

CHAPTER 3: AFFECTED ENVIRONMENT

This chapter describes existing environmental conditions in areas potentially affected by the alternatives. This section describes the following resource areas: natural resources including threatened and endangered species, migratory birds including Species of Management Concern, wilderness and soundscapes; cultural resources including historic properties and cultural landscapes; and social resources including human health and safety, park operations, visitor use and experience, visual quality and viewsheds.

NATURAL RESOURCES

Telecommunications facilities may have an effect on natural resources including wildlife, especially migratory bird species and wilderness. Yellowstone is home to some of the largest concentrations of mammals in the lower 48 states. Sixty-one different mammals live here, including a wide variety of small mammals. Records of bird sightings kept in Yellowstone since its establishment in 1872 document 320 species, of which approximately 148 species are known to nest in the park. Wildlife species in Yellowstone that are protected by the Endangered Species Act include the Canada lynx (*Lynx Canadensis*). The gray wolf (*Canis lupus*) was recently removed from the List of Endangered Species on March 28, 2008. Endangered Species Act protections were reinstated on July 18, 2008 due to a court order. The grizzly bear (*Ursus arctos*) and bald eagle (*Haliaeetus leucocephalus*) were removed from the List of Endangered Species on April 30, 2007 and August 8, 2007, respectively. Yellowstone Species of Management Concern include the gray wolf, grizzly bear, pronghorn (*Antilocapra americana*), wolverine (*Gulo gulo*), bison (*Bison bison*), bald eagle, American peregrine falcon (*Falco peregrinus*), trumpeter swan (*Cygnus buccinators*), American white pelican (*Pelecanus erythrorhynchos*), Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*), westslope cutthroat trout (*Oncorhynchus clarkii lewisii*), arctic grayling (*Thymallus arcticus*), and western toad (*Bufo boreas*).

Wildlife species that may be affected by the park Wireless Communications Services Plan include threatened and endangered species and migratory birds including bird species of management concern. These topics are discussed below.

Wildlife

Threatened and Endangered Species

Canada lynx

The Distinct Population Segment of Canada lynx in the contiguous United States was listed as threatened under the Endangered Species Act (ESA) in 2000 because existing regulatory mechanisms in U.S. Forest Service (USFS) Land and Resource Management Plans were inadequate to protect lynx or lynx habitat (65 FR 16052). Lynx in the contiguous United States are considered part of a larger metapopulation whose core is located in the northern boreal forests of Canada. Lynx emanate from that area into the United States through coniferous forests with dense understories that receive deep, fluffy snows and support snowshoe hares, the lynx's principal prey (65 FR 16052). A resident population of lynx is distributed throughout its historic range in Montana, but available data are not sufficient to determine population size or trend (65 FR 16058).

Lynx occur in low numbers in the Yellowstone ecosystem, but have been detected using DNA-based methods in 18 locales since 2000 (Yellowstone National Park 2007). Numerous other sightings of Canada lynx or their tracks, without DNA support, have occurred (Yellowstone National Park files). Historical information suggests lynx were present, but uncommon, in Yellowstone during 1880 to 1980 (Murphy et al. 2004). From 2001 to 2004, the status and distribution of lynx were documented in spruce-fir and lodgepole pine forests in the park using snow tracking and hair-snare surveys

(McKelvey et al. 1999, Murphy et al. 2006). Cumulative detections represented at least three individuals, including two kittens born in two different years (Murphy et al. 2006). The presence of offspring indicated that resident, breeding individuals were present. Lynx were documented south of the East Entrance road and on the Central Plateau (i.e., Mary Mountain).

Lynx require cold boreal and montane conifer forests with dense understories that receive heavy snowfall and that support snowshoe hares, their winter principal prey. In accordance with the Canada Lynx Conservation and Assessment Strategy (CLCAS), park habitats dominated by mesic subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmanni*), and lodgepole pine (*Pinus ponderosa*) were mapped as lynx habitat (typically late successional or mature forests) or lynx habitat currently in an unsuitable condition (successional forests 1–20 years post disturbance). Twenty landscape units—Lynx Analysis Units (LAUs) — ranging from 33,000 to 155,000 acres in size were identified, each containing >15,000 acres of lynx habitat. LAUs were primarily associated with andesitic and sedimentary-based soils common in the northern and eastern portions of the park (Despain 1990). No LAUs were identified in the central and west-central portion of the park where dry lodgepole pine stands predominate at successional climax. Park LAUs typically occurred in the Yellowstone backcountry, although seven were transected by major park roads. Developed sites in the park typically did not occur in LAUs.

Managers use the standards and guidelines provided in the CLCAS to gauge the effects of park projects on lynx. Under the CLCAS, projects that occur outside LAUs have no effects on lynx. Projects inside LAUs may affect lynx, but not adversely, if the location occurs outside of lynx habitat, or occurs in lynx habitat that is currently unsuitable for lynx foraging, or occur in lynx foraging habitat, but ample suitable habitat is otherwise available. Thus, lynx foraging habitat can be modified if more than 70% remains suitable after the project.

Wireless projects, both in developed and backcountry areas, would occur in proposed lynx critical habitat Unit 5 (Greater Yellowstone) (FWS 2008). The proposal for the park includes the area north of the West Entrance road and west of the road extending from Gardiner to Norris Junction; the entire Northern Winter Range; the Absaroka Range along the park's northern and eastern boundary; and the area east of the South Entrance Road. A broad array of habitat types and successional stages are included; montane, subalpine, and deciduous (aspen) forests; sagebrush and grassland steppe; alpine areas; and riparian zones.

Gray Wolves

The gray wolf historically existed from Greenland, Alaska, and Canada through the lower 48 states to southern Mexico, with the exception of arid deserts and portions of California and the southeast. Predator control by local, state, and federal governments in the late 1800s and early 1990s resulted in its extirpation from the greater Yellowstone area and most of the lower 48 states by the 1930s (Phillips and Smith 1996). Wolves persisted in small numbers in northern Minnesota and Isle Royale, Michigan, and possibly in northern Michigan and the southwest. Wolves occasionally dispersed south from Canada into Montana and Idaho (Ream and Mattson 1982, Nowak 1983).

In 1978 the U.S. Fish and Wildlife Service (USFWS) listed the gray wolf as endangered throughout the contiguous 48 States and Mexico (except for Minnesota where the gray wolf was reclassified to threatened). In 1994, the USFWS designated unoccupied portions of Idaho, Montana, and Wyoming as two nonessential experimental population areas for the gray wolf. This designation enabled the reintroduction of 31 wolves from southwestern Canada into Yellowstone during 1995 and 1996 (Bangs and Fritts 1996). No critical habitat was designated.

The restored population rapidly increased in abundance and distribution and achieved its recovery goals for the Greater Yellowstone Area by the end of 2002 (USFWS et al. 2003). In 2007 there were approximately 171 wolves residing in 11 packs that were widely distributed across Yellowstone, but generally associated with ungulate winter ranges across the park. The U.S. Fish and Wildlife Service

delisted wolves in the northern Rocky Mountains in February, 2008, transferring management of the species to state wildlife agencies pursuant to approved wolf management plans (72 Federal Register 36939). However, Endangered Species Act protection was re-instated by court order in July, 2008. The gray wolf would thus remain a threatened species in the park.

