Yellowstone Science

A quarterly publication devoted to the natural and cultural resources

The Upper Geyser Basin—
a Cultural Landscape
Yellowstone Fishes Reviewed
Firefighting Firepower
Arctic Grayling

Volume 8 Number 3

Tourists at Grotto Geyser, ca. 1908. NPS photo.

Integrated and Equal?

At the Yellowstone Center for Resources, there is a long-standing and (hopefully) amicable rivalry between natural and cultural resource specialists. Oops—there I go again, placing natural ahead of cultural. Why, I have been asked, not the other way around? Some voices counter that Yellowstone is primarily a "natural" park, set aside for the scenery and the "natural curiosities"—the geothermal oddities and the resplendent display of wildlife. When polled as to their reasons for coming, fewer visitors mention interest in the cultural sites, except perhaps as a place to lodge or have dinner. This may be a reflection of how we have interpreted the place, of how we and others have "marketed" the Yellowstone experience. Here in the world's first national park, aren't cultural resources just as important as natural ones? What an important event in human history the designation of Yellowstone Park has turned out to be.

I grow weary of such competition over the many special things Yellowstone has to offer. No question, it's not a level playing field out there. Geyser gazers debate whether Grand, Steamboat, or some other spouter is "the best." Wolves have, of late, supplanted grizzly bears as the rare carnivore of choice to see. Fish and flowers have their fans, but let's face it, they're lower on most visitors' wish lists; bugs and bats get no respect. The Old Faithful Inn, Lake Hotel, and Moran's paintings attract oohs and aahs, but other historic structures and collections are less known and beloved. If you can see them, you're generally not allowed to touch them, and just try to make archeologic sites or archival records photogenic.

Despite our administrative tradition that separates cultural resources from natural ones, do we really want visitors and managers to see them as such, or as equally deserving of appreciation? This issue features articles on distinctly different topics, yet each juxtaposes human and natural history: of wildland fire, and how humans fought it; of a rare fish, and how the park's cultural history has contributed both to its near extinction and our attempts to save it; of changes in the built landscape and related visitor experiences at the Upper Geyser Basin. I relish these integrated stories about Yellowstone's cultural and natural resources, all of which deserve more exposure—and protection.

—SCM

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On the cover: Bathhouse operated by Henry P. Brothers at Old Faithful, 1915–51. NPS photo. Above: Helicopter dropping Arctic grayling into Cougar Creek. Photo courtesy Cal Kaya.

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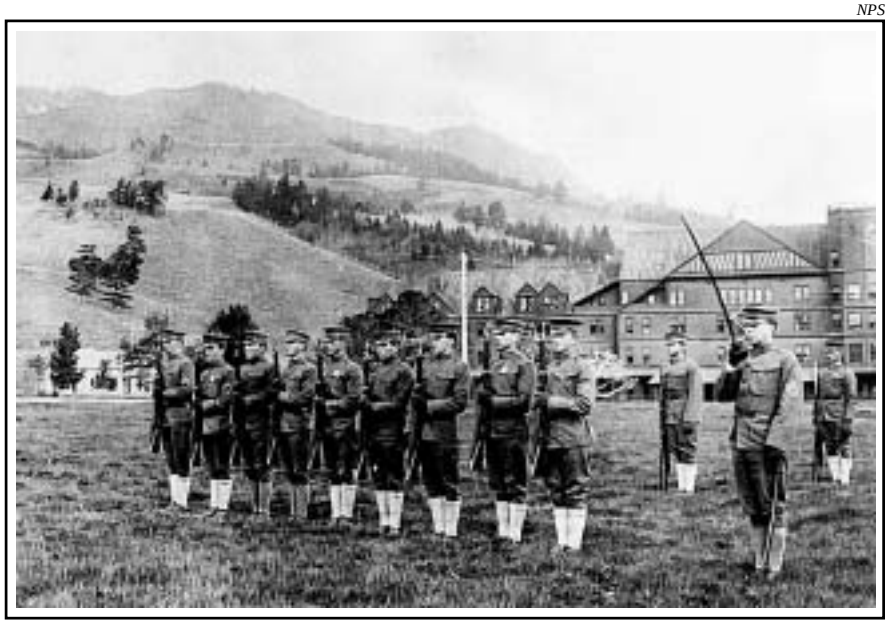
Fighting Fire with Firepower:

Firefighting in Yellowstone National Park, 1872–1918

by Doug Weber

NPS



The U.S. cavalry in Mammoth, ca. 1911. Army personnel were the first to effectively fight park fires.

Until rain and snow quelled the inferno in 1988, more than one-third of the acreage in Yellowstone National Park burned in a series of fires that persisted for weeks. Following the fires, scientists and park managers sought an explanation for the intensity of the event. Some observers argued that 100 years of effective fire suppression had allowed "unnatural" levels of fuels to accumulate, thus making the forest unusually vulnerable to a major conflagration when a drought plagued the Yellowstone area in 1988. Other scholars insisted that the 1988 fires were part of a "natural" 300- to 400-year fire cycle common to the lodgepole forests of the greater Yellowstone region. According to this argument, fire suppression—though long practiced in Yellowstone—had been so ineffective that it did not alter the expected "natural" fire cycle.[1]

Both interpretations of the 1988 fires rely, in part, on an assessment of historic firefighting practices in the park. Unfortunately, no comprehensive history of firefighting in Yellowstone yet exists. My research addresses this void by focusing on the early history of firefighting in Yellowstone—essentially, the period from the park's founding in 1872 through the era of United States Army administration (that ended in 1918).

When Congress created Yellowstone National Park in 1872, it made no provision for management and protection of the park's resources beyond the appointment of an unpaid superintendent. Not surprisingly, early park superintendents spent little time in Yellowstone, and park resources were at the mercy of concessionaires, tourists, and poachers. During the next decade, as Yellowstone attracted greater national and international attention, the government attempted to provide better protection through the appointment of a small corps of "assistants" in 1883. Since appointments were based on nepotism rather than ability, this "corps" did little to stem poaching or to prevent the increasing number of tourists from carting off antlers, wildflowers, and chunks of geyser cones as souvenirs. Finally, in 1886, the government charged the U.S. Army with the task of protecting the nation's first national park.[2]

Before the arrival of military troops, firefighting in Yellowstone was ineffective. Most often, fires were allowed to burn until they extinguished themselves or until rain and snow checked the progress of the fire. Without a suitable road system, a reliable communications network, or a system of lookout stations, superintendents could do little to hedge the progress of fires. When they did attempt to fight the fires, they relied on volunteers—that is, concession employees and settlers from the areas outside the park. This *ad hoc* volunteerism failed miserably, since many of these people were motivated to fight fires only when their own lands were threatened.[3] Consequently, many fires grew to immense size during the time that it took to gather volunteers, outfit them with equipment, and travel through the heavily forested areas to the fire.

Despite the difficulties and ineffectiveness of early firefighting efforts, a consensus existed among those who concerned themselves with Yellowstone that fire was detrimental to the landscape and should, whenever possible, be suppressed. As Stephen Pyne described in his work on fire in America, many nineteenth-century Americans saw forest fires as destructive and unnatural.[4] They also considered the

deliberate burning of the forest a Native American practice, thus generating a widespread prejudice against forest fires as unnatural. For instance, in 1900 when a large fire burned out of control south of DeLacy Lakes, a local newspaper perpetuated a rumor that "the fire was started by Indians in order to drive the game out of the park into the mountains where they could kill it." Other possibilities, such as a lightning strike or a careless tourist, were discounted. Consequently, the newspaper continually referred to the fire as "a work of destruction."[5] This attitude prevailed in Yellowstone National Park as well as in the surrounding Yellowstone Forest Reserve (which was created in 1896 and was initially administered by the U.S. Army stationed at Fort Yellowstone; this area later became national forest).

When the U.S. Army arrived at the park in 1886, the soldiers busied themselves with building roads, constructing quarters for the troops, and protecting the wildlife from poachers, while the superintendent continually fought with Congress for appropriations. Effective firefighting and fire management arrived with Captain F.A. Boutelle in 1889. Boutelle and his soldiers established new roads, improved communications through building telegraph and phone lines, punished transgressors of the law who allowed their campfires to burn out of control, established designated campgrounds where campfires were easily monitored, and purchased new equipment to fight fires.[6] Boutelle's strategy concentrated on fire prevention, where park rules concerning the complete extinguishment of campfires were clear and vigorously enforced.

Interestingly, Boutelle's ardent campaign for fire suppression and prevention eventually led to his demise. In an episode that lasted several months, Boutelle and the secretary of the interior exchanged heated correspondence concerning appropriations for the purchase of axes and collapsible fire buckets. Because the secretary failed to respond to Boutelle's plea for appropriations, the superintendent accepted money from a tourist to purchase the buckets. Boutelle included this episode in his yearly report to the secretary. In that report, Boutelle also wrote several highly critical statements concerning the secretary's supposed lack of interest in protecting the park from fire. This critical report led to Boutelle's termination as the superintendent of the park.[7] Although many of the largest fires at this time burned for weeks and overcame most of the human attempts at suppression, the soldiers extinguished most of the smaller fires before they became unwieldy, even in the most inaccessible areas of the park.

Station records, scouts' reports, and correspondence to the various superintendents of the park yield insight into the firefighting practices in Yellowstone. These practices remained at the cutting-edge of suppression techniques in the United States and allowed for the most effective wildland firefighting in the country. In a typical report to the superintendent concerning the suppression of a wildfire, Second Lieutenant F. J. Arnold wrote:

> *"On August 8th 1898 about 9 P.M. word reached me from…Riverside Station, YNP that there was a large forest fire just outside the Park line ... travelling rapidly toward the Park. I reported the fact by telegraph at once to…[the] Act. Supt. of the Park and asked for instructions. The reply was received at 10:00 P.M. directing me to take twenty men, and six day's rations with all the shovels, axes, and fire buckets at hand, and proceed to the fire at once. I was also informed that a detail of twenty men with necessary implements…would be sent from Ft. Yellowstone to join me. At 11:00 P.M. the expedition was en route to the fire."*[8]

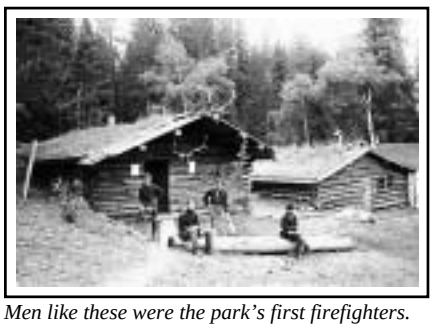
After marching all night, the soldiers arrived at the fire at 6:00 A.M. and immediately began work. Arnold reported that, "The fire was burning briskly and upon inspection was found to extend over an area of about one square mile." With only eight shovels, one axe, and no water at hand, the force amazingly brought the fire under control before noon. Shortly thereafter, however, the afternoon winds again stirred up the blaze and the fire was soon beyond control. Luckily, the force from Fort Yellowstone (which had also marched all night), arrived at the fire at 1:00 P.M. Nonetheless, due to the unbearable heat from the fire and exhaustion of the troops, the commanders decided to fall back to the Madison River (about one and a half miles away) to rest the troops and wait for the wind to die. Early the next morning, the refreshed soldiers were ordered to "distribute themselves along the edge of the fire and [chop] off the burning ends of the logs, [scatter] them, and [throw] earth upon them…[in order to] keep down the flames."[9] Without the hindrance of the wind, the troops succeeded in extinguishing the fire by 9:00 A.M., and mounted soldiers immediately began to patrol the fire to ensure that it was completely smothered. These patrols lasted for two days before the soldiers returned to their posts.[10]

