cohesive during the summer, the wolves are less easily tracked without snow, bears are around to take over carcasses, and ungulate young are still so small that they can be quickly consumed without leaving evidence behind. Four wolves from two packs were equipped with radio collars programmed to collect data every 30 minutes that was downloaded weekly from May through July. Summer predation staff hiked more than 1,600 miles to locate clusters of data points and to record the presence of wolf sign, carcasses scavenged upon by wolves, and at least 150 suspected wolf kills, of which almost 90% were elk; most of the other kills were deer. Both packs had elevated predation rates as winter weather extended into May; elk killed by wolves revealed poor bone marrow into June.

Genetics. A collaborative effort with the canid genetics lab at the University of California, Los Angeles, to analyze data on the genetics of wolves in the park continued in 2008, along with larger scale analyses of genetic diversity and gene flow among the three Rocky Mountain recovery areas for purposes of recovery monitoring as well as ecological understanding. This has been difficult because both the Yellowstone and central Idaho populations are descendants of the same genetic stock in Canada. Preliminary results show high genetic diversity within all three recovery areas, as well as ample genetic exchange between central Idaho and northwest Montana. However, low levels of gene flow between the Greater Yellowstone Area and the other two recovery areas highlight the importance of accurately identifying migrant (or offspring of migrant) GYA wolves.

Disease. The serological survey of canid pathogens in the park was expanded in 2008 to include canine parvovirus (CPV), canine adenovirus-1 (CAV-1), canine distemper virus (CDV), canine herpes virus (CHV), and *Neospora caninum*, a protozoan parasite whose life cycle includes canids (where sexual reproduction takes place), and ungulates (the intermediate hosts), in which the parasite can cause abortions. All of the other pathogens may cause sickness and death in wild and domestic canids. The analysis of serum samples collected during the early 2008 capture season suggested that wolf exposure to CPV, CAV-1, and CHV was very high in 2007. No evidence was found of exposure to CDV in wolves born since the last epidemic in 2005. Although samples from previous captures suggest that wolves are occasionally exposed to *N. caninum*, it was not found in the wolves handled in early 2008.



A GPS collar is placed on a Druid wolf during capture operations. The data provided by these collars help Wolf Project staff to understand movement patterns of wolf packs, especially along the park boundary.



Relegated to bystander status, a wolf from Mollie's pack looks for an opening to steal a tidbit.

Although the serological results indicating pathogen exposure in 2008 are not yet available, CDV genetic material was found on three dead adult wolves collected in the fall of 2008, strongly suggesting that CDV was responsible for the low pup survival that year. Computer simulation modeling suggests that CDV is likely maintained among multiple host species over a wide geographic scale, but domestic dogs probably do not play an appreciable



Wolves from the Druid Peak pack testing elk. The elk are standing their ground, often a very effective strategy against wolves.

role in local CDV dynamics. Spillover of CDV to wolves from another wild host species will likely continue to be periodic but highly unpredictable.

Having already become common in wolves outside the park, sarcoptic mange, a skin infection resulting in hair loss caused by the mite *Sarcoptes scabiei,* has become increasingly prevalent in the park in the last two years. By the end of 2008, at least one wolf in at least seven packs or groups appeared to be infected. Wolf Project staff saw evidence of recovery in several infected wolves and no evidence of mortality from mange, although it may have been a contributing factor in some deaths.

Public Involvement and Outreach

Since wolf reintroduction, certain areas of the park have become popular for wolf viewing. In 2000, YCR, Resource and Visitor Protection, and the Division of Interpretation began a coordinated effort to address the opportunities and problems that result from large numbers of wolf watchers. The objectives are human safety, wolf safety, visitor enjoyment, and wolf monitoring and research. During a 124-day period from late May to late September 2008, when wolves were visible every day in the Lamar and/or Hayden valleys, the road management crew made 8,660 visitor contacts and gave 358 informal talks to nearly 4,000 visitors. For the eighth year Wolf Project staff rode horseback with Gallatin National Forest representatives into outfitter camps near the park to discuss wolf issues.

PART III

Professional Support

This section summarizes the 2008 accomplishments of Yellowstone Center for Resources staff who provide services for other YCR branches and park divisions:

- Environmental Quality
- Spatial Analysis Center
- Research Permit Office
- Science Communication Team
- Resource Management Operations
- Funding and Personnel



Environmental Quality

The newly formed Environmental Quality (or Compliance) Branch became part of the YCR in 2008. Its purpose is to oversee documentation of the park's compliance with policies that have been established to protect the quality of Yellowstone's natural and cultural resources, including regulations associated with the National Environmental Policy Act, the National Historic Preservation Act, the Endangered Species Act, the Clean Air Act, and the Clean Water Act. It also serves as the liaison between park staff proposing projects subject to these regulations and the natural and cultural resource specialists in YCR. By facilitating early participation in the compliance process by affected and interested parties both internal and external to the park, the Environmental Quality Branch can ensure that park management decisions are informed in regard to compliance requirements and that any impacts to park resources that result from the project are mitigated.

Compliance completed by the Environmental Quality Branch in 2008 included:

- numerous National Environmental Policy Act categorical exclusion documents for projects requiring minimal compliance, such as installation of utilities, hazard fuels reduction, and development of groundwater or resource monitoring wells;
- National Historic Preservation Act consultation with State Historic Preservation Officers for projects affecting historic properties in the park, such as replacement of the columns at the Lake Hotel; and
- threatened and endangered species consultation requirements, such as submitting an annual report on fire-related activities to the U.S. Fish and Wildlife Service.

Lamar River Bridge Replacement

A larger compliance effort will be required to prepare an Environmental Assessment (EA) for replacement of the Lamar River Bridge on the Northeast Entrance Road. Public scoping and consultation with the Wyoming State Historic Preservation Office began in July 2008 on the adverse effect of removing the historic bridge. The EA is expected to be available for public review in the summer of 2009. Construction is scheduled to begin in the spring of 2010.

Wireless Communication

The *Wireless Communication Services Plan EA*, which provides guidance on wireless communications use and infrastructure in Yellowstone, was completed in 2008. Park staff looked at current and anticipated wireless communications systems needed by NPS personnel, concessionaires, cooperators, and contractors that require some form of infrastructure. These communications technologies were reviewed to assess their suitability and impacts in developed areas, along existing road corridors, and in backcountry areas. Wireless communications

services addressed in the EA included the NPS two-way land mobile radio systems, cellular phone service, wireless internet services, and research and monitoring data transmitters. Public meetings on the EA were held in Bozeman, Montana, and Idaho Falls, Idaho, and 2,055 pieces of correspondence were received during the 45-day comment period, which ended October 31, 2008. These public comments were addressed through comment responses and modifications to the EA. It is anticipated that a Finding of No Significant Impact (FONSI) will be signed by the Intermountain Regional Director during the first quarter of 2009, enabling park staff to move forward with the plan, which includes the formation of a Telecommunications Committee to review park wireless communications requests.