Migratory Bird Species including Species of Management Concern

Migratory birds are those species that generally migrate south each fall from breeding grounds to their wintering grounds. They may winter in habitats throughout the Pacific region and central North America or even farther south into Mexico, Central and South America, and the Caribbean. In the spring, they return north to their breeding grounds, where they have young and the cycle repeats. Migratory birds generally follow four geographical flyways during their north-south spring and fall migrations across North America: Atlantic, Mississippi, Central, and Pacific. Yellowstone is in the Pacific flyway west of the continental divide and in the Central flyway for most of the park. Concentrations of migrating birds are more susceptible to collisions with structures.

In Yellowstone National Park, 320 bird species have been documented; 148 of these species nest in the park. Although a few species reside in Yellowstone year-round, including common raven, Canada goose, blue grouse, gray jay, red-breasted nuthatch, American dipper, and mountain chickadee, most are migratory species. Most migrate to Mexico and Central America for the winter and migrate to the U.S. in the spring. Migration brings many birds back to the park from their winter journeys south; other birds are passing through to more northern nesting areas. Most birds migrate to lower elevations and more southern latitudes beginning in September. Fall transients include tundra swans and ferruginous hawks. A few species including rough-legged hawks and bohemian waxwings migrate here from the north for the winter.

Yellowstone bird Species of Management Concern includes the bald eagle, American peregrine falcon, trumpeter swan, and white pelican. These species are monitored as are ospreys, common loons, harlequin ducks, great gray owls, and colonial nesting birds. In addition, annual North American Bird Migration counts, Christmas Bird Count, Glacier Boulder route songbird survey, and breeding bird surveys are conducted. The North American Bird Migration Count, also known as the International Migratory Bird Day Count, has been conducted since 1992 to determine general population and arrival trends of migratory birds in Yellowstone National Park. The 2007 migration count was conducted on May 12 (Appendix 1). Five observers recorded a total of 1,902 individual birds, including 94 total species of birds of which 69 species were within the confines of Yellowstone National Park (Appendix 1). A 15-year summary of the data during 1993–2007 indicates the numbers of species and birds observed during these surveys have been relatively consistent among years (Appendix 2).

Bird Species of Management Concern

Bald Eagle

Due to a population decrease caused by organochlorine pesticides (such as DDT) and other factors, bald eagles were listed as an endangered species under the Endangered Species Act in 1978 for 43 of the contiguous states, and threatened in the states of Michigan, Minnesota, Wisconsin, Oregon, and Washington (43 FR 6233). Habitat protection, management actions, and reduction in levels of persistent organochlorine pesticides resulted in significant increases in the breeding population of bald eagles throughout the lower 48 States. In response, the U.S. Fish and Wildlife Service reclassified the bald eagle from endangered to threatened in 1995 for the 43 contiguous states (60 FR 36000). Populations of bald eagles continued to increase and current data indicate the bald eagle has recovered in the lower 48 states, with an estimated minimum of 7,066 breeding pairs today compared to 487 active nests in 1963 (71 FR 8239). Numbers of nesting and fledgling bald eagles in Yellowstone also increased incrementally during 1987–2005 (McEneaney 2006). Resident and migrating bald eagles are now found throughout the park, with nesting sites located primarily along

the margins of lakes and shorelines of larger rivers. The bald eagle management plan for the Greater Yellowstone Ecosystem achieved the goals set for establishing a stable bald eagle population in the park, with a total of 26 eaglets fledged from 34 active nests during 2005 (McEneaney 2006). This is the highest number of fledged eaglets recorded to date in Yellowstone and the increasing population trend indicates habitat is not presently limiting the growth of the population. The U.S. Fish and Wildlife Service removed the bald eagle from the List of Endangered and Threatened Wildlife on August 8, 2007 (72 FR 37346).

Peregrine Falcon

The American peregrine falcon was removed from the List of Endangered and Threatened Wildlife and Plants on August 25, 1999 due to its recovery following restrictions on organochlorine pesticides in the United States and Canada, and implementation of various management actions, including the release of approximately 6,000 captive-reared falcons (64 FR 46541). The U.S. Fish and Wildlife Service has implemented a post-delisting monitoring plan pursuant to Section 4(g)(1) of the Endangered Species Act that requires monitoring peregrine falcons five times at three-year intervals beginning in 2003 and ending in 2015. Monitoring estimates from 2003 indicate territory occupancy, nest success, and productivity were above target values set in the monitoring plan and that the peregrine falcon population is secure and viable (71 FR 60563). Peregrine falcons reside in Yellowstone from April through October, nesting on large cliffs. The numbers of nesting pairs and fledglings in Yellowstone has steadily increased from zero in 1983 to 30 pairs and 44 fledglings in 2005 (McEneaney 2006).

Trumpeter Swan

Trumpeter swans were nearly extinct by 1900, but a small group of birds survived by remaining year-round in the vast wilderness of the greater Yellowstone area. This remnant population enabled the restoration of the species and today there are approximately 30,000 trumpeter swans in North America (U.S. Fish and Wildlife Service 1998). Yellowstone National Park supports resident, non-migratory trumpeter swans through the year, as well as regional migrants from the greater Yellowstone area and longer-distance migrants from Canada and elsewhere during winter. The National Park Service is committed to the conservation of resident trumpeter swans and preserving habitat for winter migrants in Yellowstone because swans are part of the natural biota and a symbolic species with considerable historical significance. However, since 1977 the park has supported relatively low and decreasing numbers of nesting pairs (median = 7, range = 2–17) and fledglings (median = 3, range = 0–12), while the abundance of the overall population has increased from less than 1,000 to greater than 5,000 swans (McEneaney 2006, U.S. Fish and Wildlife Service 1998). Also, Yellowstone provides limited and temporary winter habitat for migrant swans due to limited sections of ice-free water that diminish as winter progresses (McEneaney 2006). Thus, it does not appear that the dynamics of swans in Yellowstone will strongly influence the overall recovery of trumpeter swans in the Rocky Mountain region of the Pacific flyway.

Counts of resident, adult trumpeter swans in Yellowstone decreased from a high of 69 in 1961 to 10 in 2007. Causes of this relatively consistent decrease are unknown, but may include decreased immigration, competition with migrants, and effects of sustained drought and predation on productivity (McEneaney 2006). The Rocky Mountain trumpeter swan population operates at a scale larger than Yellowstone, and the dynamics of resident swans in Yellowstone appear to be influenced by larger sub-populations and management actions in the greater Yellowstone area and elsewhere. Numbers of adult swans counted during autumn aerial surveys at Yellowstone and Red Rock Lakes in the Centennial Valley of Montana indicated concurrent and substantial increases in abundance during 1931–1955, followed by concurrent and substantial decreases in abundance during 1961–2005. These results suggest swan dispersal from the larger subpopulation in the Centennial Valley may be an important factor for maintaining resident swans in Yellowstone by filling vacant territories or pairing with single adult birds (McEneaney 2006). Also, increases in the number of Canadian migrants to Yellowstone during winter over the last several decades may be reducing food resources

for resident swans during breeding (U.S. Fish and Wildlife Service 1998). Resident swans in Yellowstone are also susceptible to random, naturally occurring events operating at local and regional scales (e.g., severe winter weather, droughts, and predation). Drought conditions since 1995 have been the most severe recorded in northwestern Wyoming (Wyoming Division 01 Palmer Drought Severity Index) since monitoring began in 1895 (<http://www.cpc.ncep.noaa.gov>), resulting in an extensive reduction in the abundance and size of wetlands for nesting, molting, and feeding.