Most of the reports concerning suppression efforts were similar to that of Arnold's, thus allowing the determination of a basic fire-containment paradigm practiced by the U.S. Army. Immediately following the discovery of a fire by either a soldier or tourist, the estimated location and size of the fire was reported to the commanding officer of the nearest soldier station by either telegraph or telephone. The commanding officer of the station then reported the fire to the acting superintendent of the park who, in most

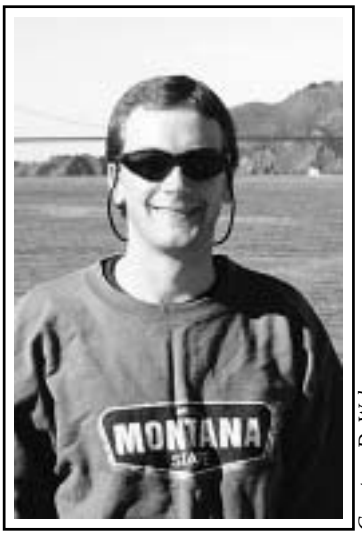
Even the terminology of wildland firefighting paralleled that of the military; firefighters dug fire lines, held those lines, and, in some cases, fell back when the line was overcome, to dig yet another line in an attempt to suppress the fire.

cases, ordered the station's officer to gather a troop of men and proceed to the fire. The superintendent, when necessary and possible, also ordered a second group of soldiers from the station nearest the fire to assist in suppression efforts. Many times the soldiers marched through the night so they might extinguish the blazes before the afternoon winds hindered their efforts. Through the digging of fire lines, smothering embers with earth, and soaking the fires with water (when possible), the soldiers remained at a fire until it was extinguished, even in the most desperate circumstances. The soldiers then patrolled the scene until they were certain the fire was completely extinguished.

Managers in the national forests adapted the army's approach following the creation of the U.S. Forest Service in 1905.[11] After the devastating fires of 1910 in the Northwest, Forest Service managers argued for the expansion of components proven in Yellowstone: better roads and, consequently, deeper access into the backcountry, improved communication, and the placement of lookout towers throughout forested areas.[12] The Forest Service also adopted the same response regime that the army practiced in Yellowstone. A fire was spotted and immediately reported (when possible) to the nearest supervisor. When necessary, the supervisor assembled a crew and sent them to the site to meet the ranger who, in many cases, had already gathered *ad hoc* volunteers and traveled to the site. Within these groups, a leader, or fire-boss, dictated strategies to the firefighters, just as a sergeant might order a soldier. From lookout to firefighter, this command structure resembled that of the military in Yellowstone National Park. Even the terminology of wildland firefighting paralleled that of the military; firefighters dug fire lines, held those lines, and, in some cases, fell back when the line was overcome, to dig yet another line in an attempt to suppress the fire. The quasi-military National Park Service also used the army's experiences in Yellowstone as a model upon its own creation in 1916.[13] The command structure at the park level resembled that of the military, and many soldiers who had served at Yellowstone were allowed to remain in the park, thus terminating their commission with the military. The army's experiences in Yellowstone provided a fire-regime paradigm that forest managers throughout the nation followed for decades.



Men like these were the park's first firefighters. Tower Fall Soldier Station, 1905. NPS photo.



Courtesy D. Weber

Doug Weber researched firefighting practices in Yellowstone National Park to complete his Master of Arts degree at Montana State University. Shortly after presenting this paper at Yellowstone's Fourth Biennial Science Conference in October 1997, Douglas received the Phi Alpha Theta Fellowship at the Montana Historical Society in Helena, Montana, where he completed his degree working as an assistant editor. Doug wrote, "I am enamored by Yellowstone's beauty and respect its place in American history. I am not a firefighter, but I respect the arduous work these men performed. My interest in this topic arose from a love of Yellowstone and the outdoors, and the chance to perform research in such beautiful surroundings. What better place is there to perform research?" Doug now resides in Denver, Colorado.

NOTES

1 Paul Schullery and Don G. Despain. "Prescribed burning in Yellowstone National Park: a doubtful proposition." *Western Wildlands* 15, no. 2 (summer 1989):30–34.

2 Aubrey Haines, *The Yellowstone Story: A History of Our First National Park* (Yellowstone National Park, Wyo.: Yellowstone Library and Museum Association in cooperation with Colorado Associated University Press, 1977), 1:292–93.

3 For a discussion of the mind set of many of the settlers of the West concerning fire and the situation of *ad hoc* volunteerism, see Stephen Pyne, *Fire in America: A Cultural History of Wildland and Rural Fire* (New Jersey: Princeton University Press, 1982).

4 Pyne, *Fire in America*.

5 "Big Fire in the Park: Hard Work by the Soldiers, Aided by Opportune Rains, Succeeded in Controlling the Conflagration," *Park County Republican*, August 11, 1900.

6 H. Duane Hampton, *How the U.S. Cavalry Saved our National Parks (*Bloomington, Ind.: Indiana University Press, 1971), 96–100.

7 Ibid.

8 Lt. F.J. Arnold, Report to Acting Superintendent, Camp Lower Geyser Basin, Yellowstone National Park, September 8, 1898. In Army Records, Archive Document 4794, Yellowstone National Park Archives, Wyoming.

9 Ibid.

10 Ibid.

11 For a good history of the Forest Service, see Harold Steen, *The U.S. Forest Service: A History* (Seattle: University of Washington Press, 1991).

12 See Western Forestry and Conservation Association, "Proceedings of Forest Fire Conference of the Forest Protective Organizations." (Portland: The Timberman, 1911). These proceedings did not provide the only example of Yellowstone's influence on firefighting techniques and policies. Foresters such as Coert Du Bois, probably the most farsighted fire expert of the day, constantly discussed needed improvements in firefighting techniques for national forests that firefighters in Yellowstone had been practicing for years.

13 William C. Everhart, *The National Park Service* (Boulder, Colo.: Westview Press, 1983).

From Fire to Fun, and Back Again:

The Changing Cultural Landscape of Yellowstone's Upper Geyser Basin

by Karl Byrand

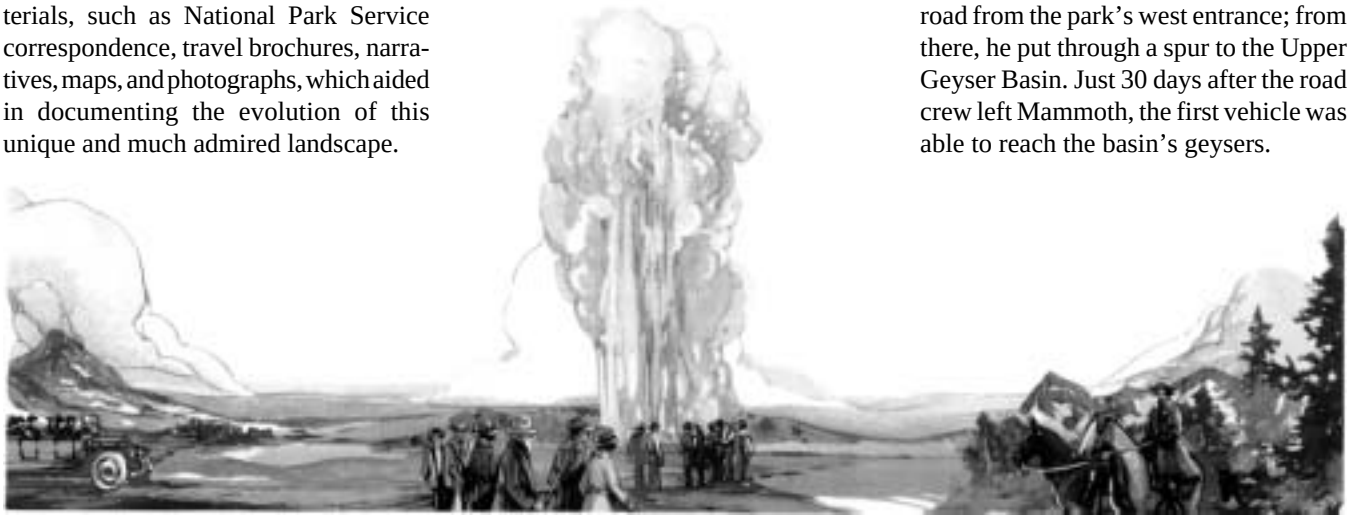
More than geothermal processes have forged Yellowstone's Upper Geyser Basin. A continually changing American culture, the national park idea, and even marketing ploys have also shaped this once wild and remote landscape, located in the park's southwest quadrant and serving as home to Old Faithful Geyser. For my graduate work in the Department of Earth Sciences at Montana State University, I looked at the evolution of this particular landscape in the context of changes in American culture. The purpose of this work was to investigate how humans responded to this landscape through time, as influenced by how the landscape was developed and promoted by park managers and concessioners. The Yellowstone archives at Mammoth Hot Springs provided a wealth of source materials, such as National Park Service correspondence, travel brochures, narratives, maps, and photographs, which aided in documenting the evolution of this unique and much admired landscape.

From the time the first crude wagon road reached its fuming landscape, the Upper Geyser Basin was on its way to becoming a pocket of urbanity. Over time, an estimated 1,000 different human structures (including tent platforms, cabins, privies, stores, and hotels) have appeared—and mostly disappeared—reflecting transformations in the external influences on the basin. As it changed, so did the way its agents promoted it. In turn, the basin's visitors have discovered experiences different from those who came before them to see this steaming landscape that spreads out along the Firehole River.

Early Years: Marketing Nature's Oddities, 1872–1903

During the park's first three decades, the development of the Upper Geyser Basin's cultural landscape was galvanized by the superintendency of the ambitious Philetus Norris, the introduction of the U.S. Army and its Corps of Engineers to the park, the appropriation of regular—although modest—funds from Congress, and the concessioners who set up shop there.

In the summer of 1878, motivated by the threat of Indian raids similar to those of the previous summer, Superintendent Norris led a crew of men to hastily construct a road leading west and then south out of Mammoth Hot Springs. Norris's road met up with a one-year-old military road from the park's west entrance; from there, he put through a spur to the Upper Geyser Basin. Just 30 days after the road crew left Mammoth, the first vehicle was able to reach the basin's geysers.



The Shack Hotel, a predecessor of the Old Faithful Inn, 1889. NPS photo.

The following year, Norris was confident that Indian raids were no longer likely and concentrated on improving the appreciation of and access to the park's natural offerings. At the basin, he established a log cabin to serve as an outpost for the exploration of a route to Yellowstone Lake and to allow observers to remain in the basin for the winter, sketch the thermal features, and obtain valuable information regarding their winter activities. In 1885, a larger cabin was established as a home for the assistant superintendent. A year later, when the army became the official overseer of the park, this cabin became part of its facilities in the basin.