Benefits Sharing

Following a lengthy internal review, the *Benefits-Sharing Final Environmental Impact Statement* neared completion. The key issue examined in this first-ever servicewide EIS is whether the NPS should share in scientific and economic benefits when researchers studying park resources discover or invent something commercially valuable from their research. The EIS is intended to clarify the rights and responsibilities of researchers and the NPS in these instances. Three alternatives for managing benefits-sharing with the scientific community were considered:

- The Preferred Alternative would require researchers who study park specimens to enter into benefits-sharing agreements with the NPS before using their research results for any commercial purpose. Engaging park researchers in benefits-sharing agreements could return scientific benefits, in-kind services, and sometimes royalties and other monetary benefits to parks for conservation-related purposes.
- Another alternative would prohibit scientific research involving NPS specimens if associated with the development of commercial products.
- The No-Action alternative would allow research that may lead to commercial products to continue in parks without any obligation to share any resulting benefits with the NPS.

During the internal review, the team worked closely and extensively with NPS Washington Office staff in order to better understand their comments and to resolve lingering concerns. Legal clearance was received from the DOI Solicitor's Office. The final EIS and its decision document are expected to be released in 2009.

With assistance from the Department of the Interior Office of the Solicitor and staff from the Assistant U.S. Attorney's Office, the team completed the 2005 Freedom of Information Act request for four years of project records, which required the review and handling of thousands of documents. EIS staff also provided assistance on issues related to benefits-sharing and bioprospecting, such as questions about Material Transfer Agreements and national-level policy issues at the request of the NPS Washington Office and parks servicewide.

Spatial Analysis Center

The Spatial Analysis Center (SAC) provides a variety of GPS (global positioning system) and GIS (geographic information system) services to park staff and cooperators by interpreting technology and technical data to suit a variety of information needs. Below are the major efforts of 2008.

GIS Data for Utilities and Buildings

In the past, information about water and sewer systems was stored on hard-copy maps and only sporadically updated. SAC and Maintenance staff are working together to map park utilities and link them to the Facilities Management Software System database. Data are collected through a combination of fieldwork, interviews, and digitized, georeferenced paper plans which are stored in a spatial database. By October 2008, a total of nearly 3,000 water features and 2,000 sewer features had been mapped, including 68 miles of water lines and 49 miles of sewer lines. End users are currently evaluating the usefulness of digital access to utility data, both on their office computers and on GPS units, along with paper map books that can be carried in their vehicles. By the end of 2009, the project will provide current information about utilities to every user in whichever form is most useful.

Before the FMSS database was linked to buildings in GIS, there was no way to graphically represent statistical data such as the Asset Priority or Facility Condition indices (on the importance and condition of the structure). By linking FMSS to GIS, those data

sets can be represented in a simple overview format, allowing managers to view the buildings as more than just lines on a spreadsheet.

Both indices are important in implementing the Park Asset Management Plan, a valuable tool for the Maintenance Division, Business Services, and park management. By the end of 2009, both FMSS and the List of Classified Structures (a database that documents historic significance) will be fully integrated with GIS.

Support for Planning Efforts and Wildland Fires

Staff continued to create and improve three-dimensional computer models of the Mammoth, Lake, Tower, Canyon, and Old Faithful developed areas, complete with realistic buildings, trees, and terrain. In addition, they worked closely with Planning and YCR staff on the Tower/Roosevelt, Old Faithful, Lake, and Mammoth Comprehensive Plans. GIS staff also support the EA process by participating on resource teams and supplying planners with numerous map and analysis products. Allowing users to view the consequences of different planning scenarios on the landscape increases the likelihood that everyone will understand the proposals and will not be surprised by the end results.

Every year the SAC staff dedicates a significant portion of the summer to mapping Yellowstone's wildland fires and creating information products for fire crews, the Public Affairs Office, and the public (via the park's website). The 2008 fire season concluded with a total of eight fires. Staff also participate throughout the year in the wildland-urban interface planning efforts through analysis of data and the creation of information products.

Other Activities

Thermal Inventory. Summer 2008 represented the SAC's eleventh field season of digitally mapping Yellowstone's thermal features. Temperature, pH, photos, and GPS locations were collected from more than 830 thermal features. The database now contains information about approximately 11,700 thermal features from areas throughout the park. This data enables park staff and outside researchers to identify individual thermal features with particular combinations of temperature, pH, and location.

Historical Wildlife Sightings. YCR staff has searched archives and collected hundreds of early



Phill VanKessel, an SCA volunteer, mapping an unnamed feature along the Firehole River in the Upper Geyser Basin.



Equipment (GPS unit and temperature probe) collecting data from an unnamed thermal feature in the Upper Geyser Basin.

narratives about the distribution and abundance of wildlife from 1796 to 1882. These documents were analyzed for specific observations of wildlife, and entered into a relational database, and then observation locations were mapped using ArcGIS. This interdisciplinary study will provide a groundbreaking way to analyze large numbers of wildlife observations. Once completed, the database will be a useful tool for regional land managers, researchers, interpreters, and constituency groups seeking to understand ecological conditions in the GYE more than two centuries ago.

Mapping Requests. Throughout the year SAC staff respond to hundreds of requests for maps and data. About 60% of these requests are typically from Yellowstone staff. The remaining 40% come from NPS staff from other locations; other federal, state, and local agencies; university faculty and students; and the general public. These requests range from the creation of a map of all the thermal features in the Upper Geyser Basin for Old Faithful interpretation, to a map of bison locations and movements for Governor Schweitzer of Montana.

GPS Support. The SAC maintains an inventory of 23 GPS units ranging from recreational grade Garmin units to high-end, sub-meter accuracy mapping grade units. The units are available for NPS staff and cooperators to check out on the GIS intranet site. SAC staff also provide training sessions and support upon request.

Computer and Software Support. One of the SAC's main functions is to help users solve computer, network, printer, and GIS questions. The work load varies from 10 to 50 questions per week, depending on the season. Many of the problems are solved quickly, but more complicated issues can take half the day to resolve. Dedicating SAC staff time to these problems in Mammoth allows the staff from Computer Support Services to provide more support to staff outside of the Mammoth area and spend their time on higher priority, more technical problems.

Research Permit Office

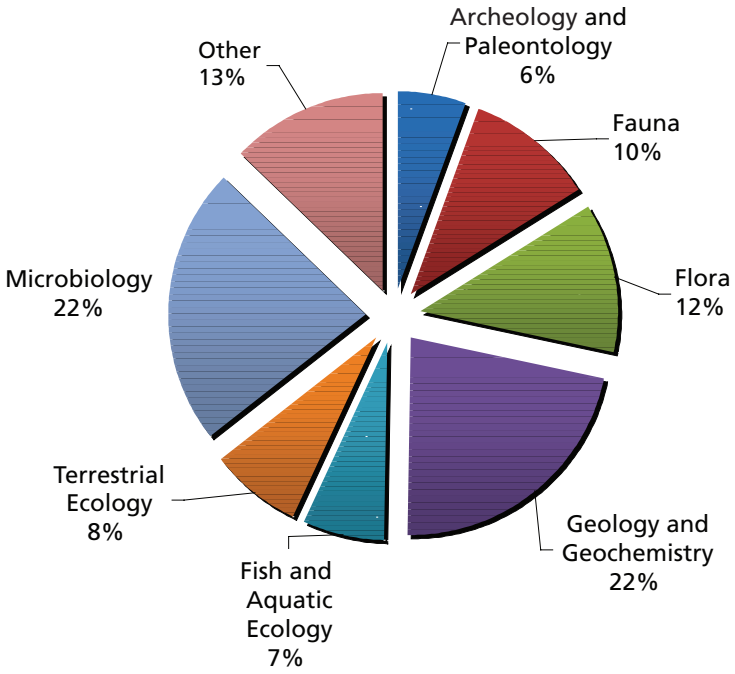
Yellowstone National Park is the proud host of numerous research studies each year. The Research Permit Office is tasked with issuing permits to researchers who conduct scientific studies in a variety of disciplines and monitoring their fieldwork to ensure that it does not negatively affect park resources or conflict with other park goals or missions. NPS policy also requires that we promote research in the park, and collect and appropriately disseminate the results of park-related scientific inquiry to the widest possible audience. Our stakeholders include research scientists, park staff, land managers, and the public. We do this through various means including scheduling research talks and disseminating journal articles, theses, and research reports to interested parties.