White Pelican

American white pelicans were identified as a Species of Management Concern and listed as a high-priority in the park's Strategic Plan because nesting attempts decreased from greater than 400 during the mid-1990s to 128 during 1999, and Yellowstone has the only current nesting colony of white pelicans in the National Park system (McEneaney 2002). Pelican control in the 1920s, followed by human disturbances in the 1940s and 1950s, kept the population at low levels. Since that time, pelican numbers have increased, but still fluctuate greatly from year to year, both in the number of nesting attempts and fledged juveniles. Flooding occasionally takes its toll on production, as does disturbance from either humans or predators (McEneaney 2002). The shallow-spawning Yellowstone cutthroat trout is the main food for white pelicans in Yellowstone. However, there are serious threats to this subspecies that could affect white pelicans, including interbreeding with introduced rainbow trout (*Oncorhynchus mykiss*), the illegal introduction of lake trout (*Salvelinus namaycush*) which prey upon cutthroat trout, and several outbreaks of whirling disease in major spawning tributaries. The recent drought in the Yellowstone area has made several spawning tributaries run dry in late summer, preventing cutthroat fry from migrating to Yellowstone Lake and making them easy prey for predators such as gulls, pelicans, and others. These threats have significantly reduced cutthroat populations in Yellowstone Lake and adjacent parts of the Yellowstone River. In 2007, a total of 427 pelicans nested and fledged 362 young, suggesting the subpopulation has recovered somewhat from the substantial decrease during the mid- to late-1990s.

Wilderness

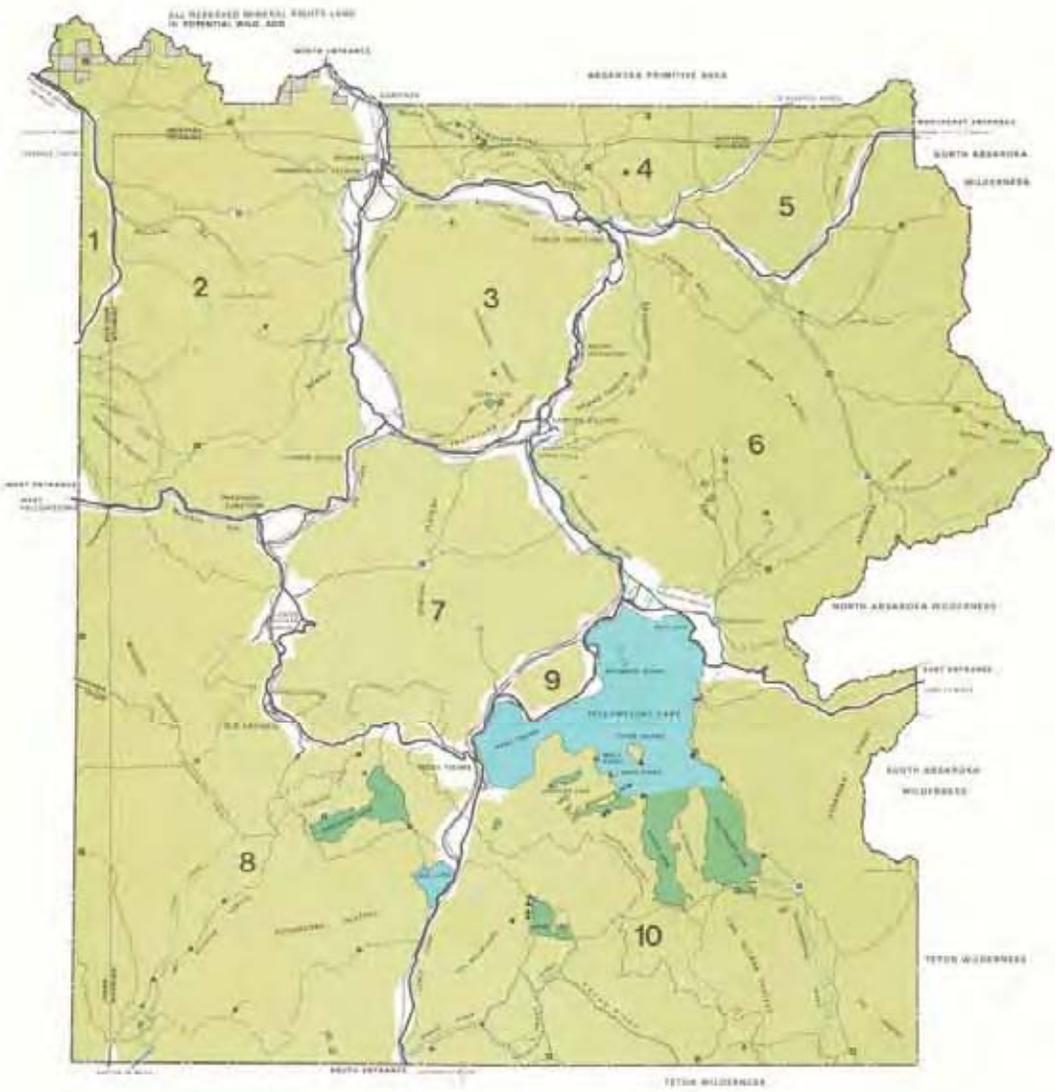
The Wilderness Act of 1964 defines wilderness as "... an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain..." and further as "... an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value" (The Wilderness Act 1964).

Approximately 91% (2,022,221 acres) of the park's 2.2 million acres are recommended wilderness (fig. 11) (NPS 1972). The remaining 9% of the park includes administrative facilities, developed areas, and roads. *NPS Management Policies 2006* state that all wilderness categories, including suitable, study, proposed, recommended, and designated shall be managed for the preservation of the wilderness characteristics, and that the NPS management decisions pertaining to lands qualifying as wilderness will be made in expectation of eventual wilderness designation. All management decisions affecting any wilderness category would further apply the concepts of "Minimum Requirement" where only actions necessary to manage the area as wilderness would be applied.

The public purpose of wilderness in NPS units includes the preservation of wilderness character and wilderness resources in an unimpaired condition, in accordance with the Wilderness Act, as well as for recreational, scenic, scientific, education, conservation, and historical use (NPS 2006). NPS does not seek to modify or eliminate risks associated with wilderness but strives to provide users with

general information concerning risks, recommended precautions, user responsibilities, and applicable restrictions and regulations.

A portion of Yellowstone's existing wireless communications services and wireless communications facilities are within Yellowstone National Park's recommended wilderness. These mostly include NPS radio repeaters, as well as scientific and weather monitoring devices. While there is patchy cell phone coverage located within isolated areas of Yellowstone's backcountry, there are no cellular towers or structures within Yellowstone wilderness lands.