In 1883, concessioners began establishing businesses in the Upper Geyser Basin; like the park administrators, they recognized the basin's scenic value and the visitation it could draw. For them, the basin was financially promising because of the 153 miles of road that by 1881 connected the Upper Geyser Basin not only to Mammoth Hot Springs and the park's west entrance, but also to Tower Junction, Yellowstone Lake, and Yellowstone Falls. These entrepreneurs, working under the approval of the Department of the Interior (though sometimes violating federal restrictions) established two tent camps, a hotel/lunch station, a Haynes photo shop, and a general store near the basin's thermal cones by 1903.

Recognizing the potential impact on the landscape, Congress passed the Sundry Civil Bill of 1883, which prohibited concessioners from locating facilities within one-quarter mile of any geyser in the park. This limitation was not intended to protect the park's physical landscape from human impact, but to prevent concessioners from monopolizing the visual landscape of the park's wondrous features (*i.e.*, blocking the view of Old Faithful as well as other geysers). However, the law was not fully enforced. The Yellowstone Park Improvement Company trespassed beyond the quarter-mile limit in 1885 by establishing a hotel near Old Faithful Geyser. Because of protests by the Department of the Interior, which realized that the location was the only suitable one for a hotel of that size in the basin, in 1894 the law was superseded by the Hayes Act, which decreased the limit to one-eighth of a mile.

Known as "the Shack," the hotel became notorious for its poor accommodations, and complaints brought about its closing to overnight guests during the 1893 season. It remained open for lunch and, after it burned down in 1894, was replaced by a similar facility, but the Upper Geyser Basin had no lodging facilities until tents were established in 1900 or 1901 (the records are unclear).

Between 1872 and 1903 the basin's boiling and steaming features were the only selling points to entice visitors, with the concessioners taking care to publicize their proximity to these fantastic features. When a 1903 Shaw and Powell Camping Company brochure touted the Upper Geyser Basin as "the most interesting geyser formation in the park," it explained that visitors could "camp for the night within sight of Old Faithful Geyser." The Wylie Camping Company facility, according to its brochure, was in a grove next to "Riverside and Giant Geysers."

Concessioners promoted the basin as a unique thermal landscape that would provide an experience never before encountered, and they used the advantageous location of their facilities to attract visitors. Northern Pacific Railroad literature of 1888 bragged that "after a little time spent in this basin, the visitor is almost certain to conclude that he has at length reached the climax of the wonders of the park." A Yellowstone Park Association brochure circa 1902 reported that "Old Faithful is the star feature, not only of the Upper Basin, but of the Yellowstone Park."

The purpose of a visit to the Upper Geyser Basin was to experience its erupting geysers, steaming pools, and bubbling hotpots. The visitors, however, did more than sightsee; as mentioned in journal and diary entries, they used the thermal features of the Upper Geyser Basin to wash their clothes and boil eggs and potatoes. Many also took to scrawling their signatures in the soft silicate formations of the geyser cones. In 1887, author Owen Wister reported that one could see "the names of asses...written in pencil" on Old Faithful's cone. With no other diversions offered, many visitors entertained themselves by throwing umbrellas and the like into geysers to watch them hurl out with the next eruption. More than one curious visitor was burned by peering into the geyser cones.

The visitors' main purpose for venturing into the Upper Geyser Basin was to enter a thermal landscape that they could interact with and be amused by. During

the early twentieth century, however, attitudes regarding how the geyser basin should be enjoyed underwent a major shift that both affected and was affected by changes to the landscape itself.

Creating a Landscape of Non-Thermal Curiosities, 1904–1940

The Upper Geyser Basin became a landscape of curiosities in addition to those offered by its natural features. Most notable of the human constructs is the Old Faithful Inn, which opened to guests in 1904 at the site of the former Shack Hotel. Like its geyser namesake, it soon became an obligatory stop for many a visitor to the park, whether or not they intended to stay there overnight.

Incorporating rustic construction materials from local sources, it was architect Robert Reamer's attempt to create a grand overnight facility that harmonized with the surrounding landscape. In addition to modern conveniences such as electric lights and baths, it offered interior balconies with gnarled, knotted, wooden railings surrounding an 85-foot-high lobby, a 14-square-foot chimney, and a wrought-iron clock with a 20-foot-long pendulum. The inn's popularity grew so rapidly that in 1913 the original 140 guest rooms were augmented by an east wing that added more than 100 rooms. In 1927, the addition of a west wing expanded the inn by more than 150 rooms.

Most of the other landscape alterations that occurred in the basin during this period came after the establishment of the National Park Service in 1916, and many were a direct result of the belief (as set forth in the legislation that established the Park Service) that public lands should have a dual purpose of preservation and use. To gain support for the national parks, early Park Service managers sought to increase the parks' usability and cater to as many types of visitors as possible through improvements in interpretive and concessioner facilities. To foster appreciation and preservation of the natural features, the Park Service employed rangers to interpret the parks' landscapes for visitors as well as to enforce laws protecting them.

However, visitor use was often at odds with protection, as in the debate that began in 1911 over whether to restrict visitors to traveling in Yellowstone only by horse. In 1915 the Department of the Interior settled the matter by deciding to permit the use of a new transportation convenience, the automobile. This soon increased access to the park, and thereby its use and abuse. Annual visitation to the park nearly tripled during the next decade, from about 52,000 in 1915 to 154,000 in 1925.

Since the Upper Geyser Basin was the most highly visited area of Yellowstone, both the Park Service and concessioners built numerous interpretive and comfort facilities there to cater to the increased visitation. By 1932, the landscape near the geyser cones sported a museum, an amphitheater, interpretive signs, two gas stations, two Hamilton stores, a Haynes photo shop, and a large campground.

Two groups of Yellowstone Park Camps Company cabins, which numbered approximately 400 by 1940, contributed heavily to the cluttered feeling of the landscape. One cluster was located just east of Old Faithful Geyser behind the Old Faithful Lodge (completed in 1928 on the former site of the Shaw and Powell Camping Company office and dining room), and the other was south of the geyser behind the Yellowstone Park Lodge and Camps Company's cafeteria (built in 1927), and the Hamilton Store (completed in 1930). These rustic one- to four-room cabins on narrow lanes created a small, albeit strange-looking town.

When advertising its offerings, the Yellowstone Park Hotel Company (successor to the Yellowstone Park Association in controlling the hotel concession) vaunted not only the creature comforts of its human facilities, but also those of the basin's bear-feeding ground, which was established in 1919. One of many such attractions in the park during this period, the basin's bear-feeding ground was located behind the automobile camp and housekeeping cabin area, less than one-half mile from the Old Faithful Inn. A hotel company brochure from circa 1920 stated that visitors could "photograph a wild bear and eat a course dinner in the same hour."

The bear-feeding ground consisted of a wire barricade strung between trees and posts, wooden benches for the human visitors, a shallow ditch "to keep people from going beyond the danger line," and an armed ranger in case things got out of hand. At a feeding platform on which the bears could dine, the sign read, "LUNCH COUNTER FOR BEARS ONLY." While visitors watched the bears eat, interpretive rangers lectured about bear behavior and natural history. Because of the number of bears and the lectures, the park's bear-feeding areas became "one of the most interesting features of the park to the majority of tourists," according to Superintendent Horace Albright's 1919 annual report.

In 1936, however, the bear-feeding grounds were closed except for the one at Otter Creek. The Park Service had determined that the grounds—which were, in actuality, dumps—not only produced bad odors, but also encouraged bears to roam

The first cars arrive at Old Faithful Wylie Camp, 1915. NPS photo.

A closeup of the "lunch counter" in 1923.

Left: Ranger Philip Martindale giving an interpretive bear lecture on horseback in 1931. The lunch counter was closed in 1936 due to public and bear health and safety concerns. NPS photos.

around visitors, employees, and facilities. (The first recorded basin visitor death at the paws of a bear did not occur until 1942. However, while the basin's feeding area was still in operation, two black bears chased each other through the wire barricade and the seating area, posing a threat to a crowd of spectators.)

The Haynes Guides during this period increasingly promoted the basin's human landscape. They displayed photographs of the facilities and visitors enjoying their amenities by engaging in recreational activities such as swimming, dancing, and horseback riding. The guides' map of the basin showed human features such as the Old Faithful Inn and the Old Faithful Lodge alongside the more prominent thermal features. The Haynes Guides were also the first to describe the basin's human and natural features in terms of distances on an automobile odometer, giving visitors an almost foot-by-foot estimate of how far they were from the next feature of interest.

The transformation of the basin's human landscape during this time created a marked change in the typical visitor experience. Instead of being drawn to this area of Yellowstone only for the peculiarity of its natural wonders, visitors now sought out a recreational experience complete with dance halls, horseback riding, scheduled bear feedings, and geyser baths. The latter amenity was fed by runoff from nearby thermal springs. Established by Henry Brothers in 1914, this bathing facility began as a 5,000-square-foot plunge (see photo on cover). In 1933 Charles A. Hamilton (owner of the park's Hamilton stores) bought Brothers' bathhouse and radically remodeled the structure by converting it into an enormous log building with a stone base. Within this facility was a 25-foot-tall lifeguard tower with a rope swing for rescuing swimmers (there would be three drownings here) and a skylight constructed from two-inch-thick glass. This facility remained part of the basin's landscape until 1950, when it was closed for public health reasons.