During 2008, Yellowstone's Research Permit Office issued 191 research permits to scientists from 32 U.S. states and 7 foreign countries. It was the second year in a row that the number of permits dropped below 200; many scientists have had to suspend their research due to lack of funding. However, the number of permits approved for new projects (28) has remained stable. An additional 25 scientists inquired about conducting research in Yellowstone, but did not pursue obtaining a research permit. Thirty investigators reported the conclusion of their studies and submitted their research findings and publications to the park.

We accompanied several research groups in the field, enabling us to better understand their project's needs as well as ensure that no park resources were harmed. During these field outings our staff and the researchers usually discover better ways to record data or collect samples as well as minimize any potential negative affects on resources. These ideas

for "best practices" are documented and transferred to our staff and other researchers when applicable.

Though Yellowstone is widely known for its abundant wildlife and unique geothermal features, scientific research is conducted in a variety of disciplines. A breakdown of research studies, by topic, is as follows:

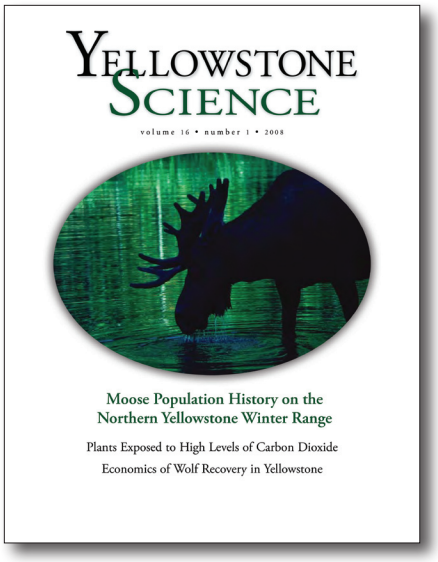


In addition to the above-mentioned tasks, the Research Permit Office staff continues to provide general park information and logistical support to researchers throughout the year.

Science Communication Team

The mission of the Science Communication Team is to synthesize scientific and technical information and make it available in language and formats that are accessible to researchers, other agency scientists, interested members of the public, and park managers who need to take research results into consideration when making decisions about park policies and priorities. Through presentations, events, printed and electronic publications, and outreach efforts, staff strive to contribute to the scientific body of knowledge about the park and discussion of park issues and policies by a variety of participants, and promote resource conservation and visitor enjoyment through improved understanding of ecological issues.

Personnel worked toward those goals in 2008 by producing three issues of *Yellowstone Science* magazine; creating content for and working through a restructuring of the Greater Yellowstone Science Learning Center website with support from the Yellowstone Park Foundation and Canon U.S.A., Inc.; finalizing plans for and participating in the 9th Biennial Scientific Conference on the Greater Yellowstone Ecosystem; and producing a variety of other materials in support of the YCR and other divisions.



Yellowstone Science Magazine

In its sixteenth year of publication, *Yellowstone Science* presented information on many aspects of the park's natural and cultural resources for nearly 2,600 subscribing individuals and institutions. Among the highlights this year was an issue devoted to Yellowstone grizzly bears. Other topics included the history of moose populations on the northern Yellowstone winter range; the effects of high levels of CO_2 on plant communities in Yellowstone, the economic impacts of wolf recovery, the use of religious terminology in the nineteenth century to describe Yellowstone, and Fishing Bridge as a case study of the response by NPS management to changing values.

9th Biennial Scientific Conference

Staff collaborated with the International Association of Wildland Fire in planning *The '88 Fires: Yellowstone and Beyond*, held in September in Jackson Hole, Wyoming, to mark the 20th anniversary of the fires that covered 1.4 million acres of the Greater Yellowstone Area and other large fires that occurred in the West that year. The conference featured more than 140 presentations and discussions in which the primary themes were lessons learned from the fires and how fires and their management are likely to change in the future. Among the approximately 450 attendees were agency managers, scientists, university researchers and students from the United States and other countries, and many who participated in the 1988 firefighting efforts.

Other Publications

Other recurring publications in 2008 included annual reports on YCR, Wolf Project, and Yellowstone Fisheries and Aquatic Sciences activities, all of which were edited and designed by science communication staff. Special publications included the design, layout, and printing of the *Yellowstone Wildlife Health Project Annual Report 2007*, the *Wildlife Health Project Workshop Report*, a rare plants guide, and the *Lake Area Fish Hatchery Historic Structure Report*. Editing and layout of the *Servicewide Benefits-Sharing Final Environmental Impact Statement* continued through the end of the year. Science communication staff also compiled the YCR's submission for the 2007 Superintendent's Annual Report and were involved in the editing of the *Tower-Roosevelt Comprehensive Plan/Environmental Assessment* and the *Wireless Communications Services Plan/Environmental Assessment*. Research and writing were completed on a history of the Fishing Bridge peninsula that will be used to guide the road reconstruction design in that area, and continued on *An Ecological History of Greater Yellowstone Wildlife, 1800–1882*. This work will document hundreds of early narratives about wildlife for land managers, researchers, interpreters, and constituency groups seeking information regarding previous ecological conditions in Greater Yellowstone.

Greater Yellowstone Science Learning Center

The Greater Yellowstone Science Learning Center is a partnership between the YCR, the Greater Yellowstone Inventory and Monitoring Program, the Rocky Mountains Cooperative Ecosystem Studies Unit, Montana State University, the Sonoran Institute, the Yellowstone Association, the Yellowstone Park Foundation, and Canon U.S.A., Inc., as part of the *Eyes on Yellowstone* is made possible by Canon program. It has been recognized as a servicewide model for a website strategy for NPS Research Learning Centers and Inventory and Monitoring Networks. Its primary purposes are to promote mission-oriented research in the Greater Yellowstone Inventory and Monitoring Network (Yellowstone and Grand Teton national parks, John D. Rockefeller, Jr. Memorial Parkway, and Bighorn Canyon National Recreation Area), and to explain the need for and results of research in the network to park managers, researchers, educators, students, and interested public.



Former YCR Director John Varley gives a plenary talk at the 9th conference, The Yellowstone Fires: '88 and Beyond.

During 2008, the website (www.greateryellowstonescience.org) was formally introduced to the public and an article was published about it in *Park Science*. In addition, as part of a Centennial Challenge project, a usability assessment and evaluation of the website was completed and a writer hired through a CESU agreement to produce more content. In a joint effort with the Learning Center of the American Southwest, a developer was hired through a CESU agreement with Montana State University to improve the structure and functionality of the site and a webmaster was hired through a CESU agreement with the Sonoran Institute. Staff also developed content for 20 additional topics on the website and updated information on existing topics, created a GYSLC bookmark and informational handout, and assisted members of the Inventory and

Monitoring Network and the other park units with their products.