ACREAGES

GRAND PARK ACRES: 7,227,772.91
 FEDERAL LAND: 1,976,706.98
 NON-FEDERAL LAND: 2,629.74

UNIT	WILDERNESS
1	11,249
2	191,814
3	122,216
4	41,221
5	50,165
6	49,761
7	92,100
8	116,840
9	7,670
10	406,274
TOTAL	1,374,000 ACRES

RESERVED WILD ADD 6,886 ACRES

LEGEND

PARK BOUNDARY	---
WALK	----
TRAIL
TELEPHONE	—●—
ROCK	—■—
WATER	—□—
PATROL CABIN	■
CAMPFIRE	●
LOOKOUT	▲
ROCK COLUMN OR MOUND	◆
GEODESIC RESIDENCE	◆
FISH TRAP	■
RESERVED MINERAL RIGHTS	▨
WILDERNESS AREA	■

EXHIBIT A
WILDERNESS PLAN
YELLOWSTONE NATIONAL PARK
 GRAND TETON MOUNTAINS

Figure 11 - Recommended Wilderness Map

Soundscapes

In accordance with *NPS Management Policies* (2006) and Director's Order 47, *Sound Preservation and Noise Management*, an important part of the NPS mission is preservation of natural soundscapes associated with national park units. Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among NPS units, as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

The natural soundscape of Yellowstone National Park is highly variable both spatially and temporally. Sound producing physical processes such as geothermal activity, wind and water and especially, biological processes such as animal vocalization depend heavily on season and time of day. Natural soundscapes vary from the mountain peaks to sage brush flats and along the banks of cascading rivers and streams to the middle of Yellowstone Lake. Weather conditions can be calm, but are often windy, especially in the afternoons. Rain and thunderstorms during the summer and fall and blizzards during the winter can dominate the natural soundscape. Rushing streams, waterfalls, and rivers create a constant localized high to moderate sound level that tends to mask nearby natural sounds. Geothermal areas have intermittent gurgling, hissing, rushing, and explosive sounds. Birds can be heard all year, but spring and early summer mornings enjoy dawn breeding bird choruses unlike other times of the year. Bison grunts and elk bugling form a dominant soundscape during their breeding seasons in the late summer and fall. Sounds associated with branches and trees rubbing against each other and popping sounds from wood freezing and thawing during very cold periods are commonly heard within the forested areas of the park. Sounds from the wind rustling the dried autumn leaves of cottonwoods and aspen and other deciduous trees are a certain indication of the departure of warm weather. Waves lapping on the shores of the larger lakes such as Yellowstone and Lewis Lakes mingle with the calls and wing-whistle of ducks and geese. These sounds fade as winter approaches and are replaced with the groaning, popping, ethereal sounds of freezing lake waters. The primitive calls of Sandhill Cranes ring through the park as they begin their southbound migration. Red squirrels' chatter and marmot and pika shrill whistles greet the visitor of the forest and high country. Voles and other small mammals can be heard scurrying among the forest duff and dried leaves. After the activity of the days, the depth of night and early morning are often blissfully silent. Some of the quietest sound levels ever measured in natural environments have been recently documented during the winter in Yellowstone.

Superimposed upon these natural soundscapes are those non-natural sounds generated by human activity. Hauling material, operating equipment, chipping organic debris, operating chainsaws, electric drills, construction equipment, helicopter access, and other construction activities could result in dissonant, human-caused sounds. Similarly, excessive human voice interactions may distract from otherwise tranquil and quiet park settings. From public scoping, excessive cell phone talking within park settings may affect visitor experience.

Federal and state land management agencies have received cell phone calls from hikers in need of assistance. To many people, a cell phone is as essential to one's backpack as a map, compass, and bottles of water (*American Hiker* 2005). Nearly as common, however, are the hikers who use their cell phones to offer commentary on their experience to friends and family back home. Ring tones, coupled with loud one-sided conversations, can be highly disruptive to the natural quiet and solitude that are treasured parts of the hiking experience (*American Hiker* 2005).

CULTURAL RESOURCES

Historic Properties including Cultural Landscapes

Historic properties are the buildings, structures, objects, cultural landscapes and districts listed on or eligible for listing on the National Register of Historic Places. There are seven nominated historic districts (HD) within Yellowstone National Park. These include Old Faithful HD, Lake Fish Hatchery HD, Roosevelt Lodge HD, Mammoth Hot Springs HD, Lamar Buffalo Ranch HD, and the Canyon Horseshoe Village HD. Six additional areas have been had determined eligible as historic districts including Lake HD, Yellowstone Park Transportation Company HD, Tower Junction HD, Fishing Bridge HD, Bechler Ranger Station HD, and Canyon Service Area HD. Seven individual properties which include multiple buildings have been designated as National Historic Landmarks: Fort Yellowstone NHL Historic District, Northeast Entrance Station, Old Faithful Inn, Obsidian Cliff, and the Madison, Norris, and Fishing Bridge Museums. Yellowstone has 953 historic buildings; of these, 371 are listed on the National Register, while an additional 320 have been determined eligible for listing. The park's Grand loop Road and the park East, West, North, Northeast, and south Entrance Roads are also determined eligible as historic districts.

Cultural landscapes consist of "a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values." They provide a living record of an area's past, and a visual chronicle of its history. The character-defining features and patterns of a cultural landscape may include, as appropriate: natural systems and features; spatial organization; topography and landforms; vegetation; circulation systems and features; land use; buildings and structures; building cluster arrangement; water features; small scale features; and views and vistas.

In 1998, as part of its ongoing efforts to identify and manage its significant cultural resources, the NPS initiated the identification and documentation of cultural landscapes at Yellowstone National Park. As a result of these efforts, the NPS determined that cultural landscapes potentially exist at 41 areas within the park. These areas can be found at or within developed areas, historic districts, road historic districts, overlooks, scenic feature stops, campgrounds, trails, national historic landmarks, and some historic sites.

Cultural landscape inventories have been conducted for some of these park areas. A cultural landscape inventory (CLI) identifies and documents the characteristics of a cultural landscape that make it significant and worthy of preservation. Of the 41 identified cultural landscapes, CLIs have been completed for Artist Point, Apollinaris Springs, and Historic Game Ranch at Stephens Creek, which have all been determined eligible for listing in the National Register of Historic Places. The remainder of the cultural landscapes inventories are intended to be completed, and determinations of eligibility to the National Register be made over time for all 41 cultural landscapes.

There is a potential that some wireless communications facilities including antennas and structures would be placed on buildings within historic districts or on historic structures or may affect cultural landscapes within the park.

SOCIAL RESOURCES

Health and Human Safety

Visitation to Yellowstone has averaged 2.8–3.1 million visitors each year from 1993-2006; most visitations occur during the summer months. Visitor use in the park is concentrated in the major

developed areas, such as Old Faithful, Canyon, Lake, and Mammoth Hot Springs. Backcountry use accounts for 5–10% of park visitation (NPS 2000).

The NPS is committed to providing appropriate, high-quality opportunities for visitors and employees to enjoy the parks in a safe and healthful environment. Further, the NPS strives to protect human life and provide for injury-free visits. Human health and safety concerns associated with this wireless communications services plan include: exposure to electromagnetic frequency fields, the ability of cell phone users to reach 911 for emergency services, and the potential for increased traffic accidents related to cell phone use while driving.