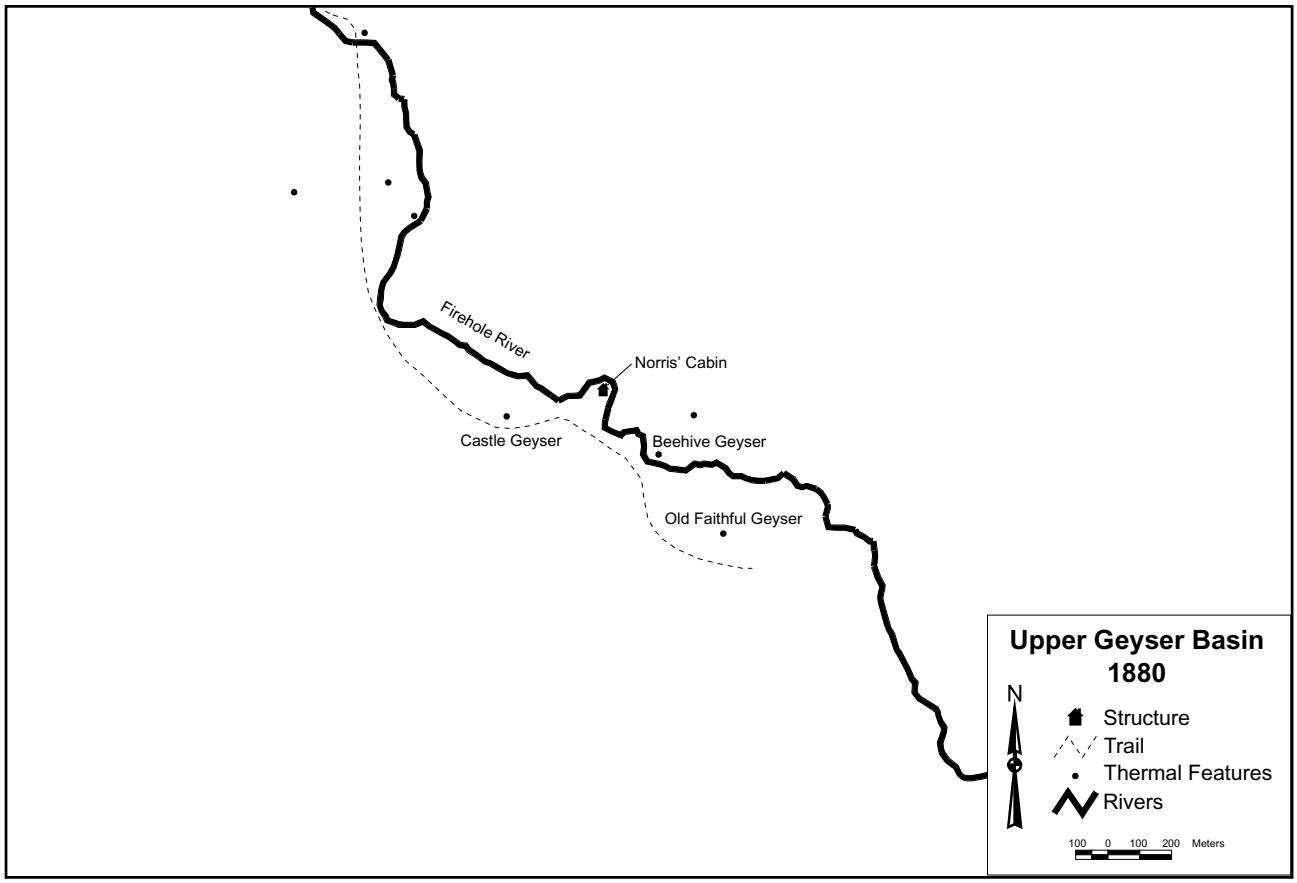
Because of the National Park Service's philosophy of use between 1916 and 1940, the basin's human and natural worlds became increasingly separated. While in the Upper Geyser Basin, visitors may no longer have felt that they were in the "wilderness," but in a resort town that happened to lie within a national park.

Promoting Visual Consumption, 1941–1990

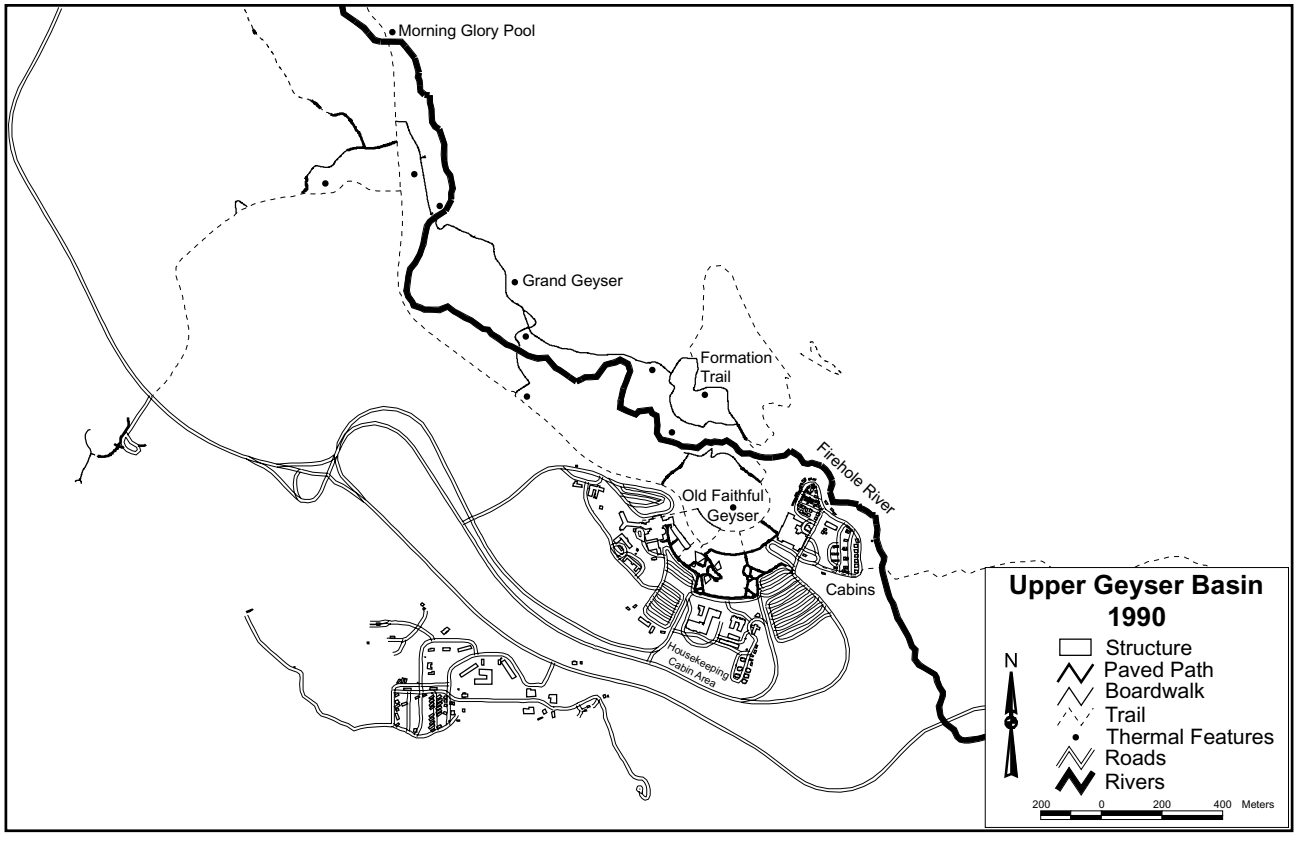
The Upper Geyser Basin's facilities, like those in many parks, fell into disrepair during World War II because of a reduction in funding and staffing. After the war, park roads and structures were strained by a deluge of travelers who were eager to shake off the fear, suffering, and restrictions that war had brought by heading out to enjoy America's scenic wonders. Although Yellowstone had heretofore been visited by persons of all classes (albeit those of the poorer and working classes tended to come from nearby states), the park began experiencing, along with the rest of the nation, a boom in the size and influence of the middle class; these visitors were increasingly mobile and ready to spend their newfound disposable income.

The National Park Service launched Mission 66 as a 10-year program to bring the parks up to par by its fiftieth anniversary in 1966. The goal was to both accommodate the increased visitation and reduce its impact by adding and improving roads and overnight facilities, eliminating camping in high-impact areas, encouraging the use of the park's backcountry, and offering educational programs about bears. The Upper Geyser Basin, however, was not affected by Mission 66 until the late 1960s. This lag reflected the basin's cultural history and the Park Service's belief that much of the development in the Upper Geyser Basin encroached on a sensitive thermal area. To correct past development and lessen the impact of increased visitation to the basin, the Park Service drastically reduced the number of structures, redirected automobile traffic via the development of a cloverleaf bypass, and constructed an intricate system of trails and boardwalks that would direct human movement.

By providing mostly self-guided interpretation explaining these changes, the Park Service hoped to engender a greater appreciation of the basin as a place to visually consume the landscape's wonders, not to disport as if at a resort, zoo, or



A map of the Upper Geyser Basin, 1880.



A map of the Upper Geyser Basin, 1990. Maps courtesy of Yellowstone's Spatial Analysis Center.

amusement park. As such, the basin's physical and interpretive landscapes changed to reflect this goal, as did the promotional literature of the time. To spread out visitation so as to reduce its impact, and perhaps to fill up visitors' time that was once spent soaking in the geyser baths or watching bears being fed, Park Service literature highlighted not only Old Faithful Geyser and the Upper Geyser Basin's trails, but also promoted other nearby trails and thermal features.

Keying in on this trend, concessioners also began to promote the basin as a wild landscape. In addition to photographs of its facilities, a 1972 Yellowstone Park Company brochure depicted images of wildlife with text explaining the importance of not approaching or feeding wild animals. Another brochure described the Upper Geyser Basin not as a resort, but as a "rustic village [that had] sprouted in the wilderness surrounding Old Faithful Geyser." Even the Haynes Guides reduced the depiction of visitors engaged in diversionary activities in the basin's facilities. For example, the guides had no photographs of visitors riding horseback or swimming in the geyser baths from 1940 to 1972. The removal of the pool in 1951 accounts for the lack of photos of swimmers after that year, but throughout this period visitors could rent saddle horses in the basin. The lack of such pictorial promotion seems to reflect the new emphasis on visitors having more of a sightseeing experience, and less of a resort one.

Although the Park Service's and concessioners' efforts improved the appreciation and preservation of the Upper Geyser Basin's thermal landscape, they also to some degree kept the visitor experience a homogenized one. Visitors all left their vehicles in the same consolidated parking lot, walked the same trail to the visitor center, and saw the same interpretive film. They read the same interpretive pamphlet, and most flocked in one direction around the geyser basin, with only a few choosing to gander in a circuit opposite the crowds.

Throughout the 1970s and 1980s, the promotion of the wild aspect of this landscape increased as a result of changes in Park Service philosophy, management, and funding. Groups that during the 1960s amid environmental circles had championed the belief that park development and preservation were incompatible found an ear with the Ford and Carter Administrations, who directed the parks toward a philosophy of less development. The establishment of the Office of Management and Budget in July 1970 reinforced this philosophy when it took control of, and subsequently reduced funding for park development.

The impact of these events at the national level became visible on the Upper Geyser Basin's landscape. Yellowstone's administrators attempted to reshape the park to fit this increasingly environmental philosophy through the park's 1973 *Master Plan* and the 1984 *Old Faithful Development Concept Plan*, which called for making facilities adjacent to the basin for day use only. By leaving specific areas untouched by human development, such as the basin's thermal features, winter wildlife habitat, and the Firehole River, the park sought to continue to reduce the congestion and physical/visual impact on the basin's landscape while considering the value of the basin's cultural resources. Buildings such as the Old Faithful Inn and the Lodge, which were on or proposed for the National Register of Historic Places, were valued for their unique architectural and historical significance, but more than half of the camper cabins (some 155 in all) were eliminated in the 1980s. Almost all of the new development between 1973 and 1990, such as employee housing and maintenance buildings, took place away from the geyser cones in the utility area, hidden from the visitors' view.

As intended, these landscape changes affected visitor experiences. The thermal features continued to be promoted, but now there was a stronger emphasis on the basin's other natural aspects. For example, a 1973 Yellowstone Park Company brochure urged the visitor to "look for wildlife" while walking along the basin's boardwalk, and a 1983 brochure by the hotel concessioner, Trans World Association, advertised that "elk and bison wander through the geyser area, enchanting photographers."

