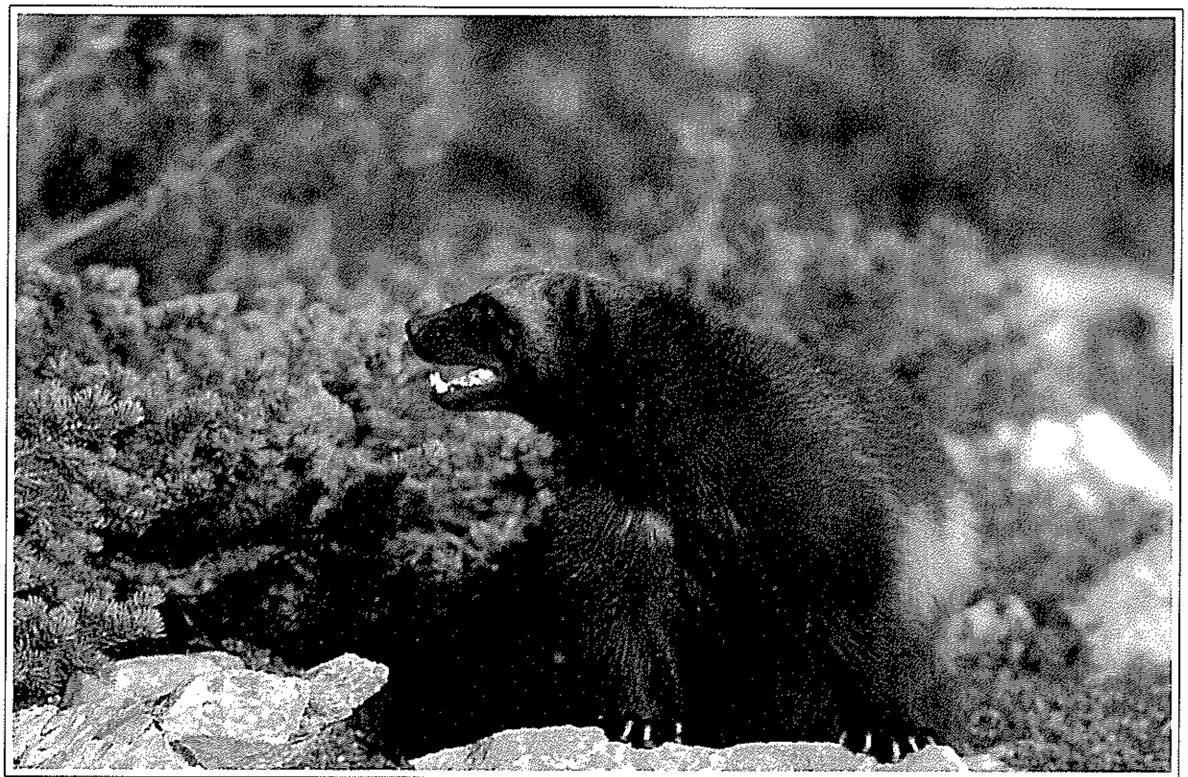
Yellowstone Science

A quarterly publication devoted to the natural and cultural resources



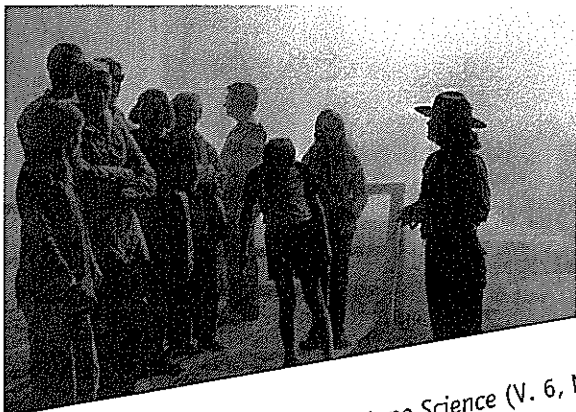
The Spirit of Yellowstone

Fire Effects on Streams

Tracking Wolverines

Volume 6 Number 3

Another Voice for Science and Interpretation



We have often hoped that our magazine would provoke thoughtful commentary or discussion among readers, but seldom have we received such direct indication. However, the last issue prompted the following letter, which we reprint with permission of the author, William Locke of Bozeman, Montana, who has studied deformation in the Yellowstone caldera:

I couldn't let the *Yellowstone Science* (V. 6, No. 2) interview with Dr. Richard Sellars go by without commenting on its irony. Despite his background in geology, no recognition of the heritage of the national parks and its science intruded on the biologically centered discussion. To be blunt: My perspective of modern geoscience in the parks is that it is at the same level as bioscience was 50 years or more ago.