Radio Frequency (RF) Exposure

Electromagnetic fields are produced by the local build-up of electric charges including those generated by human-made sources such as X-rays, television antennas, or telecommunications towers. These fields are present everywhere, but are invisible to the human eye. Included in this range of electric charges is radio frequency energy, a type of radio wave. These waves are measured by their frequency, or the number of waves passing a given point in one second. When discussing radio frequency signals, this frequency measurement is referred to as a hertz (Hz). One Hz equals one wave per second, one kilohertz (kHz) equals 1,000 waves per second, one megahertz (MHz) equals one million waves per second, and one gigahertz (GHz) equals one billion waves per second. Radio frequency (RF) energy includes waves with frequencies ranging from 3 kHz to 300 GHz. The FCC licenses most commercial and private radio frequency services, facilities, and devices used by the public, industry, and state and local government organizations (FCC 2007). The NTIA provides the same role for federal government organizations.

The spectrum of electromagnetic radiation includes radio waves and microwaves, collectively referred to as electromagnetic frequency, emitted by transmitting antennas. Radio frequency (RF) is one of several types of electromagnetic radiation. Radio frequency radiation can be generated from all wireless communications devices. Types of telecommunications that emit RF include cellular telephones, microwave dishes, radios, television and radar guns. High intensities can be harmful due to the ability of RF energy to heat biological tissues rapidly. Tissue damage can result because of the body's inability to cope with and dissipate the excessive heat. The FCC has created two limits to protect employees and the general public from RF emissions, expressed in the unit mW/m^3 , which is power density per unit area. The Occupational/Controlled exposure limits apply to situations in which persons are exposed as a consequence of employment and in which those persons who are exposed have been fully aware of the potential for exposure and can exercise control over their exposures. This limit is $5.0 \text{ mW}/\text{m}^3$. The General Population/Uncontrolled exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure. This limit is $1.0 \text{ mW}/\text{m}^3$. This level applies to NPS and non-NPS employees.

In May 2004, an OSHA survey was conducted to assess employee exposure to RF at Mt. Washburn using a *Nards 06 E-9* monitor. Five indoor samples were taken inside the lookout on the top level: one near each corner and one in the center. No overexposures were detected. Six samples were taken outside. Three of these (the northwest and southwest corners of the lookout upper level and the NPS North District repeater) were $2.0 \text{ mW}/\text{m}^3$, exceeding the 1.0 limit. It is not expected that employees would be exposed more than a few minutes in these areas. Additionally, the public is not allowed access to the third floor. With the exception of the North District repeater, all areas routinely accessed in the lookout by visitors were below $1.0 \text{ mW}/\text{m}^3$. Regardless, the park installed RF warning signs on the lookout gate and lookout door and RF caution signs on the northwest and southwest corners of the lookout railing, and on the North District repeater south of the lookout. Park personnel that access the site are trained in RF hazards.

Radio frequency exposure from physical proximity to antennas and radio equipment can have harmful effects on human health. The formulas for precise effects on human health and safety are

complicated and depend on amount of exposure, frequency band, signal strength, and type of radio waves to which one is exposed to. Potential adverse effects on human health from exposure to cellular antennas, two-way radio systems, satellite dishes and monitoring radios are generally negligible. Large microwave dishes, such as those used by the commercial phone service provider throughout the park to transport data, contain an increased risk to human health. All sites in Yellowstone National Park containing this riskier equipment are well signed, and most occur far away from areas frequented by visitors. The most significant exception to this is the Mt. Washburn Visitor Contact Station, where there is a significant collection of antennas representing many forms of communication. This location also serves as the commercial phone service provider's primary "hub" for data transmission throughout the park, and associated collection of microwave antennas.

Road Safety and Emergency Services Access

Accident Reporting: Cell phone use by the general public to 911 expedites accident response where cell coverage exists. During the summer months, visitors are more common within the park's developed areas and, to a lesser extent, the park's road system than they are in the park's backcountry. During the period of 2004 to 2007, the Yellowstone Park 911 dispatch center received 210 calls for assistance for motor vehicle accidents with injuries, 11 motor vehicle accidents that resulted in fatalities, and a total of 1,771 non-injury motor vehicle accidents.

Many employees and vehicles of Yellowstone National Park carry government issued cell phones. They are used to enhance an employee's ability to function more effectively while conducting National Park Service Business. Additionally, they are used during emergency response incidents, such as law enforcement, medical and fire situations. However, cell phones are not considered the primary method of communication for emergencies. The primary tool for emergencies is considered by the National Park Service to be the two-way radio system and cell phones are considered only an enhancement tool to be used when incidentally available.

Driving Safety: The use of cell phones while operating motor vehicles is widely known to increase motor vehicle accidents and associated injuries that occur as a result. National Park Service policy prohibits employees from using a cell phone while operating a government vehicle, except for law enforcement activity involved in an emergency incident.

Park Operations

Implementation of a parkwide program such as wireless communications can affect the operations of a park. These include an array of park operations including phone, computer, radio communications, visitor protection, dispatch operations, maintenance of park facilities and infrastructure, visitor education and resource monitoring and protection.

NPS Two-Way Radio system

Yellowstone National Park uses a two-way narrowband radio system, operating in "mixed" (analog/digital) mode to support essential law enforcement, public safety and emergency management functions. Most government vehicles contain a mobile radio and most park employees actively use a portable radio while working and traveling around the park. The radio system is complex, containing seven mountaintop repeaters (Fig. 1). These repeater locations generally occur at or near 10,000 feet elevation, providing maximum coverage in order to minimize the required number of repeaters. Each of these sites is connected, using a variety of technologies, to the park's 24/7 Communications or Emergency 911 Dispatch center, located in Mammoth. The radio system uses 20 base stations scattered around the park, each also connected back to the Communications Center. These base stations, located in developed areas, support approximately 300 "remote" desktop radios scattered in offices, visitor centers, and ranger stations around the park, providing direct access to the radio system.

The system is considered the park's primary form of emergency communications and is used for emergency medical services (EMS), structural fire, wildland fire, law enforcement, search and rescue, weather, avalanche, earthquake and other required types of necessary emergency services response. The National Park Service retains "exclusive jurisdiction" over Yellowstone National Park and is the primary provider of these services within the park. In areas along park boundaries, where partner agencies assist with these services, such as West Yellowstone Police Department, Grand Teton National Park, Cooke City Search and Rescue, five county Sheriff departments, three state police departments, Gardiner EMS, Gardiner Fire, and a number of other emergency functions. The park's radio system is shared with them. These agencies have direct access to Yellowstone dispatch and are able to communicate with park responders. In special cases, such as FBI, Department of Justice, air ambulances and other specialized responses that Yellowstone National Park does not provide itself, such assisting agencies will also have access to and utilize this same radio system.

The nature of two-way radio systems changes over time as technology and demands change. In some cases more repeater sites are added to provide more adequate radio system coverage throughout the park. At present, the system covers approximately 93% of backcountry areas and 99% of road and development areas in the park. As the park radio system is converted to full digital over the next 10 years, the percentage is likely to decrease and additional repeater sites may be necessary to provide communications coverage for emergency services. The advantage of digital communications includes vastly increased communications capabilities, such as digital encryption, private radio to radio communications and radio Caller ID. These features are required by current EMS, fire and law enforcement standards to protect the identities and conditions of EMS patients, as well as ongoing law enforcement investigations.