Assistance and Support

During 2008, science communication staff produced miscellaneous flyers, maps, and graphics for park staff, including a redesign of a report on Turbid Lake restoration, covers for various bison documents, and graphics for *The '88 Fires: Yellowstone and Beyond* conference. They also provided guidance to park staff on working with the Government Printing Office and obtaining printing bids, and technical assistance on graphics software and layout issues; reviewed publications for the Division of Interpretation; and facilitated public comment on the progress report to the World Heritage Committee on the park's status as a World Heritage site.

Resource Management Operations

As part of the park's Core Operations Analysis effort, Resource Management Operations was reassigned from the Resource and Visitor Protection Division to the YCR in September 2007. With staff

Yellowstone National Park 2008 aquatic nuisance species program summary of contacts.

Contacts by ANS and other NPS Staff	Number Contacts	With Watercraft Users	With Anglers	With Non-water Recreating Public	With NPS Employees	With Concession Employees
SOUTH AREAS	**2150**	**1884**	**176**	**47**	**32**	**11**
Fishing Bridge and Lake Village Area	12	1		6	1	4
Nez Perz and Yellowstone River	24		23	1		
Bridge Bay Marina	1003	905	67	21	4	6
Other Yellowstone Lake Areas	3		3			
Grant Village Marina and Grant Area	662	612	37	10	2	1
Lewis Lake, Lewis River, and Snake River	424	366	46	9	3	
Grand Teton National Park	22				22	
WEST and NORTH AREAS	**244**	**35**	**122**	**86**		**1**
Hebgen Lake	82	26	11	45		
Quake Lake	16	8	7	1		
Madison River	36	1	32	2		1
Firehole River	23		18	5		
Jaffe Lake	11		5	6		
Indian Creek	2		1	1		
Gibbon River	18		7	11		
Gallatin River	5		5			
Gardner River	21		13	8		
Slough Creek	30		23	7		
TOTAL CONTACTS	**2394**	**1919**	**298**	**133**	**32**	**12**
Contacts made by ANS dedicated Staff *	718	244	298	133	32	11

*There were a total of 930 contact hours by ANS dedicated staff.

Other Program Statistics

Inspections Conducted	Total Inspections	Watercraft	Anglers	Other		
	399	198	195	6		
Watercraft Treated		3				
Contacts that had prior knowledge of ANS		492				
Contacts declaring their equipment is clean		1318				
Contacts by Country		United States—43 states Canada—16 contacts				
Contacts by Month	April (0)	May (48)	June (598)	July (931)	August (627)	September (190)



Each winter and spring, wildlife such as this pine marten enter unoccupied buildings. Using safe and humane methods, resource management staff relocate wildlife and other building pests as part of the division's integrated pest management program.

positioned throughout the park, their primary role is to intervene in the day-to-day situations in which the park's cultural or natural resource values are at risk because of human activities. By working with staff in the maintenance, interpretation, and protection divisions, they help manage backcountry areas, enhance public safety by removing hazard trees, and educate visitors in protecting park resources. Their involvement in these functions greatly facilitates YCR engagement in broad resource management issues and helps the YCR carry out its own projects, long-term programs, and field research. Throughout this report, the specific accomplishments of this work unit are described under the resources they relate to. The pie chart below shows the diversity of activities in which Resource Management Operations staff participate.

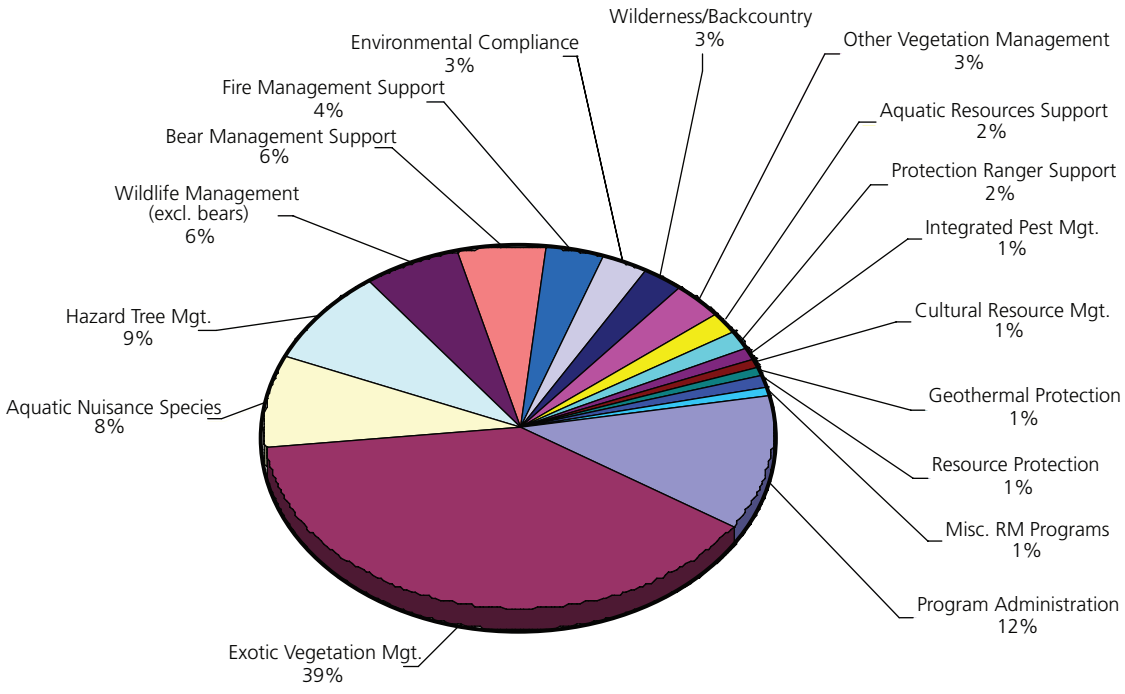
Nearly half of the staff time (47%) in 2008 was spent educating the public about and monitoring and controlling the spread of invasive species. An equal amount of time was spent in various support roles, illustrating the degree of cooperation within and outside of the YCR.

Funding and Personnel

Base Operating Budget

The final base operating budget was $4,917,700 for the YCR in FY08. The increase of $569,700 over FY07 funding levels represented the reallocation of park base funds to support the parkwide reorganization and consolidation decisions made in FY07 that became effective October 1, 2007, adding resource management operations and compliance

2008 Staff Hours
Resource Management Operations



functions to the YCR. The base operating budget accounted for 59% of the YCR total for FY08. This compares to an average of 60% for the period FY95–07.

Additional Funding

Recreation Fee Demonstration Funds. The fee demo program provided $199,700 in FY08 to begin a multi-year project to convert 20 acres of former tilled and irrigated agricultural lands from low-quality, exotic weed–dominated lands to high-quality wildlife habitat in the Gardiner Basin section of the park and to develop interpretive media for this project. Visitor fees also provided $375,500 for ongoing projects: renovation of and improvements to interpretive exhibits along the Nez Perce Trail, northern range riparian studies, the final year of a geothermal features inventory, two fisheries conservation projects, improvement of collections storage at the Heritage and Research Center, additional visitor service assistance at the Heritage and Research Center, a condition survey of historic structures with high visitor use, and the hazard tree reduction and exotic plant control programs transferred from the Division of Resource and Visitor Protection at the beginning of FY08. Since the YCR began receiving fee demo money in 1997, about $2.9 million has been allocated from this funding program for 27 different projects.