With the addition of interpretive ecology walks and visitor center displays revealing the damage that humans had caused to the basin's thermal features in the past, the Park Service attempted to teach visitors the value of the basin as a natural landscape where they could have a fulfilling visit without engaging in diversionary pastimes that stand apart from observing the geyser basin, *i.e.*, dancing or swimming. Instead, recreations such as geyser gazing, photography, and bird watching were encouraged. The result was a return to activities more akin to those enjoyed by many of the park's first visitors, but without the previous destructive interactions with the geysers like washing clothes and inscribing names.

Welcoming Visitors to Yellowstone's "Warm Winter Heart," 1973–1990

When the Snow Lodge was built in 1972, it contributed to a whole new visitor experience by providing a comfortable base from which to observe the basin's thermal features during the winter. With its addition, the Park Service hoped to reduce some of the impact of visitation by spreading it out over four seasons.

Yellowstone's "Warm Winter Heart" at Old Faithful, 1991. NPS photo.

The Park Service and concessioners promoted this visitor experience somewhat differently than that of the summer, calling the basin "the warm winter heart" of Yellowstone. Here visitors could have an enjoyable day viewing the thermal features and wildlife via snowshoes, cross-country skis, or snowmobiles; afterward, they could relax in the warm environs of the Snow Lodge. A 1975 Yellowstone Park Company brochure lured visitors by saying "a friendly fireplace invites you, your family, and friends to drop worldly cares." A 1980 Trans World Association brochure reported that "a crackling fire beckons you to relax with family and friends while you relive a day of fun in the snow."

Overall, the Park Service and concessioners promoted the Upper Geyser Basin's wintertime landscape as a place where visitors could engage in simple pleasures of the natural world, participating in an experience that reflected the park values of the period. The promotion of the park's wintertime landscape was so successful that winter visitation increased from more than 69,000 during the 1974–75 season to more than 118,000 during the 1989–90 season.

Seeking to Protect a Sensitive Ecosystem

Once sought only during Yellowstone's brief summer for its "fire"—that of an extraordinary thermal landscape—the Upper Geyser Basin became known for a variety of recreational activities provided by the park and its concessioners, and later because of its connections to a feral terrain. Then during the early 1970s, the Upper Geyser Basin opened to winter visitors, offering a new season for remarkable experiences. Park managers began promoting a visitor experience that was again focused on the thermal environment of this landscape, but which also advocated sensitivity for its ecology. Today's visitors are apt to learn how the basin's hot pools are home to resilient microorganisms whose applications in medicine and technology are under investigation; one such life form has proven essential for unlocking the mysteries of DNA.

Many people have worked to achieve ecosystem protection and enhancement in the greater Yellowstone area, hoping to safeguard the Upper Geyser Basin's fragile landscape from visitors and impacts other than boardwalks, guardrails, and warning signs. For example, federal legislation introduced in 1991 sought to limit parties from tapping into underground thermal reservoirs that lie outside the park. Although the only known reservoirs were well to the west or north of the Upper Geyser Basin, the bill was entitled the Old Faithful Protection Act—exemplifying how this icon has become the centerpiece of a landscape that endures both thermal outbursts and the consequences of being loved, even revered, by humans.

Although the act did not pass, the Park Service has continued limiting development within the boundaries of the Upper Geyser Basin. Two new buildings have been constructed in the basin (a new ranger station in 1996 and a new Snow Lodge in 1998), but they were intended to consolidate some of the existing Park Service and concessioner facilities. Moreover, park administrators sought to provide both buildings with an architectural style more in harmony with the surrounding natural landscape than those constructed in the basin during the late 1960s and early 1970s.

The 300 visitors who came to the park in 1872 had a multi-day trek on foot or by horse and wagon to get to the Upper Geyser Basin from Mammoth Hot Springs, but those who visit today need only drive a few hours. Accessible to even the largest of recreational vehicles, the basin has become the most visited destination in Yellowstone. Each year, millions of people from around the world arrive to stride on its boardwalks, gawk at its thermal splendors, scrutinize the vista for any signs of wildlife, and peruse its shops for souvenirs. Moreover, technology is making it possible for more people to view the Upper Geyser Basin's wonders without ever entering Yellowstone. IMAX theater presentations called "Yellowstone" and "Grizzlies, Geysers, and Grandeur" have played as far away as Washington, D.C. Will these six-story-high shows become an established, customary way for people to experience Yellowstone? Or will they motivate viewers to become real-life visitors?

The Upper Geyser Basin has served in several roles: geologic wonder, tourist attraction, the heart of Yellowstone, a sacred hallmark of America, and pitstop. If the past serves as an accurate predictor, we should expect the future to bring more changes to the cultural landscape of the Upper Geyser Basin. How these alterations affect the physical environment and our perspective of it remains to be seen, but their evolution should provide interesting material for future geographical study.

This article is based on Karl Byrand's master's thesis, which he completed as a student of geography at Montana State University in Bozeman. Karl just earned his Ph.D. in geography at the University of Maryland, writing his dissertation on the 1880–1920 urban evolution of Shaw, a District of Columbia neighborhood, as it transformed into the "Harlem of D.C." He starts this fall as an assistant professor of geography at the University of Wisconsin–Sheboygan. Karl misses Yellowstone very much and is looking forward to bringing his new son, Kade Wylde, for a visit.

MAJOR SOURCES USED IN THIS STUDY:

- Correspondence between the Superintendent of Yellowstone National Park and the Secretary of the Interior, Yellowstone National Park Archives.
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Arctic Grayling in Yellowstone:

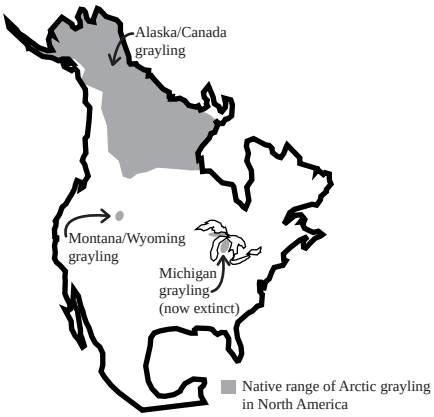
Status, Management, and Recent Restoration Efforts

by Cal Kaya

Arctic grayling. NPS photo.

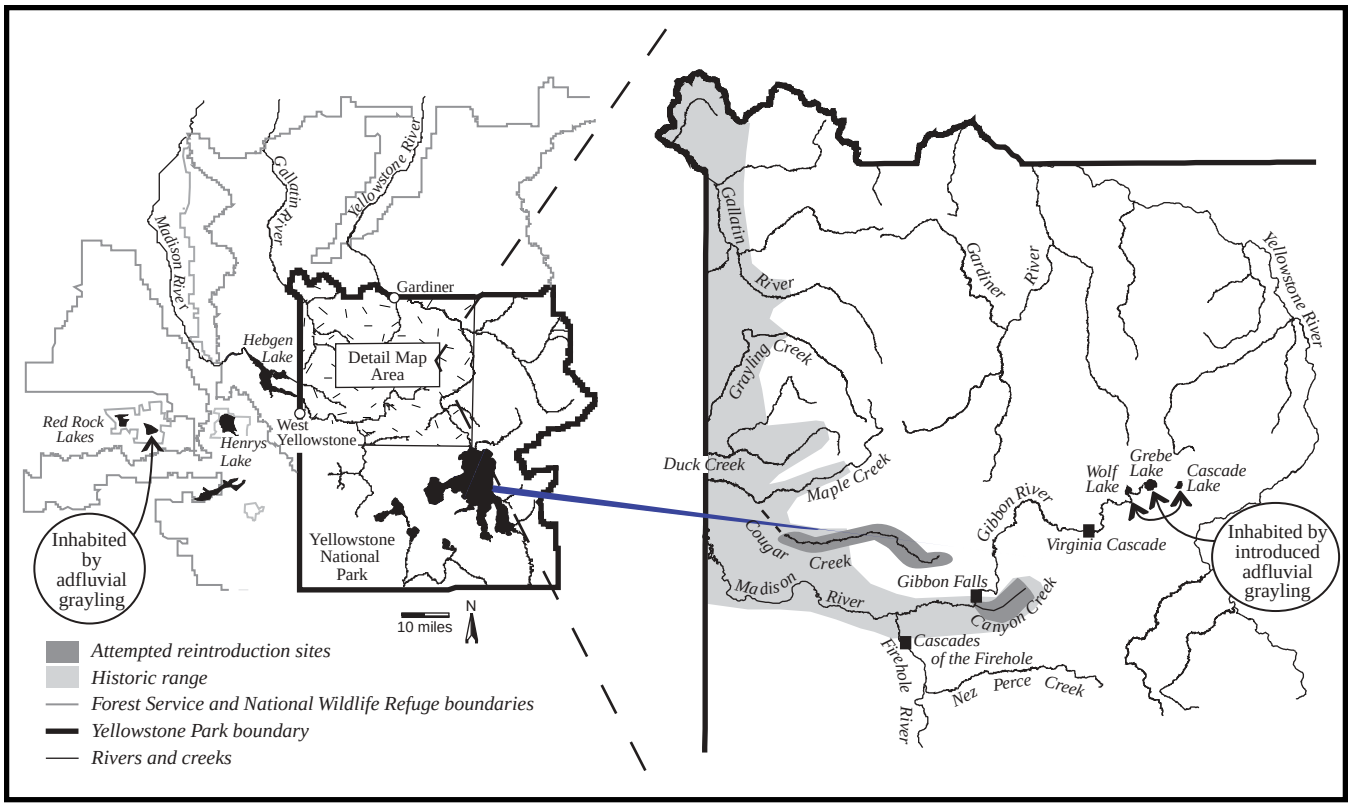
Arctic grayling (*Thymallus arcticus*) were historically common within the Madison and Gallatin rivers and tributary streams within Yellowstone National Park (YNP), but their presence within the park has become limited to several lakes into which they were introduced (Varley and Schullery 1998), and to occasional fish that have apparently strayed downstream from one of these lakes into the Gibbon and Madison rivers. The native range of Arctic grayling extends from the Ural Mountains in Russia and across Siberia to Saint Lawrence Island in the Bering Strait, and across Alaska and Canada to Hudson Bay. Geographically disjunct populations were also present in Michigan (extinct since the 1930s) and in the upper Missouri River drainage above the Great Falls.

The fluvial (entirely stream-dwelling) Arctic grayling of the Madison River within YNP and the adfluvial (living in lakes and spawning in streams) fish of nearby Upper Red Rock Lake in the headwaters of the Jefferson River drainage represented the southernmost indigenous populations of the species. The adfluvial population in the Red Rock Lakes National Wildlife Refuge persists, and Arctic grayling are now present in the park only as introduced adfluvial populations in Grebe and Wolf lakes in the Madison River drainage and Cascade Lake in the Yellowstone River drainage. However, with the exception of the Big Hole River in Montana, fluvial Arctic grayling have been extirpated from their entire native range in the upper Missouri River drainage, including within YNP. In 1991 the U. S. Fish and Wildlife Service (USFWS) was petitioned by two private agencies to list fluvial Arctic grayling of the upper Missouri River drainage as endangered, and in 1994 the USFWS determined that listing was "warranted but precluded" because other species were of higher priority. This candidate status continues to the present.