Cellular and Satellite Phones

Park staff use cell phones, where service is available, as an adjunct to the park radio system. Many of Yellowstone's employees state that cell phone service is essential to ensure that in critical life and safety situations, the NPS will have reliable communications for emergency service personnel. NPS staff and partners also use cell phones to conduct routine business.

Park staff, especially backcountry and fire management staff use satellite phones where park radios may be unreachable. However, this is an early use of this type of communication and has showed inconsistent results depending upon the availability of satellites at any given time. Satellites require no infrastructure in the park and are not covered in this document.

Research/Monitoring (Geothermal, Seismic, Water, Wildlife, Air Quality, Weather)

There are numerous types of resource monitoring communication functions and structures within Yellowstone National Park. These include communications to support the Yellowstone Volcano Observatory (YVO) seismic monitoring, SNOWpack TELEmetry (SNOTEL) stations to record snowfall and precipitation, and Remote Automated Weather Stations (RAWS).

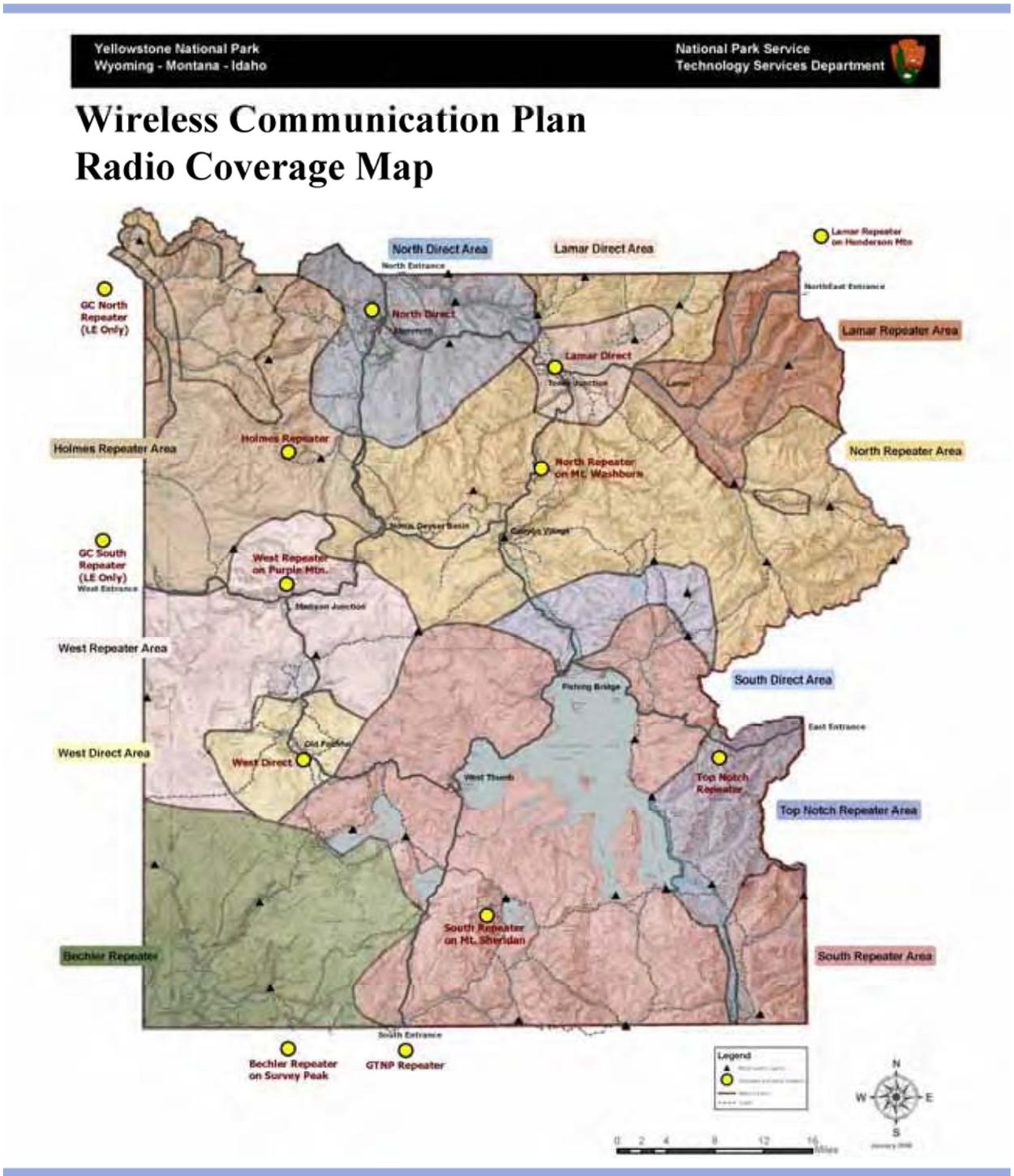


Figure 12 – Existing NPS Radio Coverage Map

Seismic Monitoring

An existing network of seismic monitoring stations in the park provides data to help understand overall seismicity in the region and gauge the magnitude of earth tremors. Thermal features and basins respond violently to volcanic/seismic activity, which creates both a hazard to humans and an opportunity to study and possibly predict major geologic hazards. The Yellowstone volcanic system has the additional characteristic that it is impacted by large earthquakes that occur as part of the mountain-building processes in the western U.S. Yellowstone operates this network under the Yellowstone Volcano Observatory (YVO), a partnership among the park, the U.S. Geological Survey (USGS), and University of Utah. The YVO is one of five USGS volcano observatories that monitor volcanoes in the United States.

There are many YVO monitoring sites throughout the front- and backcountry of Yellowstone National Park (Fig. 1). Volcanologists use the following two primary methods for assessing volcanic activity:

Seismographic Network to evaluate types, magnitudes, and locations of earthquakes. The Yellowstone seismographic network includes 20 above-ground seismograph stations of three types: 1) single-component stations measure short-period (1–10 Hz) vertical ground motion but do not measure lateral movement; 2) three-component stations yield data from both horizontal and vertical motions; and 3) broadband seismic stations are a type of three-component station that detects short-period energy as well as much longer waves that range over periods from one second to hundreds of seconds. The data are available in real time through the USGS and YVO websites (<http://www.seis.utah.edu/> and <http://volcanoes.usgs.gov/yvo/>). Additional sites are outside the park. Seismic networks with co-located accelerometers can determine the intensity of local shaking when ground motions are intense, such as during a large earthquake. There are no accelerometers currently deployed at Yellowstone.