Fishing Fee Program. The YCR received authorization to use $351,900 from fishing permit fee revenue to cover part of the $792,200 cost of the Fisheries and Aquatic Sciences program in FY08. This allocation included a slight increase in the overall percentage of the YCR's share of the fish fee income to cover angler use surveys formerly conducted by resource management personnel in the Division of Resource and Visitor Protection.

Federal Lands Highway Program. Federal Highways funded $647,500 for natural resource inventories, archeological surveys, and resource compliance along the road corridors in the park scheduled for major repair or reconstruction in the near future, and to perform exotic weed control in the completed construction areas undergoing revegetation.

Special Emphasis Program Allocation System. The Branch of Cultural Resources successfully competed for a total of $532,100 in special emphasis program funding that was used to stabilize and maintain the historic Upper Blacktail cabin, perform cyclic maintenance on the Buffalo Plateau cabin, Lake Lodge cabins, and the Fishing Bridge Museum collection, and support four museum cataloging projects. This funding was also used for two new projects: an archeological survey of the Nez Perce National Historic Trail and a study of the traditional use of wickiups in the park.

The special emphasis program also provided $113,100 to the Branch of Natural Resources for several ongoing air quality monitoring projects, the start of a three-year study on mountain goat habitat vegetation, the start of a three-year project to evaluate the effectiveness of grizzly bear management closures, to cap a disused geothermal well adjacent to the park, and to close out the final phase of a long-term wolverine study.

Other Park Service Funds. The YCR continued work on the Benefits-Sharing EIS in FY08 with funds provided by the servicewide planning office of the NPS ($115,000). The national Centennial Challenge Initiative program selected three YCR projects to support: an all-taxa biodiversity inventory of Lake Yellowstone, the Greater Yellowstone Science Learning Center project, and a collections preservation project for a total of $594,300.

Other Federal Funds. A total of $172,500 was provided to Yellowstone from other federal agencies. Funds were provided by the Greater Yellowstone Coordinating Committee ($6,900) and the U.S. Fish and Wildlife Service ($19,800) to assist Yellowstone with aquatic nuisance species control. The U.S. Forest Service contributed $9,500 to ethnography research on the Nez Perce National Historic Trail. The bulk of the funding in this category, however, was provided by the U.S. Fish and Wildlife Service for increased monitoring of grizzly bears ($136,300) in the wake of their removal from the Endangered Species List.

Private Funds. A total of $375,300 was donated to the park by private organizations or individuals in support of various YCR projects, including restoration of westslope cutthroat trout, Yellowstone cutthroat trout conservation efforts, wolf recovery program operations, the Tauck World Discovery volunteer program for historic structures conservation, cultural resource preservation projects, a bear management oral history project, the Yellowstone

Atlas project, a wolverine survey, and support for the Greater Yellowstone Science Learning Center and Yellowstone Wildlife Health Initiative. Most of this funding ($334,500) came through the Yellowstone Park Foundation. The National Fish and Wildlife Foundation provided $31,100 for fish restoration projects, and an additional $9,700 was donated by private organizations for exotic weed control and archeological work in the park.

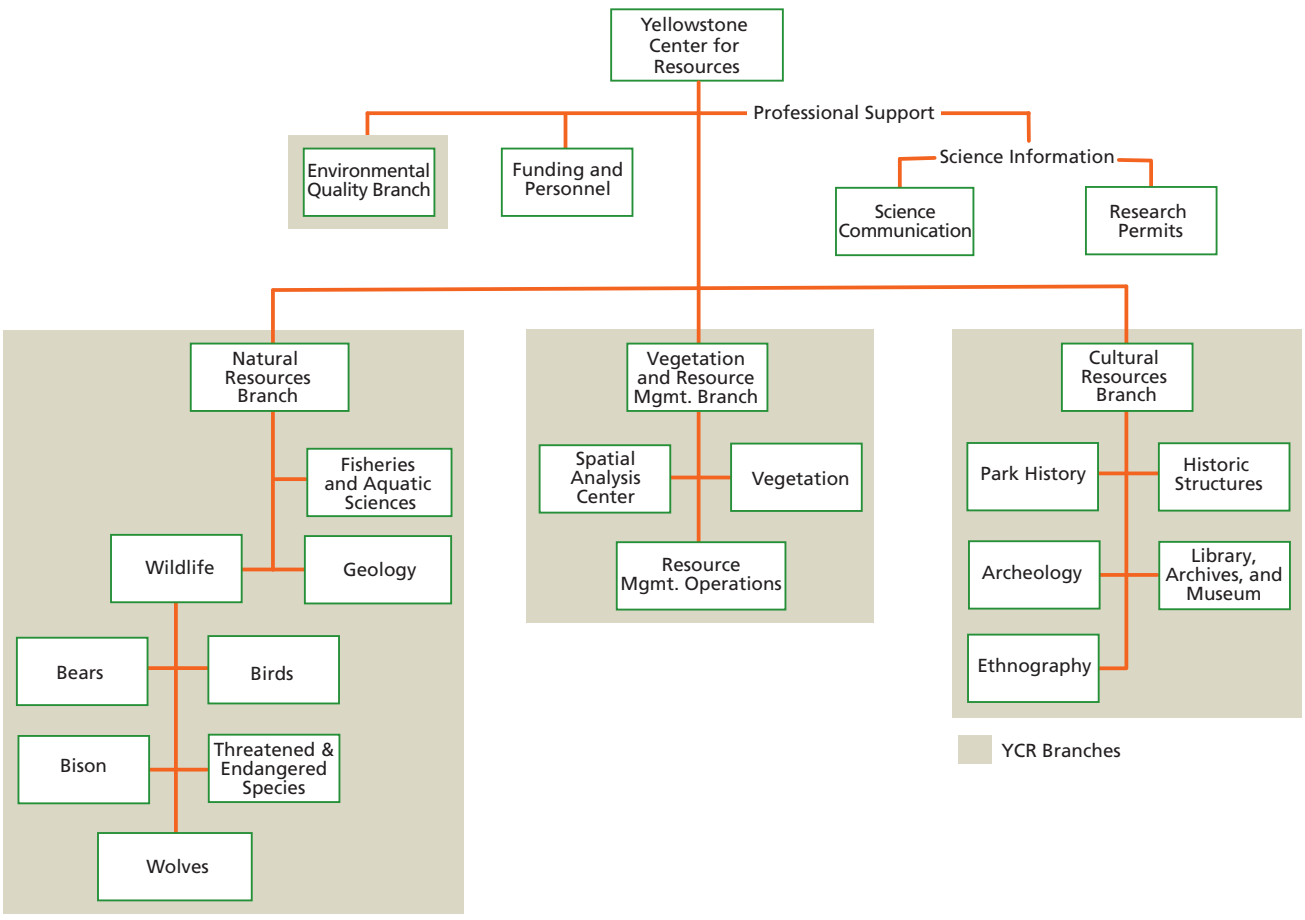
Personnel

At the end of July 2007, park management solidified many staffing decisions and subsequently published the *Core Operations One-year Report* in October 2007. This report signified the culmination of two years of the Core Operations Analysis effort and presented scenarios to address the park's base budget realities, starting with actual 2005 finances and ending with 2010 financial projections. The decisions that went into this report gave Yellowstone and the YCR a foundation for sustainable park operations and position management and provided a framework for future staffing decisions.