Arctic grayling were native to upper Missouri tributaries within YNP: the Madison River and its tributaries (the Gibbon and Firehole rivers up to the first cascades above their confluence at Madison Junction, Grayling Creek, and possibly Duck and Maple creeks) and the upper Gallatin River and possibly one or more of its tributaries. They were described as abundant in the Madison River below the junction of the Firehole and Gibbon rivers and within the lower reaches of both these tributaries, below Gibbon Falls and Firehole Cascades, when the first formal fish surveys within YNP and nearby areas of Wyoming and Montana were conducted in 1889 and 1891.

These descriptions of their former abundance by David Starr Jordan (1891) and Barton Evermann (1893) are highly reliable, as both men are considered among the most prominent of American ichthyologists. Evermann described the Madison River within and adjacent to the park as "evidently an excellent fish stream, at least as far up as the forks—grayling and whitefish being really abundant; dace, blobs, and suckers were all common." The latter three fishes are longnose dace (*Rhinichthyes cataractae*), mottled sculpin (*Cottus bairdi*), and mountain sucker (*Catostomus platyrhynchus*); the forks refers to the confluence of the Firehole and Gibbon rivers at Madison Junction. Neither man sampled the Gallatin River, but Jordan stated that Arctic grayling "are said to be found in the Gallatin River, in the northwest part of the Park."



Former and present distribution of, and attempted restoration sites for Arctic grayling within YNP. Former distribution is based on surveys by Barton Evermann (1893). Maps in this article by Sarah Stevenson.

Introduction of Non-Native Fish

Concurrent with these first ichthyological surveys of the Yellowstone area, changes were already being initiated that would alter the fauna of the Madison River and its tributaries and eventually contribute to the elimination of Arctic grayling from YNP streams. Jordan mentions the introductions in 1889 of rainbow trout (*Oncorhynchus mykiss*) into the Gibbon River above Virginia Cascades, and brown trout (*Salmo trutta*) into the Firehole River above Kepler Cascades. (According to Varley 1981, these may have been brook trout.) Evermann refers to brown trout planted in 1890 into Nez Perce Creek, a principal tributary of the Firehole River. Before these introductions of non-native fishes, only mottled sculpins lived in the Gibbon River above Gibbon Falls, and the Firehole River was inhabited by fish only in its lowermost reaches, downstream from Firehole Cascades.

These early introductions of non-native fishes in YNP streams were carried out with the cooperation of the U.S. Fish Commission, during the period when the park was administered by the U.S. Army. Plantings of both native and non-native salmonids continued under the administration of the National Park Service after its creation in 1916, and as the cooperating federal agency for fisheries in the park passed from the former U.S. Fish Commission, through various administrative reorganizations to the most recent, U.S. Fish and Wildlife Service. According to Varley's (l981) comprehensive tabulation of fish stocking activities in YNP, plantings of brown, rainbow, and brook trout into streams continued until the mid-1950s.

Another change that affected the Madison River within YNP was the completion in 1915 of Hebgen Dam a few miles downstream from the park. Adfluvial populations of brown and rainbow trout became established in Hebgen Reservoir, which backs water nearly to the park boundary. The effects on resident native fishes of large rainbow and brown trout ascending the river into YNP reaches during spring and fall spawning seasons, or of their progeny produced in the river, are not known. Inundated by the reservoir were waters in which fluvial Arctic grayling had been abundant—that segment of the Madison River and a spring creek called Horsethief Springs (Evermann 1893). Arctic grayling in Alaskan rivers and in the Big Hole River of Montana are known to migrate through many miles of stream (Armstrong 1985, Shepard and Oswald 1989), and those in the inundated segment of the Madison River and Horsethief Springs may have had an important role in the viability of the species in the entire upper river, including within YNP.

The fish community of the Madison River and the lower Gibbon and Firehole rivers had changed drastically by the end of active stocking of non-native salmonids into these waters (1889 to 1955). Westslope cutthroat trout were gone and Arctic grayling were reduced to very small numbers, and these native species had been replaced by brown, rainbow and brook trout. Only small numbers of Arctic grayling and no cutthroat trout were reported caught from 1953 to 1957 by anglers fishing the Madison, Gibbon, and Firehole rivers, and an electrofishing survey of sections of the Madison River between Madison Junction and the park

The Madison River at 7-Mile Bridge is known to have had an abundance of Arctic grayling. Photo courtesy Cal Kaya.

The Madison River—

"...an excellent fish stream...grayling and whitefish being really abundant..."

—B. Evermann, 1893

boundary in 1957 yielded 1,320 brown trout, 560 rainbow trout, and only 1 Arctic grayling (Benson et al. 1959). Among the native salmonids, only whitefish were still common. Brown, rainbow, and brook trout had become well established upstream from Gibbon Falls and Firehole Cascades, but Arctic grayling had neither been native nor successfully established in these middle and upper sections of both streams.

The decline of Arctic grayling in YNP streams continued after most fish stocking ended, and there has been no evidence since the 1950s of any reproducing population of Arctic grayling in any stream in the park. A few are reported caught each year by anglers on the Gibbon River and occasionally in the Madison River (Jones et al. 1993), but these are most likely either juveniles that have drifted down from the thriving population in Wolf Lake or misidentified whitefish. The disappearance of Arctic grayling from streams and their replacement by non-native fishes during the first half of the present century was not confined to YNP; except for the upper Big Hole River in Montana, similar changes were occurring in all streams inhabited by Arctic grayling in the upper Missouri River drainage (Vincent 1962, Kaya 1992). The only confirmed population of fluvial Arctic grayling remaining in the upper Missouri River drainage is in the upper Big Hole River, a tributary of the Jefferson River in Montana, within about 4 to 5 percent of historic riverine range (Kaya 1992).

Grayling in Park Lakes

Extirpation of Arctic grayling from the park was prevented by their introduction into lakes. As they were disappearing from their native streams in Montana and Wyoming, Arctic grayling were being introduced into many lakes in these and other states. Eggs taken from adfluvial populations, starting in 1898 from Upper Red Rock Lake (Henshall 1907) and in 1908 from Ennis Reservoir (Kelly 1931), were used to stock other waters. In 1921, Arctic grayling fry originating from one of the introduced populations, in Georgetown Lake in Montana, were placed into Grebe Lake in the upper Gibbon River drainage. The species was successful in the lake and joined the rainbow and Yellowstone cutthroat trout populations that had been introduced in 1907 and 1912 (Kruse 1959).

Arctic grayling quickly became so numerous in Grebe Lake that a station for egg-taking and hatchery operations was started at the lake in 1931 and continued in operation until 1956. Spawning fish were trapped in the lake's tributary streams and stripped of gametes to produce fertilized eggs that were sent off for distribution or hatched at the station. Arnold (1967) estimated that about 27 million fertilized eggs were produced at this station from 1933 to 1952 and distributed to at least 14 states. Millions of fry and fertilized eggs from this facility were also planted into nine other lakes and five streams within the park. The Grebe Lake facility and the federal (at Bozeman and Ennis, Montana) and state of Montana (at Anaconda) hatcheries became the sources of most adfluvial Arctic grayling populations in the U.S. outside of Alaska.

The presence or absence of Arctic grayling in the 10 Yellowstone lakes into which they were stocked suggests that they can coexist with certain introduced trout but not others, especially not with brown trout. Populations became established in only two of nine other lakes stocked, in some cases repeatedly, with fertilized eggs from Grebe Lake: Wolf Lake of the Madison River drainage and Cascade Lake of the Yellowstone River drainage. Introductions were not successful in Harlequin and Ice lakes in the Madison River drainage, Lewis and Shoshone lakes in the Snake River drainage, and McBride, Rainbow, and Twin lakes in the Yellowstone River drainage.

In the three lakes that presently sustain populations, Yellowstone cutthroat trout had already been introduced to Cascade Lake, and rainbow and Yellowstone cutthroat trout and hybrids to Grebe Lake and probably to Wolf Lake, before the introductions of Arctic grayling. Arctic grayling did not become established in Shoshone and Lewis lakes, which already supported introduced populations of both brown trout and lake trout (*Salvelinus namaycush*). Other lakes were too shallow or did not have streams for spawning habitat (Harlequin, Ice, Rainbow, and Twin lakes), and are presently fishless despite repeated introductions of Arctic grayling and other species. Only in

McBride Lake did introductions fail despite an apparent suitability of physical habitat combined with the presence of only Yellowstone cutthroat trout, which are native to the lake. Brown trout are the only introduced fish in common to the Madison River (from which Arctic grayling disappeared after brown trout became established) and Shoshone and Lewis lakes (in which brown trout were already established prior to unsuccessful plants of Arctic grayling).

Table 1. Unsuccessful attempts to restore or introduce Arctic grayling fry from Grebe Lake.

Stream	Number of Attempts	Total Stocked	Years
Gallatin River	3	640,000	1937 to 1948
Madison River	7	>5,000,000	1934 to 1943
Gibbon River	12	>5,000,000	1933 to 1943
Grayling Creek	11	842,000	1934 to 1942
Gardner River	2	650,000	1933 to 1934

Decline Continues in Park Rivers

Aside from the establishment of non-native fish, especially brown trout, and the possible influences of Hebgen Dam and Reservoir, it is not known what factors may have contributed to the decline and disappearance of fluvial Arctic grayling from Yellowstone. The role of angling harvest in their decline within the park is not known. The first published estimate of angling catches of Arctic grayling in the Madison and lower Gibbon and Firehole rivers was for 1953 through 1957 (Benson et al. 1959), when they had already declined to very low numbers. Arctic grayling in Wolf and Grebe lakes were at times protected from harvest, but until 1970 the species was not afforded any special protection in streams beyond the general regulations also applicable to trout. Since 1970, all angling for the species within the park has been restricted to catch-and-release. Yellowstone streams have not experienced the habitat degradation, especially dewatering by diversions, that may have contributed to decline of the species in other Missouri drainage waters (Vincent 1962). The YNP streams in which grayling were once described as abundant, the Madison River and the lower reaches of the Firehole and Gibbon rivers, appear today as they were described by Jordan and Evermann in 1889 and 1891. Thermal tolerances of Arctic grayling (Lohr et al. 1996) are similar to those of rainbow trout in the Firehole River (Kaya 1979), and changes in Madison River temperature, if such have occurred, would not account for disappearance of one and not the other.

From 1933 to 1948, millions of fry and fertilized eggs from Grebe Lake were used in unsuccessful efforts to restore or introduce Arctic grayling in park streams. Estimates of the numbers of plants attempted in each stream, total numbers planted, and the years of the plants (Varley 1981) are shown in Table 1.

Despite these efforts, fluvial Arctic grayling continued their decline into oblivion in the park, as they were also doing in nearly every other stream they inhabited in the upper Missouri River drainage. The failure of attempts to restore Arctic grayling to streams may have been related to the use of fish from an adfluvial population, that of Grebe Lake. Recent studies have demonstrated that fluvial Arctic grayling from the Big Hole River are better adapted to living in a riverine habitat than are adfluvial populations (Kaya 1991).

The barrier on Canyon Creek above its confluence with the Gibbon River. Photo courtesy Cal Kaya.