Ground Deformation Network to observe and interpret uplift and subsidence of the ground surface. Within the Yellowstone area, this is currently monitored through four techniques: 1) Continuous Global Positioning System (GPS) is a satellite-based technique that provides daily or hourly high-precision locations. This technique is critical for volcano monitoring because it yields high temporal resolution (frequent updates) and can therefore alert scientists to rapid ground movements that may accompany subterranean magma movement. 2) Interferometric synthetic aperture radar (InSAR) is a satellite-based technique that provides one to two synoptic views per year of ground movement over the entire park. 3) Campaign GPS surveys, in which GPS data are collected at many stations on an annual or less frequent basis using temporary deployments of GPS receivers. 4) Precise leveling that measures the vertical component of ground motion through labor-intensive surveying. The technique yields an annual or less frequent, high-precision determination of ground movement

Remote Automated Weather Stations (RAWS)

The park's fire management program uses the RAWS system to determine seasonal fire conditions and potential strategies related to fuels and fire management. RAWS use satellites to transmit data. Each station has a GPS unit for receiving data but not used to transfer data. Data is transmitted ten minutes prior to each hour. There are three permanent RAWS in the Bechler, Quadrant and Thorofare areas of the park (Fig. 1). The RAWS antennas are 6 feet high, with a tubing mast up to 20 feet in height. The platform is 4 x 4 x 4 feet. They usually require at least one annual maintenance visit. There are also six manual weather stations located throughout the park. The park is seeking to replace the existing manual stations over time to allow for more accurate and timely weather information associated with fire management. There is also a need to propose two additional RAWS in the northeast area of the park, and at the Canyon developed area.

Temporary stations primarily service wildland fire needs, but also serve requests from park resource management for research and monitoring. The antennas for these are 3 feet off the ground and the

mast is 5 feet tall. They are typically set up on a temporary basis associated with a wildland fire or prescribed fire project.

SNOTEL Sites

Snowpack Telemetry (SNOTEL) is an automated system of snowpack and related climate sensors operated by the Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture in the western United States. The sites are generally located in remote high-mountain watersheds where access is often difficult or restricted. Access for maintenance by the NRCS includes various modes from hiking and skiing to helicopters. All SNOTEL sites measure snow water content, accumulated precipitation, and air temperature. Some sites also measure snow depth, wind speed, solar radiation, humidity, and atmospheric pressure. These data are used to forecast yearly water supplies, predict floods, and for general climate research.

Microwave Dishes

There are telephone microwaves (passed through dish antennas or passive reflectors) throughout the park including Tower-Roosevelt, Mt. Washburn, Grant (two), Canyon, Old Faithful and Lake. These microwaves can be thought of as conduits or cables, for data transmission through the air. This data transmission is needed for both the commercial landline and data system, and for wireless technologies. Microwaves are all owned by a private telephone company. All have vehicle access. They are 9–10 feet in width and between 20 and 110 feet in height. Most are over 50 feet. The dish at Canyon is 80 feet tall, and dishes at Grant are 110 feet and Lake is 90 feet.

Wireless Internet

Wireless Internet is a limited function in Yellowstone National Park. Wireless fidelity (WiFi) Internet equipment has been installed in the Yellowstone Park School, all employee dormitories operated by park concessioners except at Tower-Roosevelt, and at the medical clinic in Mammoth. All current WiFi access is designed for park employees or residents; visitors do not have access to the Internet in Yellowstone unless they have a personal subscription plan via their cell phone provider.

Visitor Use and Experience

People from around the world come to Yellowstone National Park each year to experience its wonders. Visitation is highly seasonal. June, July, and August are the months of highest use, with 68% of the park's annual visitors arriving during this time. The shoulder-season months of September through November account for about 20% of park visitation; April and May account for 9%, with December through March (the winter season of oversnow visitation) accounting for only 3%. Park visitation between 1993 and 2006 ranged from 2.8 to 3.1 million visitors. In 2007, the park received 3,151,342 recreational visits, an all time high. Prior to 2007, 1992 had the highest level of park visitation with 3,144,405 visitors. While there are no day use quotas in Yellowstone during the peak summer season, overnight use is limited to the 14,341 visitors the park accommodates per night in hotels and lodges (7,498 "pillows") and campgrounds (2,281 total campsites with a capacity of 6,843 people).

A 2006 survey showed that 89% of park visitors came from outside the surrounding states of Idaho, Montana, and Wyoming; 94% came from outside the "local area" (defined as within 150 miles of Yellowstone). Ten percent of park visitors are international, with about 25% of them coming from Canada. About half of the people coming through Yellowstone's entrances are first-time visitors (Manni et al. 2006).

The most common site visited in the park is Old Faithful (90%), followed by Mammoth Hot Springs (69%), Canyon Village (64%), Fishing Bridge/Lake/Bridge Bay (45%), West Thumb/Grant Village (49%), Madison (47%), and Tower-Roosevelt (45%). Seventy percent of visitors were in groups of

two, three, or four; 25% were in groups of five or more. Of the visitor groups that spent less than 24 hours in the park, 82% spent five or more hours and 18% spent up to four hours. Of the visitor groups that that spent more than 24 hours in the park, 53% spent two to three days and 44% spent four or more days (Manni et al. 2006).

A high percentage of park visitors (93%) are satisfied with facilities, services, and recreational opportunities in Yellowstone. Visitors were especially satisfied with ranger programs (100%), visitor centers (96%), opportunities for learning about nature, history, or culture (94%), assistance from park employees (94%), exhibits (93%), and opportunities for outdoor recreation (93%) (NPS 2007).

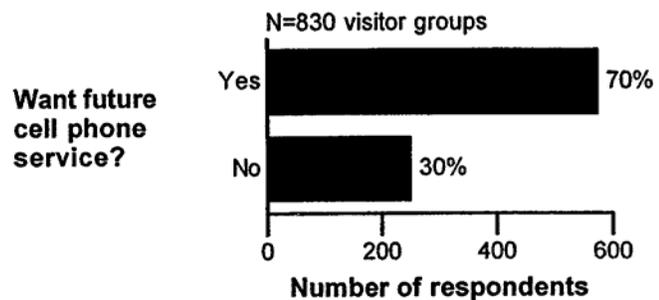
Greater than 95% of visitors to Yellowstone stay on park roads and within developed areas, the area the 1991 Yellowstone *Statement for Management* defines as the "Park Development Zone." Lands within this zone (10% of the park) are managed to provide and maintain developments that serve park management and visitor needs, although natural conditions are maintained to the greatest extent possible (NPS 1991).

Within the Park Development Zone, concessioners provide food and lodging services (2,225 guest rooms, 28 food and beverage operations, 21 gift shops, 11 grocery stores, five campgrounds) at Old Faithful, Mammoth Hot Springs, Madison, Tower-Roosevelt, Canyon, Fishing Bridge, Lake, Bridge Bay, and Grant Village; 3 medical clinics; 7 vehicle service stations; 1 marina; 3 livery operations (Canyon, Mammoth, and Tower-Roosevelt); and 4 public showers and laundry facilities. Yellowstone's interpretive rangers manage and staff the park's five primary visitor centers (Canyon, Fishing Bridge, Grant Village, Mammoth, and Old Faithful) and four information stations (the Madison Museum, Museum of the National Park Ranger, Norris Geyser Basin, and West Entrance contact stations). Approximately 2.1 million visitors, or 70% of all park visitors, used Yellowstone's visitor centers in 2002. The NPS operates seven campgrounds (Mammoth, Norris, Tower, Pebble Creek, Slough Creek, Indian Creek, and Lewis Lake), 52 picnic areas, and seven outdoor amphitheatres and maintains 466 miles of road (NPS 2003).