By the end of FY07, the YCR had largely completed the difficult position changes that were needed to meet the projected FY10 budget. However, the Core Operations Analysis exercise recommended some significant parkwide organizational changes to be implemented at the opening of FY08 in order to increase the efficiency of certain park functions, including resource management. Under the new plan, the YCR was tasked with establishing and staffing a National Environmental Policy Act compliance program, as well as incorporating into YCR operations the existing Resource Management Operations program and staff, formerly vested in the Resource and Visitor Protection Division.

The restructuring and administrative process changes went fairly smoothly, and priorities for recruiting positions to fill in the new staffing configuration got underway. Of the 276 personnel actions processed by the YCR in FY08, these were of special note:

Yellowstone Center for Resources Organization as of December 2008



- Janine Warner, who came to the YCR on a temporary basis in October 2007 to backfill the Editorial Assistant vacancy left by Virginia Warner, accepted a term appointment to that position effective February 3, 2008.
- After being vacant for a year and a half while the Resource Management Operations program was moved to the YCR and restructured, a permanent, subject-to-furlough Assistant Resource Management Coordinator position, vice-Paul Miller, was filled by Rick McAdam as of April 13, 2008.
- Veteran wolf program Biological Technician Deb Guernsey resigned as of April 12, 2008. Her permanent, subject-to-furlough position was backfilled by former wolf program volunteer Erin Albers on May 6, 2008.
- While Fisheries Biologist Patricia Bigelow was granted time to complete her doctoral thesis, Fisheries Technician Phil Doepke received a temporary promotion on May 12, 2008, to assume responsibility for directing the lake trout control program on Yellowstone Lake during the summer/fall field season.
- Term Hydrologist Sean Eagan resigned as of June 7, 2008, to take a permanent position at Lassen Volcano National Park in California.
- As part of the Core Operations Analysis restructuring, existing compliance personnel were moved into the YCR division at the beginning of FY08 on October 1, 2007. Park management committed to funding a new Compliance Coordinator position to head up the Branch of Environmental Quality, and the position was recruited through the winter and spring of 2008. Linda Mazzu, of the BLM Division of Fire Planning in Boise, Idaho, was selected and entered on duty in Yellowstone June 22, 2008.
- Cultural Resources Technician Tasha Felton resigned her position at the Heritage and Research Center on June 22, 2008, in order to pursue further education.

The total FTE of the YCR staff was equivalent to 75 full-time employees for FY08. The increase of 10 FTE over FY07 staffing levels represented the reallocation of park base funds to support the parkwide reorganization and consolidation decisions made in FY07 that became effective October 1, 2007, adding resource management operations and compliance functions to the YCR.

Other Administrative Activities

Assistance Agreements. Staff processed 71 assistance agreements and task orders in FY08, totaling obligations of $2,310,200, of which 28% was used for historic structures, archeological surveys, and other cultural resources projects; 26% was devoted to science information projects, including website development for the Greater Yellowstone Science Learning Center, an all-taxa inventory of Yellowstone Lake, and preparations for a multiagency climate change workshop; and 20% went toward the administration of the Montana Water Compact and geothermal monitoring plan. Other significant investments were made in vegetation research and restoration projects, wildlife health research, aquatic resources studies, and research in support of winter use studies.

Procurement Actions. Staff processed 695 procurement actions. Beginning January 1, 2007, all Yellowstone divisions were required to use the Interior Department Electronic Acquisition System (IDEAS) to request acquisition services from the Yellowstone Procurement and Contracting Office. This created a new workload for the YCR administrative staff and a larger workload for staff involved in the credit card purchasing process because more micro-purchasing was done internally. During this first full fiscal year of using the electronic system, 180 purchase requests were prepared in IDEAS, while 515 acquisitions were accomplished primarily through administrative staff credit card orders, for a total of 695 procurement actions in FY08, resulting in approximately $756,200 in contracting and micro-purchasing expenditures.

Clerical Support. Staff processed 1,234 pieces of correspondence and 264 travel authorizations in FY08.

Funding history (FY 1993–2008), Center for Resources, Yellowstone National Park.

YCR Base Increase	FY	National Park Service Funds: Park Base	Nat. Res Project Funds	Cult. Res Project Funds	Fish Fee	FLHP	Fee Demo	Other NPS	Other Federal	Private	Total	% Soft Funded
	93	1,004,600	16,000	-	-	-	-	785,000	188,000	20,000	2,013,600	50%
245,400	94	1,250,000	260,000	33,200	65,000	43,300	-	320,600	79,600	10,000	2,061,700	39%
250,000	95	1,500,000	420,000	45,000	65,000	303,600	-	59,800	20,000	5,300	2,418,700	38%
44,100	96	1,544,100	404,000	201,100	274,500	626,700	-	157,800	65,000	31,500	3,304,700	53%
130,000	97	1,674,100	204,000	228,400	213,400	433,700	340,000	42,700	398,300	48,000	3,582,600	53%
571,500	98	2,245,600	130,500	242,100	284,800	330,800	31,000	24,000	65,300	37,700	3,391,800	34%
286,300	99	2,531,900	-	221,900	285,000	396,500	298,000	152,900	105,200	56,700	4,048,100	37%
36,700	00	2,568,600	237,500	101,000	280,000	214,900	631,000	1,418,000	41,300	52,700	5,545,000	54%
93,300	01	2,661,900	297,000	216,700	285,100	409,000	-	-	15,000	85,500	3,970,200	33%
772,900	02	3,434,800	293,000	198,700	261,900	293,200	6,000	-	11,700	126,400	4,625,700	26%
(16,100)	03	3,418,700	101,000	326,300	250,000	431,000	103,000	454,400	24,000	224,300	5,332,700	36%
569,700	04	3,988,400	92,600	470,400	332,600	623,500	133,000	855,000	22,400	229,200	6,747,100	41%
375,700	05	4,364,100	218,000	676,900	342,300	495,900	167,700	367,800	23,700	181,300	6,837,700	36%
(152,800)	06	4,211,300	193,800	466,890	368,400	427,700	224,500	249,000	224,200	340,400	6,706,190	37%
136,700	07	4,348,000	205,200	208,900	333,400	567,100	349,700	162,000	296,900	226,100	6,697,300	35%
569,700	08	4,917,700	113,100	532,100	351,900	647,500	575,200	709,300	172,500	375,300	8,394,600	41%

YCR distribution of FY08 funds.