Recent Restoration Efforts

More recent efforts to restore fluvial Arctic grayling to Yellowstone began in 1976, when USFWS fisheries biologists Jack Dean and John Varley introduced fish into a small stream called Canyon Creek (Jones et al. 1981). A tributary of the Gibbon River downstream from Gibbon Falls, Canyon Creek is within the historic range of Arctic grayling and westslope cutthroat trout. A barrier falls was constructed on Canyon Creek near its confluence with the Gibbon River and the stream was chemically treated to remove non-native brook, brown, and rainbow trout above the barrier. Arctic grayling from differing habitats were planted in the creek, with the hope that fish from one of these populations would have the ecological adaptations to be successful in this location. Young grayling originating as fertilized eggs from the Grebe Lake population were transplanted into the stream during spring 1976. These appeared to drift downstream into the Gibbon River soon after being released. A second plant of about 120 grayling captured from the fluvial population of the Big Hole River was made in August. Some of these fish were still present the following spring of 1977.

In 1977, 2,000 to 4,000 fertilized eggs from the adfluvial, outlet-spawning popu-

lation from Deer Lake in the Gallatin River drainage in Montana were placed in Vibert egg-incubation boxes in the stream. Young grayling of the Deer Lake population typically hatch out and remain in a small, short section of stream above a waterfall at least through early fall before migrating upstream to the lake. Deer Lake grayling hatched out in Canyon Creek and were visible in the creek that summer of 1977. In 1978, about 5,000 young fry from the adfluvial Upper Red Rock Lake population in Montana were planted into the creek. Electrofishing later in 1978 yielded small numbers of grayling in the creek, but many more non-native brown, rainbow, and brook trout. It is not known whether these were survivors of the 1976 chemical treatment or migrants that had managed to circumvent the barrier. In June 1980, about 38,000 young fry from the adfluvial Meadow Lake population in Wyoming (descendants of fish transplanted there from Grebe Lake) were planted into the creek. No grayling were encountered during electrofishing surveys of the creek in September. Thus, Arctic grayling from different sources and of different ages all eventually disappeared following their introduction into Canyon Creek.

The most recent attempts to restore fluvial Arctic grayling into YNP have been in Cougar Creek, another small tributary within the Madison River drainage (Kaeding et al. 1995). This small stream eventually disappears entirely, as water is lost through seepage into the stream bed. The stream is thus physically isolated from downstream reaches of the drainage and the only fish present are westslope cutthroat trout and mottled sculpin. The stream has low biological productivity, and an electrofishing survey in 1991 (Jones et al. 1992) yielded an estimate of 144 to 160 trout per mile (of fish at least 6 inches in length). This stream provides two advantages difficult to find elsewhere. One is the potential to establish a community of westslope cutthroat trout, Arctic grayling, and mottled sculpins (which are all native and sympatric in the Madison River drainage) and to do so without removal of any non-native fishes. The other is that the downstream cessation of flow means that planted fish cannot be lost to downstream emigration, as has been observed with Arctic grayling planted into some other streams. However, because fluvial Arctic grayling of the upper Missouri River drainage have been associated with larger streams, it was not known whether they could live in such small streams. Thus, plants of Arctic grayling into Cougar Creek were also intended to address this question.

About 800 Arctic grayling from fluvial Big Hole River genetic stock, mostly age-0 and age-1,were planted into Cougar Creek in 1993, 1994, and 1995. Electrofishing surveys in the years following each introduction yielded very few Arctic grayling. In 1996, about 50,000 to 60,000 fertilized eggs were distributed within two tributary spring creeks near the patrol cabin located beside the central portion of Cougar Creek. Young free-swimming fry were seen by the author and others in one of the spring creeks and in Cougar Creek a few weeks later. However, Arctic grayling were not seen in the creek in surveys conducted in each of the following two years by USFWS biologists (Dan Mahony, pers. comm. 1998).

The Arctic Grayling's Future

The Arctic grayling presently appear secure in Yellowstone National Park as adfluvial populations in Wolf, Grebe, and Cascade lakes, but the future for reestablishment of fluvial populations remains uncertain. With the well-established and recreationally popular non-native trout populations, especially brown and rainbow trout, present in the main stem of the Madison River within the park, it is highly unlikely that the once-thriving native fluvial community of westslope cutthroat trout and Arctic grayling will ever be restored to this river. And if small streams do not provide adequate habitat for Arctic grayling, as suggested by the apparent failure of efforts in Cougar Creek and nearby Canyon Creek, then reestablishment of the species in its native Yellowstone waters within the upper Missouri River drainage becomes a more difficult problem. All streams within YNP once inhabited by Arctic grayling now contain well-established populations of brook, rainbow, or brown trout. These non-natives were likely a major contributor to the extirpation of fluvial Arctic grayling and their continued presence would hinder and perhaps prevent restoration of fluvial grayling. These non-native trout would be difficult to remove. The size of larger streams, like the reaches of the Madison or Gallatin rivers within YNP, would make it logistically very difficult to eliminate non-native fishes, and the non-native trout support popular recreational fisheries whose removal would be strenuously opposed by many anglers and guides.

Although upstream from waterfalls which had prevented colonization by native Arctic grayling, reaches of the Gibbon River above Virginia Cascades have been proposed as potential sites for establishment of fluvial Arctic grayling. These waters have both apparent good habitat and presently support mostly introduced brook trout, with which grayling do coexist in the Big Hole River. Consideration of these and other sites continues by YNP and by the interagency Montana Fluvial Arctic Grayling Workgroup, which includes YNP biologists. With only one fluvial population remaining in native waters of the upper Missouri River drainage, the future of Arctic grayling as stream-dwelling fish remains very insecure in the U.S.A., except in Alaska. Efforts to restore fluvial populations continue to have high priority within YNP and in Montana.

Cal Kaya collecting fertilized eggs on Cougar Creek. Photo courtesy Cal Kaya.

Calvin M. Kaya completed degrees at the University of Hawaii-Manoa and the University of Wisconsin-Madison prior to moving to Bozeman to join the faculty at Montana State University in 1971. He is currently a professor of biology, and has studied Arctic grayling since 1986. He is a member of the interagency Fluvial Arctic Grayling Committee, which coordinates grayling conservation and restoration programs throughout Montana. He studied native trout in Yellowstone's Firehole River in the 1970s, and has advised park biologists on grayling restoration efforts at Cougar Creek and elsewhere. While hiking on the trail between Cascade Lake and Grebe Lake, hoping to take photographs to illustrate this article, he "turned back when my wife and I had a close encounter with a grizzly bear."

Grebe Lake. Present habitat of established adfluvial Arctic grayling populations. NPS photo.

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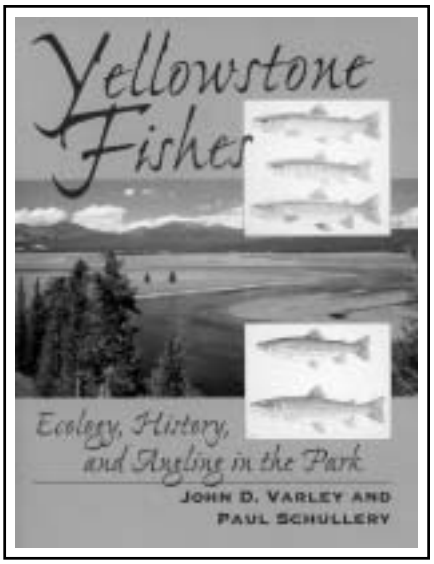
Yellowstone Fishes—Ecology, History, and Angling in the Park

by John D. Varley and Paul Schullery



Book review by Rick Mossman

Stackpole Books, 1998, 154 pages. $19.95 (Trade Paperback)

It has been said that within a 100-mile radius around West Yellowstone, Montana, is the finest concentration of fly fishing in the world. Of course, half of that area is within Yellowstone National Park. Yellowstone has a long tradition of sport fishing and a comparatively pure natural fish ecosystem (more on that later). In John Varley and Paul Schullery's new book, *Yellowstone Fishes—Ecology, History, and Angling in the Park,* they describe both the rich fishing history and fish ecology of Yellowstone. This book is an updated edition of their 1983 book, *Freshwater Wilderness: Yellowstone Fishes and Their World.*

This edition contains more information and updated knowledge on threats to the fish and fisheries of Yellowstone. The black-and-white illustrations and photographs seem more crisp than in the older edition. The only things missing are the very artful watercolor paintings of fish in their natural settings by Michael Simon that were in the 1983 version. The book is divided into three parts, with 12 chapters and the obligatory appendices, bibliography, and index.

In part one, "The World of Yellowstone Fishes," the aquatic environment of Yellowstone is described, including the rivers and lakes. Many of the typical facts and figures on park waters are listed. Want to take a guess on how many separate streams there are in the park? (Over 500.) The authors go into the creation of the lakes and streams geologically, and the evolution into aquatic environments, including the decaying vegetation, the insects, the things that eat the insects, the fish, and the things that eat the fish. This book is written in layperson's terms, so readers do not have to be worried about being bogged down by a lot of hard-to-understand science.

In this first section is also a new chapter on fire and fish. Ever since the Yellowstone fires of 1988, many critics have blamed anything wrong with the park on the fires. I believe this chapter is to mollify many of the critics who blame what they perceive as poorer fishing on the fires. Also, the authors go into the relatively new crisis of lake trout in Yellowstone Lake. They take the time to explain what is known about the invasion and, more importantly, the future implications of the issue. The authors explain that the lake trout could destroy one of the largest and most pure aquatic ecosystems in North America. Of all the articles that have been written about the lake trout issue, this is probably the most succinct, yet it contains all the primary facts.

One of the things I enjoyed about this book is the way the authors continually weave in how important everything is in the ecosystem. They think "outside the box," beyond the obvious. At one point in this section they mention the still-outstanding rewards being offered for information leading to the capture and conviction of whoever put the lake trout in Yellowstone Lake. The authors go another step and ask, since the cutthroat trout are at risk and since they are a key food source for grizzly bears (a threatened species under the terms of the Endangered Species Act), might the person responsible for planting the trout also be prosecuted in violation of that act? Food for thought.

Part two of the book describes each of the 18 species of fish (12 native, 6 nonnative) found in the park. It reads like a field guide, but it's not as dry. It gives the pertinent information such as scientific names, common names, description, distribution, habitat, spawning seasons, and growth rates for each species. Most interesting are additional comments by the authors, including fun things about Yellowstone fish and anglers. In describing the whitefish the authors state, "The whitefish is pretty much the ugly duckling on the sport-fishing scene in Yellowstone...but we suspect that if suddenly all the trout disappeared, or if they never existed, there would be many serious and devoted whitefisherman, wearing 'Whitefish Unlimited' patches and extolling the virtues of this fine big fish."

In part three of the book, the authors go into the history of fish and humans in the park. Since Yellowstone was the first

national park, in its infancy fish and game management was very haphazard. Although hunting was finally stopped in 1883, sport fishing was becoming a popular activity in the United States. In 1889 the U.S. Fish Commission (which later became the U.S. Fish and Wildlife Service) set up shop in Yellowstone, and shortly thereafter began hatchery and stocking operations. The authors describe the history of this work through 1957, when fish stocking efforts stopped. The authors go into the very interesting early philosophical debates that took place from the 1920s through the 1940s on whether stocking was good or bad, and discuss its effects on Yellowstone.