The primary *raison d' être* for most of the western national parks is geological. The isolation imposed upon Canyonlands, Mount Rainier, Yosemite, Yellowstone, etc. by their geology also delayed homesteading, thus preserving wildlife. Because we see geology as a static stage on which ecological dramas are played out, most parks don't even have a resident geoscientist. Thus, geological research needs in the parks are almost entirely driven by the curiosity of outside scientists rather than national needs. Does this matter? It does when a national outcry arises over the potential of geothermal development affecting Yellowstone. The single best tool to address that issue would have been baseline data on temperature, discharge, and chemistry of thermal features—a database which, to my knowledge, neither exists nor is envisioned. Geology may change slowly but it lacks the flexibility of some biological systems, where managers can be successful at both extermination and introduction, depending on the societal context. We ignore it at our peril.

The Park Service can no more allow their priorities regarding geological research in the parks to be established by outside scientists than they can their bioscience priorities. That science may be good science or even wonderful science (as in Margaret Hiza's article preceding the interview!), but it doesn't necessarily serve national needs. But even goal-setting requires knowledge that, with due respect to the Park Service colleagues, is rare. And knowledge doesn't come cheap. If the Park Service is serious about real science of all kinds rather than knee-jerk responses to issues like fire, bison, and groundwater, it is going to have to find some powerful friends of science in high places, and put their money where its interests lie.

The economic theme is emphasized by Ranger Suderman's review of Dr. Sellars' book. In twenty years of exposure to the national parks I have observed interpretive rangers to be grossly underpaid, enthusiastic, and often highly qualified translators of park science to the public. In our society, however, it is often assumed that "you get what you pay for." The enthusiasm which draws teachers to spend their summers informing and educating at less-than-minimum wages (after housing deductions) also costs them credibility in the long run. Very little could be more effective in the cause of science in the national parks than a successful strike by ranger-interpreters!

We invite other readers to share their comments on issues prompted by our features on Yellowstone science and resources. SCM

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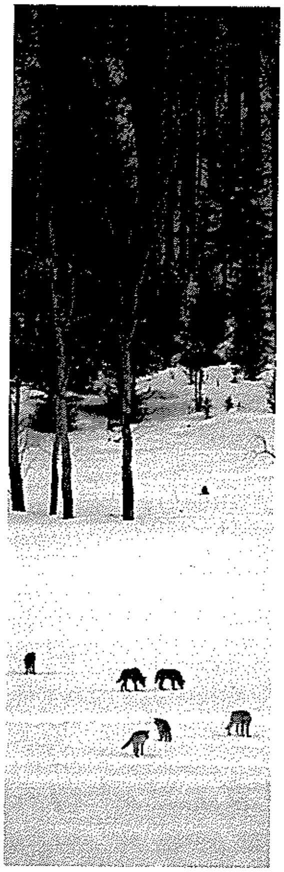

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On the cover: Photo of captive wolverine in the Bridger Mountains, by wildlife photographer Michael H. Francis. Photo of wolfpack, above, by Dan Hartman.

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Yellowstone Science is published quarterly, and submissions are welcome from all investigators conducting formal research in the Yellowstone area. Correspondence should be sent to the Editor, *Yellowstone Science*, Yellowstone Center for Resources, P.O. Box 168, Yellowstone National Park, WY 82190.
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Searching for "Skunk Bears"

The Elusive Wolverine

by Betsy Robinson and Steve Gehman

Wolverines (*Gulo gulo*) are among the least-studied and most poorly understood fur-bearing animals in North America. This largest terrestrial member of the weasel family (Mustelidae) is renowned for its ferocity in story and legend, but indeed only two scientific studies of wolverines have been conducted in the lower 48 states. Hornocker and Hash (1981) conducted a seven-year study of wolverines in northwestern Montana during the 1970s, and Copeland (1996) studied wolverines in central Idaho from the winter of 1992-93 through 1995.