The 2006 Visitor Study, conducted during July 23–29, 2006, and distributed to 1,302 visitor groups within this Park Development Zone, described the primary reasons that visitors cited for visiting the park as (a) sightseeing/taking a scenic drive (59%); (b) viewing wildlife or birdwatching (16%); and (c) visiting a boardwalk/geyser basin (9%).

Question #23 of this study asked: On a future visit, would you and your group like to have the following

services available in developed areas in Yellowstone National Park, cell phone, internet access. Of the 830 responses regarding cell phone service, 70% said they would like to have cell phone service available on a future visit. Of the 726 responses regarding Internet access, 53% said they would not like to have this service available on a future visit. While some people feel passionately about this issue, wireless coverage and infrastructure do not seem to be primary concerns for most park visitors. For example, during the 2006 Visitor Study, visitors were encouraged to respond to the open-ended question "Is there anything else you and your group would like to tell us about your visit to Yellowstone National Park?" Of the 820 comments received in response to this question, only 14 (less than 2%) related to wireless communications services, including six that commented "please no cell phone/Internet in park;" six that commented "cell phone/Internet service would be good;" and two that commented "cell phone/Internet in some places."



Cell phone service available on a future visit

In a separate project, park interpretive rangers recorded 449 unsolicited comments made by visitors from October 2006 through September 2007. Of these comments, only one related to wireless services: a request for WiFi service in the park.

The Natural Zone, estimated at around 90% of the park, encompasses those lands recommended as wilderness in Yellowstone's 1973 Wilderness Recommendation and has been termed Yellowstone's "backcountry" (NPS 1991, Olliff and Consolo Murphy 2000). Lands in this backcountry zone are characterized by their primeval nature, relative lack of facilities, and a low level of visitor use. Within this zone, the park maintains approximately 1,000 miles of interconnected backcountry trails, 97 trailheads, and about 300 designated backcountry campsites.

Similar to trends at other western national parks, overnight backcountry use in Yellowstone peaked in 1977 at around 55,000 "people use nights" (the total number of nights spent in the backcountry) per year. Since 1990, people use nights have fluctuated between 34,000 and 46,000 with an overall downward trend (Olliff and Consolo Murphy 2000). Day use was monitored in 1992. Day use varied, depending on trail location and distance from the trailhead, and ranged from zero to 109 people per day per trail. Overall, the level of day use appears to be approximately four times the level of overnight use (Olliff, unpublished data).

A 1999 visitor survey found that "solitude and tranquility" was the most important desired benefit of overnight backcountry campers, followed by "to avoid crowded areas" and to "look at scenery." All three of these desired benefits rated very high on a 1–5 scale. "Social contact with other people," which rated at the opposite end of the 1–5 scale, was the least desired benefit (Oosterhous et. al. 2007).

Visitor satisfaction in national parks depends on people's individual motivations. Because park visitors' motivations differ, a particular park experience may satisfy some visitors and not others. As indicated above, visitors to Yellowstone's developed area and backcountry differ in the park experience they seek. Personality traits seem to be another important source of differing visitor motivation. While conducting a visitor use survey, Eisenberger and Loomis (2002) tested for personality traits. They found that at least three personality traits influenced the stated purpose for visiting Yellowstone and affected the enjoyment of the visitors' park experience, as follows:

- Visitors with the *Need for Sensory Experience* personality trait most strongly desired to experience enjoyable sights, smells, sounds, and visited to learn about nature, history, and culture;
- Visitors with the *Need for Affiliation* personality trait visited to engage in shared experiences;
- Visitors with the *Need for Exercise* trait visited to engage in strenuous physical activities, such as walking, hiking, or climbing.

While this is by no means an exhaustive list of personality traits or visitor motivations, it does point out that visitors come to Yellowstone for a variety of reasons, with a variety of backgrounds, and experience the park in individual ways. Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks, and to maintaining within the parks an atmosphere that is open, inviting and accessible to every segment of American society.

Yellowstone's stated visitor experience goals, as outlined in the Long-Range Interpretive Plan (NPS 2000), describe the cognitive, affective, sensory, and behavioral experiences that the park would like to be available to visitors. Visitors will have opportunities to:

- Experience the essence of the park's wild nature from wildlife, waterfalls, geysers, and scenery to wonder, quiet, solitude, and personal inspiration
- Develop a sense of appreciation and responsibility that will result in actions to protect, support, and promote the park and the National Park System (e.g., politically, financially, through volunteer activities)

- Successfully plan their visits and orient themselves to facilities, attractions, features, and experiences
- Behave in ways that do not hurt themselves or park resources
- Enjoy themselves, have memorable experiences, and go home feeling enriched
- Understand the park's significance and its primary interpretive themes
- Experience programs, media, and facilities that enhance their educational experiences
- Learn about the fragility of the park and threats to its resources

As communications technology becomes more widespread, some visitors have expressed concerns about how technology such as cell phones, GPS units, and laptop computers affect the visitor experience in the wilderness, backcountry, or while viewing thermal features and vistas within the park. The types of wireless service available (cell phone, Internet access), locations, and the siting of wireless facilities such as cell towers all affect how visitors experience the park.

Visual Quality including Viewsheds

Scenery has always been an integral part of the fundamental resources and values of national parks. Yellowstone's enabling legislation from 1872 reserves the park as a "pleasuring-ground for the benefit and enjoyment of the people." Historian Ethan Carr explains that "in the context of the 19th-century landscape park, the preservation of unimpaired scenery could be identified with civic virtue." The 1916 Organic Act that created the National Park Service sought to "conserve the scenery...and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." And finally, Thomas Moran's paintings and William Henry Jackson's photographs of Yellowstone scenery were instrumental in convincing the Congress to set this area aside and "preserve it from injury or spoliation."

Outstanding scenic character has always distinguished national parks from other areas, including national forests. Yellowstone National Park abounds with impressive viewsheds of the highest quality. Despite being one of the oldest units in the park system, the majority of its landscapes appears untouched by humans and retains their primeval characteristics. Less than ten percent of the park is within the "Park developed Zone" (NPS 1991) and facilities are predominantly grouped along the figure-eight Grand loop Road system and within a handful of small park communities, leaving substantial acreage in its natural condition. Wide vistas of unique scenery such as Old Faithful geyser with a backdrop of forest and blue sky have attained iconic status representing not only Yellowstone, but the entire National Park Service. It is with these thoughts in mind that alternatives for wireless communications infrastructure must be evaluated.

Part of the allure and expectations associated with Yellowstone involve the impression that the park is predominantly in its natural condition. Visitors expect to see facilities grouped together and close to the roads instead of utility corridors and manmade structures out in the landscape. Because the primary viewsheds are natural, built structures often stand out in stark contrast to the scenery and thereby degrade part of the fundamental resource. The *NPS Management Policies 2006* require that telecommunications sites "are located where they would have the least impact on park resources" and "are not located in scenic, historic and/or sensitive areas."

A variety of installations relating to wireless communications currently exist in Yellowstone National Park (Fig. 1). They range from simple antennas to large towers with multiple attachments and associated buildings and roads. Their locations also vary from the middle of developed areas to remote research monitoring units in the backcountry. Given the multiple locations and types of equipment, there are varying degrees of visibility and visual intrusion (Fig. 13).



Figure 13 - Microwave dish (near) and cell tower (far) in the Old Faithful area