											% of Total Funding
Support: Mgt, Admin, Science, Science Commun., GIS, Enviro Qual	1,342,100	-	-	-	61,500	15,000	230,000	-	105,400	1,754,000	20.9%
Natural Resources	3,128,100	113,100	-	351,900	330,900	409,100	399,300	163,000	218,900	5,114,300	60.9%
Cultural Resources	447,500	-	532,100	-	255,100	151,100	80,000	9,500	51,000	1,526,300	18.2%
Total:	**4,917,700**	**113,100**	**532,100**	**351,900**	**647,500**	**575,200**	**709,300**	**172,500**	**375,300**	**8,394,600**	**100%**

Other NPS:

115,000	Benefits Sharing EIS
594,300	Centennial Challenge Initiative (3 projects)
709,300	

Other Federal:

136,300	USFWS–Grizzly Conservation Strategy
6,900	GYCC–Aquatic Nuisance Species
19,800	USFWS–Aquatic Nuisance Species
9,500	USFS–Nez Perce Nat'l Historic Trail
172,500	

Private:

100	General Donations
3,600	Archeology Donations
4,000	Xanterra
2,000	Montana Dept of Transportation
31,100	Nat'l Fish & Wildlife Foundation
334,500	Yellowstone Park Foundation
375,300	

Not Included:

5,400 USGS–BRD Bear Study Team (no YCR charges—pass through only)

Base:	**4,917,700**	**59%**
All Other:	**3,476,900**	**41%**

APPENDIX I

Personnel Roster, 2008

Professional Support Branch

Management and Administration

			YCR FTE	Non-YCR FTE
1.	Cline, Barbara	Division Secretary	1.02	
2.	Gunther, Stacey	Environmental Protection Assistant	0.42	
3.	Hendrix, Christie	Environmental Protection Assistant	1.02	
4.	Housley, Sara	Center Clerk	0.11	
5.	Lindstrom, Montana	Budget Analyst	1.11	
6.	McAdam, Melissa	Sprv. Budget Analyst	1.01	
7.	Olliff, Tom	Division Chief	1.06	
8.	Smith, Christine	Environmental Protection Assistant	0.26	
	Maintenance & custodial assistance (Lake Research Dorm)		-	0.02
		subtotal Management & Admin:	**6.01**	**0.02**

Science Communication

9.	Blackford, Tami	Editor	1.02	
10.	Franke, Mary Ann	Technical Writer-Editor	0.45	
11.	Schullery, Paul	Resource Naturalist	0.39	
12.	Stevenson, Sarah	Technical Writer-Editor	0.07	
13.	Waller, Janine	Editorial Assistant	0.79	
14.	Warner, Virginia	Editorial Assistant	0.51	0.35
		subtotal Resource Information:	**3.23**	**0.35**
		Professional Support Branch FTE:	**9.24**	**0.37**

Environmental Quality Branch

Compliance and Environmental Quality

1.	Desmet, Adrienne	Office Assistant	0.27	
2.	Deutch, Ann	Environmental Protection Assistant	0.51	
3.	Hale, Elaine	Archeologist	0.97	
4.	Madsen, Douglas	Environmental Protection Specialist	1.07	
5.	Mazzu, Linda	Sprv. Environmental Protection Spec	0.28	
6.	Mills, Sue	Environmental Protection Specialist	1.01	
		Environmental Quality Branch FTE:	**4.11**	-

Natural Resources Branch

Natural Resources Administration

1.	Burson, Shan	Ecologist (Bioacoustics)	0.51	
2.	Plumb, Glenn	Chief of Natural Resources	1.06	
3.	Wyman, Becky	Administrative Support Assistant	1.01	

	Horse handler & packer support (bison, fish, geology projects)		-	0.33
	Winter Use Monitoring Assistance (wildlife, air quality, acoustic, safety)		-	0.23
		subtotal NR Admin FTE:	**2.58**	**0.56**
Wildlife Resources Team				
4.	Albers, Erin	Biological Science Technician	0.41	
5.	Baril, Lisa	Biological Science Technician	0.39	
6.	Blanton, Doug	Biological Science Technician	1.07	
7.	Bramblett, Amanda	Biological Science Technician	0.42	
8.	Coleman, Tyler	Biological Science Technician	0.46	
9.	Davis, Troy	Biological Science Technician	1.03	
10.	Geremia, Chris	Biological Science Technician	1.06	
11.	Guernsey, Deb	Biological Science Technician	0.54	
12.	Gunther, Kerry	Wildlife Biologist	1.04	
13.	Jones, Jennifer	Biological Science Technician	1.05	
14.	McEneaney, Terry	Wildlife Biologist	0.15	
15.	McIntyre, Rick	Biological Science Technician	0.50	
16.	Murphy, Kerry	Wildlife Biologist	1.00	
17.	Rees, Mariah	Biological Science Aid	0.23	
18.	Smith, Doug	Wildlife Biologist	1.03	
19.	Stahler, Dan	Biologist	0.73	
20.	Tallian, Aimee	Biological Science Technician	0.48	
21.	Treanor, John	Biological Science Technician	1.05	
22.	Wallen, Rick	Wildlife Biologist	1.04	
23.	White, PJ	Wildlife Biologist	1.01	
24.	Wyman, Travis	Biological Science Technician	1.11	
	Grizzly Bear Conservation Strategy monitoring		-	2.16
		subtotal Wildlife FTE:	**15.80**	**2.16**
Fisheries and Aquatic Resources				
25.	Adams, Rebecca	Biological Science Technician	0.18	
26.	Arnold, Jeff	Aquatic Ecologist	0.97	
27.	Bigelow, Pat	Fisheries Biologist	1.01	
28.	Billman, Hilary	Biological Science Technician	0.26	
29.	Brown, Scott	Biological Science Technician	0.39	
30.	Brown, Stuart	Biological Science Technician	0.34	
31.	Bywater, Tim	Administrative Support Assistant	0.15	
32.	Coleman, Angela	Biological Science Technician	0.22	
33.	Doepke, Phil	Biological Science Technician	0.97	
34.	Ertel, Brian	Biological Science Technician	1.01	
35.	Glaser, Nicholas	Biological Science Technician	0.09	
36.	Helmy, Olga	Biological Science Technician	0.45	
37.	Koel, Todd	Sprv. Fishery Biologist	1.01	
38.	Ladd, Hallie	Biological Science Technician	0.41	
39.	Legere, Nicole	Biological Science Technician	0.08	
40.	Rupert, Derek	Biological Science Technician	0.32	

41.	Sibley, Jeannine	Biological Science Technician	0.23	
42.	Skorupski, Joseph	Biological Science Technician	0.38	
43.	Squires, Audrey	Biological Science Technician	0.08	
44.	Sigler, Stacey	Biological Science Technician	0.09	
45.	Young, Chelsey	Biological Science Technician	0.29	
	Assistance to fisheries special projects		-	0.05
		subtotal Aquatic Resources FTE:	**8.93**	**0.05**
Geology and Physical Sciences				
46.	Eagan, Sean	Hydrologist	0.69	
47.	Heasler, Hank	Geologist	1.02	
48.	Jaworowski, Cheryl	Geologist	0.97	
49.	Mahony, Dan	Fishery Biologist	1.01	
	Assistance to geology special projects		-	0.04
		subtotal Geology FTE:	**3.69**	**0.04**
		Natural Resources Branch FTE:	**31.00**	**2.81**

Vegetation and Resource Operations Branch

Vegetation Management

1.	Anderson, Heidi	Botanist	0.91	
2.	Bontranger, Jonathan	Biological Science Aid	0.27	
3.	Hektner, Mary	Sprv. Vegetation Mgt Specialist	1.01	
4.	Islar, Kay	Biological Science Technician	0.16	
5.	Klaptosky, John	Biological Science Technician	0.54	
6.	Renkin, Roy	Vegetation Management Specialist	1.01	
7.	Whipple, Jennifer	Botanist	0.73	
	Web support for vegetation projects (Gardiner Basin, mtn goat)		-	0.04
		subtotal Vegetation FTE:	**4.63**	**0.04**
Resource Management Operations				
8.	Bosserman, Heather	Biological Science Technician	0.33	
9.	Cimino, Hillary	Biological Science Technician	0.29	
10.	Cloghessy, Samuel	Biological Science Aid	0.21	
11.	Donovon, Mary A.	Biological Science Technician	0.31	
12.	Fey, Margie	Biological Science Technician	0.36	
13.	Flannery, Joseph	Biological Science Technician	0.41	
14.	Fleming, Kaitlin	Biological Science Technician	0.32	
15.	Gerot, Sharon	Biological Science Technician	0.34	
16.	Goodwin-Johansson, Reed	Biological Science Aid	0.24	
17.	Haynes, James	Biological Science Technician	0.32	
18.	Holdren, Anita	Biological Science Technician	0.45	
19.	Howell, Matthew	Biological Science Technician	0.37	
20.	Kraegel, William	Biological Science Technician	0.21	
21.	Mashburn, William	Biological Science Technician	0.17	
22.	McAdam, Rick	Asst Resource Mgt Specialist	0.48	