Wolverines may never have been numerous, but their numbers and distribution have been drastically reduced in the lower 48 states since the arrival of European humans. Outside of Alaska, the largest wolverine populations in the United States are thought to be in Montana and Idaho, with sightings also reported in Wyoming, Colorado, California, Oregon, and Washington. Montana and Alaska are the only states that still allow wolverines to be legally trapped. Currently, an average of eight wolverines are trapped in Montana each year.

Information about the historic and present abundance and distribution of wolverines in and around Yellowstone National Park is scant. Schullery and Whittlesey (1992) documented 12 reports of wolverine sightings between 1806 and 1883, and noted three additional statements about wolverine presence. Consolo Murphy and Meagher (in press) searched park records from 1883 through 1995 for evidence from in and around the park and found 104 sightings, 25 track reports, 4 additional records, and 1 museum specimen. However, records were often lacking in the detail necessary to evaluate their reliability and accuracy. They concluded that there was a likelihood that Yellowstone National Park helped support a resident wolverine population and that more information was needed on this rare carnivore's status and distribution.

Natural History of the "Skunk Bear"

Wolverines are known as "skunk bears" because of physical features and behavioral characteristics that remind people of both skunks and bears: light stripes that often extend from the face down the sides of the wolverine; a habit of marking carcasses on which they are feeding with musk or urine; a stocky, low-slung body and broad head; incredible olfactory abilities; and scavenging habits. Wolverines weigh between 30 and 60 pounds, possess long, sharp claws that allow them to dig through deep, frozen snow, and have extremely powerful jaws that can crush frozen bones.

During winter, wolverines are known to visit avalanche chutes where unwary bighorn sheep, mountain goats, elk, or moose may have been caught and buried by a snow slide. In the winter of 1993-1994, Steve discovered just such a scene in upper Cache Creek. A bull elk had been buried in several feet of snow by an avalanche. Two wolverines used their acute sense of smell to locate the carcass, their long claws to excavate the frozen animal, and their powerful jaws to gradually consume it. By the time Steve happened on the scene all that was left was the elk's skull and piles of its hair, along with a series of trails made by the wolverines as they visited the carcass over a period of days or perhaps weeks. Wolverines feed almost exclusively on carcasses during winter, but are omnivorous the rest of the year, consuming berries, insect larvae, bird eggs, and even porcupines.

Wolverines seem to require true wilderness, and in sizeable chunks. Some of the animals in Copeland's study had home ranges of 770 square miles, and wandered up to 125 miles while dispersing. These figures put wolverines in the company of other wide-ranging carnivores such as grizzly bears and wolves. Male wolverines require larger home ranges than females, and often a single male's range overlaps with the ranges of several females.

One adaptation that helps wolverines cover such large ranges in winter is the large size of their paws in relation to their body. All members of the weasel family have five toes, compared to four toes for the canids and felids. In addition, the wolverine has a distinctive chevron-shaped interdigital pad. The wolverine tracks that we have found in the Yellowstone area measured 4 to 4 1/2 inches wide.