They then delve into more of the fish management efforts that occurred in the 1960s and 70s. Management policies changed dramatically during this period due to the great numbers of anglers and the crash in numbers and sizes of fish due to overharvesting. I remember as a kid in 1962 going out fishing on Yellowstone Lake with a concession guide. Between my mom, dad, and brother, we took back to the campsite 13 fish! (The limit was 12, but the guide miscounted.) We caught these fish in about 45 minutes at the mouth of Pelican Creek using nightcrawlers! In 1970 on a return trip, we fished all day with a guide at the far end of the lake and caught only three fish in total.

"As long as we can take care of the ecosystem, the trout will take care of themselves."

The authors go into the very basics of sport fishing in Yellowstone with a short section on how to fish, what equipment to use, and where to go. They continually try to steer the reader into thinking in favor of the trout—in other words, using barbless hooks, fishing by catch-and-release only, and being considerate to other anglers and the fish. It is also in part three that the authors express the virtues of fish watching. You do not have to catch or eat fish to enjoy and appreciate them in their natural environment. The authors share their enjoyment of this as well as where to watch fish in Yellowstone.

In the last chapter of this section, new to this edition, the authors talk about the future. They discuss the invasion of aliens, not just lake trout, but also whirling disease and New Zealand mud snails. They end on a positive note, though, about how DDT is now out of the aquatic ecosystem and comment on the fact that the sport fishing in Yellowstone is now as good as it probably ever has been. As a park ranger, it amazes me how many complaints we get about the size of the fish in Yellowstone Lake. Since anglers can only keep cutthroat under 13 inches long, people are always complaining that the fish are too big—I've never lived anywhere else where that was a complaint!

One appendix of the book is a reference listing all the streams and lakes in the park and what type of fish, if any, live there. Another is a nice key to fish species identification for Yellowstone. The authors leave us with one simple notion: "As long as we can take care of the ecosystem, the trout will take care of themselves."

There are hundreds of books on the market about fishing in Yellowstone. There are books on which stretch of which river to fish. There are books on what equipment to use and which rivers, streams, and lakes have fish. There are even books on how to tie the flies to use just in the park. However, I cannot think of any other book that really goes into the history of Yellowstone fish and fisheries management. You cannot live in this area without being exposed to fish and fishing in some form. If you have any interest in the park's aquatic life, this an excellent book to read. It has the most complete coverage of Yellowstone fish, fish ecology, fish management, and fish fun that exists. I highly recommend it.

Fishing along the Lamar River. NPS photo.

Rick Mossman is the Snake River Subdistrict Ranger and oversees Lewis, Shoshone, and Heart lakes and most of the Snake River drainage in Yellowstone National Park. Before he arrived in Yellowstone in 1996, he worked at Wrangell-St. Elias National Park, Glacier Bay National Park, Grand Canyon National Park, Bandelier National Monument, Ford's Theater National Historic Site (where there are no fish), Petrified Forest National Park, and Buffalo National River. He has a Bachelor of Science degree in wildlife biology with minor studies in fisheries biology from Kansas State University. He has been an avid fisherman since the age of two, when he caught his first fish.

New Fossil Location Found

While performing routine road cleanup between Mammoth and Tower Junction in June, park maintenance employees stopped to take a closer look at debris on the road. Embedded in a piece of sandstone were fossils of Metasequoia (also known as dawn redwood). These trees occurred throughout North America from the Upper Cretaceous (80 million years ago) through the Middle Miocene (15 million years ago). Other plant fossils and petrified wood were also discovered on this steep hillside. Although petrified wood is common in Yellowstone, this was a previously unknown location and is now an important addition to Yellowstone's fossil database.

Metasequoia fossil found during road cleanup. NPS photo.

In the past few years, other Yellowstone employees have identified new and important fossil locations. While monitoring mountain lion movement, an employee discovered a fragment of a jawbone and tooth of a Titantothere, a giant rhinoceros-like creature that lived 30 to 50 million years ago. A large, remote plant fossil site was discovered, which yielded many different types of fossil leaves from the Eocene epoch (35 to 55 million years ago). This extensive site will be further investigated and documented in the future. During construction of the East Entrance Road, a fossil leaf horizon was uncovered which produced an extinct genus of sycamore that is about 45–50 million years old.

All fossils in Yellowstone National Park are protected resources, and finding new sites is important so they may be documented and studied.

New Branch Chief of Natural Resources Selected

Tom Olliff, who has been the Branch Chief of Resource Operations for the Resource Management and Visitor Protection Division in Yellowstone since 1992, has been selected to fill the Branch Chief of Natural Resources position in the Yellowstone Center for Resources (YCR). Tom will be responsible for the management and supervision of all the natural resource programs for the YCR, including wildlife management, physical sciences, vegetation management, and aquatic resources. Tom will begin his new position on August 27, 2000.

Flood Threatens Park Archives Collections

On May 23, 2000, raw sewage and "gray water" backed up into the park archives, and flooding occurred in and near the library's rare book room. Because the incident occurred during business hours, staff were able to rescue the collections. But storage equipment, including the cabinet used to house rare maps and other oversized materials, was contaminated. The archives is in the lowest part of the basement of the Albright Visitor Center in Mammoth Hot Springs. Park plumbers suspected that high levels of use in the public restrooms, also located on the basement level of the visitor center, had clogged a sewer line. Subsequently, workers cleared a 20-foot-long obstruction in the area's main sewer line.

Staff from the library, museum, and archives, following an existing disaster plan, had emergency equipment and supplies on hand and used them effectively to save an array of priceless material that was jeopardized. However, since the collections are housed in the basement of a building known to be both flood and earthquake prone, there is continuing potential for great damage to or total destruction of some of Yellowstone's great treasures—rare books and numerous other materials held in the park collections. Included are several original (1870) handwritten manuscripts by the first superintendent, N. P. Langford, and thousands of original (often handwritten) letters bearing signatures of Theodore Roosevelt, F. Jay Haynes, P.W. Norris, and other historical figures. The photo archives include William Henry Jackson's personal four-volume set of his 1871 photographs, probably the first ever taken of Yellowstone, and the ones used to promote the establishment of the park.

The park continues to seek funding to build a new facility to store a growing array of museum objects, photographs, research materials, and other collections.

Seventh Yellowstone Interagency Meeting Scheduled

The seventh Yellowstone Ingeragency Science Conference will be held in Yellowstone at the Youth Conservation Corps (YCC) building in Mammoth Hot Springs on September 14–15, 2000. This meeting brings together scientists from numerous government agencies and universities to report and present papers on new and continuing scientific studies in and around the park. Topics include geophysics, geology, geochemistry, geothermal studies, limnology, biochemistry, biology, hydrology, mapping, remote sensing, and GIS applications. The meeting is open to persons conducting or interested in scientific studies on such topics in the park, and is cosponsored by the U.S. Geological Survey and Yellowstone. A small registration fee is required; for more information about presentations and registration, contact coordinator Margaret Hiza of the U.S.G.S. at MS 980, P.O. Box 25046, Federal Center, Denver, CO 80225, 303-236-0075, mhiza@usgs.gov, or Mary Hektner, Yellowstone Center for Resources, P.O. Box 168, Yellowstone National Park, WY 82190, 307-344-2151, mary_hektner@nps.gov.

Annual Aerial Pronghorn Census

On April 3, 2000, Yellowstone biologists conducted the annual aerial census of the northern Yellowstone pronghorn herd. A total of 205 pronghorn were counted, an increase of only 1 animal from the 204 counted in March 1999. The northern Yellowstone pronghorn herd is both historically and biologically significant.

Yellowstone pronghorn are genetically unique, expressing much of the genetic variation formerly widespread in the species but no longer present elsewhere. The Yellowstone herd is also one of the few pronghorn populations that was not exterminated or decimated by the early twentieth century and has largely retained its historic migration pattern. This population was the source for reestablishing or supplementing pronghorn populations in several states during the first half of the twentieth century. In recent years, the Yellowstone pronghorn herd has experienced an apparently precipitous decline, from a high of 594 in 1991 to the present level of less than 225 animals. The population has been identified as being at an 18 percent risk of extinction over 100 years, a level generally considered unacceptable.

Nez Perce National Historic Trail Foundation to Meet in Cody

The Nez Perce National Historic Trail Foundation will hold their annual meeting at the Buffalo Bill Historical Center on September 12–15 in Cody, Wyoming. The theme of this year's meeting is the Nez Perce War of 1877, with a focus on their two-week flight through Yellowstone National Park. On September 12, Lee Whittlesey, park archivist and acting historian, plans to deliver a paper on the archival sources concerning the 1877 passage through Yellowstone. Lake district ranger John Lounsbury, also very knowledgeable about the Nez Perce presence in the park, will make a presentation on how the Nez Perce dealt with over 2,000 horses on their journey to Canada. For more information about the meeting, contact the Nez Perce National Historic Trail Foundation at (435) 655-3210.

The Canyon Visitor Center, now eligible for the National Register, in 1958. NPS photo.

Canyon Village Eligible for the National Register

Postwar affluence in the 1950s brought record numbers of visitors to Yellowstone and other national parks across the nation. Recognizing that the visitor centers and infrastructure in the national parks were grossly inadequate to handle these new visitors, NPS Director Conrad Wirth initiated a program to rebuild the parks by 1966, the fiftieth anniversary of the National Park Service. This initiative, known as Mission 66, would become the greatest construction period in the parks' history and reflected a modernizing America.

The Canyon Village was the first Mission 66 project completed by the NPS. Welton Becket and Associates, a prestigious architectural firm that designed the Los Angeles Airport as well as other notable buildings worldwide, designed much of the Canyon Village development. Becket envisioned the project as a contemporary development serving automobile travelers. All the facilities visitors might need—a grocery store, gift shops, cafeteria, lodging, and information—were centrally located around a large parking plaza. These "National Park Service Modern" buildings were simple and unadorned, and often had high ceilings and few interior walls.

In January 2000, the National Park Service determined that a portion of Canyon Village is eligible for listing on the National Register of Historic Places because of its significance as a part of the Mission 66 program. In July, the Wyoming State Historic Preservation Office concurred with this determination.

Today, the Canyon Visitor Center, a part of the historic Mission 66 landscape, has major structural deficiencies and is too small to effectively serve its 400,000 annual visitors. Yellowstone is proposing to rehabilitate the visitor center by adding a second story, which will nearly double the square footage. The NPS is working with an architectural firm to ensure the design of the new building will be compatible with the other Mission 66 buildings. In addition, the park will prepare an environmental assessment to further evaluate the rehabilitation.

Errata

A statement in the interview with Glen Cole, published on page 18 of *Yellowstone Science 8(2)*, was mistakenly attributed to Paul Schullery. The paragraph starting with the statement that " This was one of the most intellectually stimulating places…" should have been attributed to Dr. Cole. We regret the error.