23.	McClure, Craig	Resource Mgt Specialist	1.01	
24.	Nagashima, Vincent	Biological Science Technician	0.27	
25.	Nedved, Troy	Asst Resource Mgt Specialist	0.57	
26.	Overbaugh, Chris	Biological Science Technician	0.02	
27.	Perrotti, Patrick	Resource Mgt Specialist	1.01	
28.	Reinertson, Eric	Asst Resource Mgt Specialist	0.65	
29.	Reinhart, Daniel	Resource Mgt Specialist	1.02	
30.	Sechrist, George	Biological Science Technician	0.31	
31.	Teets, Brian	Biological Science Technician	0.79	
	Aquatic Nuisance Species monitoring assistance		-	0.04
		subtotal Resource Management FTE:	**10.46**	**0.04**
Spatial Analysis Center				
32.	Bone, Sarah	Cartographic Technician	0.45	
33.	Comer, Greg	Cartographic Technician	1.01	
34.	Fano, Elisabeth	Cartographic Technician	0.39	
35.	Guiles, Carrie	Cartographic Technician	0.98	
36.	Miller, Steve	Cartographic Technician	0.94	
37.	Park, Brian	Cartographic Technician	0.18	
38.	Rice, Matthew	Cartographic Technician	0.21	
39.	Rodman, Ann	Sprv. GIS Specialist	1.04	
40.	Syphus, Matthew	Cartographic Technician	0.31	
		subtotal Spatial Analysis:	**5.51**	-
		Vegetation & Resource Operations Branch FTE:	**20.60**	**0.08**

Cultural Resources Branch

1.	Curry, Colleen	Museum Curator	1.01	
2.	Dawson, Herb	Historic Architect	0.71	
3.	Felton, Tasha	Cultural Resources Technician	0.73	
4.	Finn, Lauren	Archives Technician	1.04	
5.	Green, Holly	Library Technician	0.23	
6.	Guild, Bridgette	Museum Technician	0.95	
7.	Johnson, Ann	Archeologist	1.00	
8.	Murphy, Alicia	Museum Technician	0.36	
9.	Reid, Charissa	Cultural Anthropologist	0.15	
10.	Sucec, Rosemary	Cultural Anthropologist	0.97	
11.	Washburn, Andrew	Museum Technician	0.95	
12.	White, Katie	Anthropology Technician	0.57	
13.	Whittlesey, Lee	Historian	1.00	
14.	Zirngibl, Wendy	Museum Technician	0.19	
	Collections assistance; installation of new security systems		-	0.57
		Cultural Resources Branch FTE:	**9.86**	**0.57**
122.	**YCR Employees**	**TOTAL YCR FY08 FTE:**	**74.81**	**3.83**

APPENDIX II

Publications and Reports

Professional Publications

Blackford, T., editor. 2008. *Yellowstone Science* 16, volumes 1–3.

Gunther, K. A. 2008. Yellowstone grizzly bears, delisted but not forgotten: Management, monitoring, and conservation of grizzly bears in Yellowstone National Park after delisting. *Yellowstone Science* 16(2): 30–34

Gunther, K. A., and T. Wyman. 2008. Human habituated bears: The next challenge in bear management in Yellowstone National Park. *Yellowstone Science* 16(2): 35–41.

Haroldson, M. A., K. A. Gunther, and T. Wyman. 2008. Nature note: Possible grizzly cub adoption in Yellowstone National Park. *Yellowstone Science* 16(2): 42–44.

Haroldson, M. A., C. C. Schwartz, and K. A. Gunther. 2008. Grizzly bears in the Greater Yellowstone Ecoystem: From garbage, controversy, and decline to recovery. *Yellowstone Science* 16(2): 13–24.

Administrative Reports

Gunther, K. A. 2008. Yellowstone National Park conservation strategy tasks and accomplishments 2007. U.S. Department of the Interior, National Park Service, Bear Management Office, Yellowstone National Park.

_____. 2008. Yellowstone National Park recreational use. Page 40 *in* C. C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana.

Gunther, K. A., M. T. Bruscino, S. L. Cain, K. Frey, Lauri Hanauska-Brown, M. A. Haroldson, and C. C. Schwartz. 2008. Grizzly bear–human conflicts in the Greater Yellowstone Ecosystem. Pages 42-44 *in* C. C. Schwartz, M. A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana.

Gunther, K. A., R. A. Renkin, J. C. Halfpenny, S. M. Sigler, P. Schullery, L. Whittlesey. 2008. Presence and distribution of white-tailed jackrabbits in Yellowstone National Park. U.S. Department of the Interior, National Park Service, Bear Management Office, Yellowstone National Park.

_____. 2008. White-tailed jackrabbits in Yellowstone National Park: A rebuttal to reports of extirpation, range retraction, and population decline. U.S. Department of the Interior, National Park Service, Bear Management Office, Yellowstone National Park.

Gunther, K. A., T., Wyman, M. Boyce, T. Coleman, K. Loveless, A. Tallian, K. Wells, S. Sigler, and C. Mogensen. 2008. Bear Management Office administrative annual report for calendar year 2007. U.S. Department of the Interior, National Park Service, Bear Management Office, Yellowstone National Park.

Gunther, K. A., T. Wyman, T. M. Koel, P. E. Bigelow, P. Perrotti, and E. Reinertson. 2008. Spawning cutthroat trout. Pages 31-33 *in* C. C. Schwartz, M. A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana.

Koel, T. M., J. L. Arnold, P. E. Bigelow, P. D. Doepke, B. D. Ertel, and M. E. Ruhl. 2008. Yellowstone Fisheries & Aquatic Sciences: Annual report, 2007. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2008-02.

National Park Service. 2008. Wireless communication services plan environmental assessment. National Park Service, Yellowstone National Park, Mammoth Hot Springs, Wyoming.

Podruzny S., K. A. Gunther, and T. Wyman. 2008. Spring ungulate availability and use by grizzly bears in Yellowstone National Park. Pages 28-30 *in* C. C. Schwartz, M. A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana.

Sievert & Sievert. Cultural Resource Consultants in conjunction with the Montana Preservation Alliance. 2008. Lake area fish hatchery historic structure report. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2008-06.

Smith, D. W., D. R. Stahler, D. S. Guernsey, M. Metz, E. Albers, L. Williamson, N. Legere, E. Almberg, and R. McIntyre. 2008. Yellowstone Wolf Project: Annual report, 2007. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2008-01.

Yellowstone Center for Resources. 2008. Surveillance for brucellosis in Yellowstone bison: The power of various strategies to detect vaccination effects. National Park Service, Mammoth Hot Springs, Wyoming, YCR-2008-04.

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