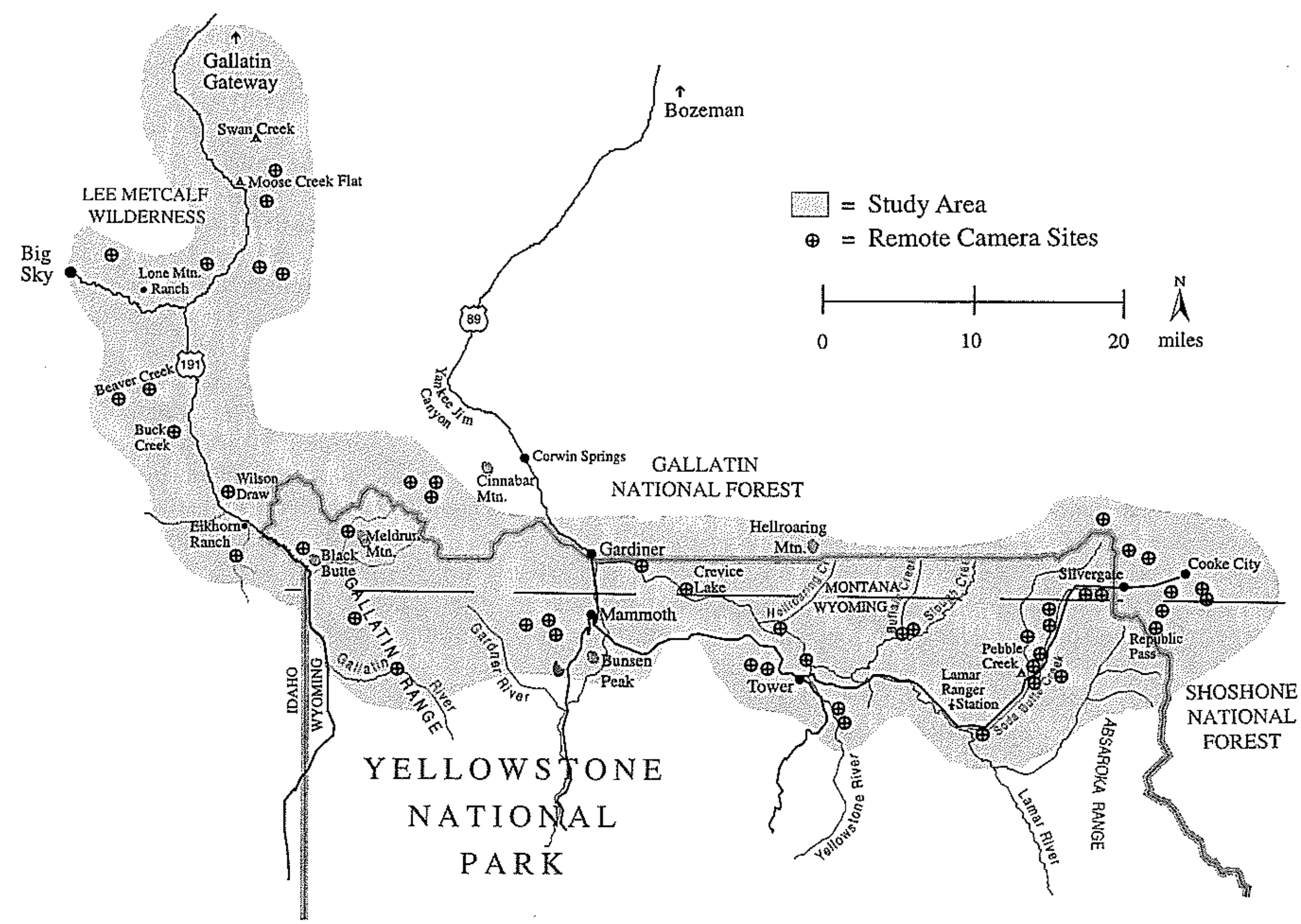
Wolverines have an unusual reproductive strategy that is shared by other mustelids as well as bears. In all cases, the animals mate in spring or early summer, the egg is fertilized and develops for a short time, and then development is suspended for many months. In the case of the wolverine, the period of suspended development may last for almost a year before the fetus implants in the mother's uterus and development continues. Once that happens, gestation lasts approximately a month. Young are born in February or March and stay with their mother through the summer. Evidence from Copeland's study suggests that extended family groups may stay together even longer. He found wolverines visiting den sites of animals believed to be cousins, and fathers seemingly sharing parental duties. Perhaps the most surprising discovery of his study is that wolverines are not loners, as once was assumed.

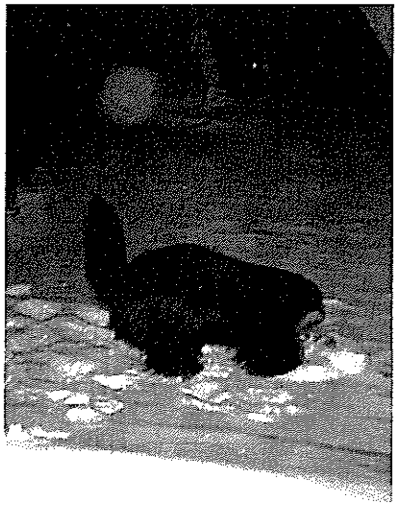
The Yellowstone Study: Slowly Accumulating Evidence

For the past five winters we have searched for wolverines and other carnivores on the northern range of Yellowstone National Park and the adjacent Shoshone and Gallatin national forests. Our work has focused on determining the presence/absence of a number of medium-sized mammalian carnivores: weasels, pine martens, fishers, river otters, wolverines, bobcats, mountain lions, lynx, foxes, coyotes, and wolves in various locations and habitats across the northern range. In particular, we have been interested in determining the extent to which the three rarest of these carnivores (fisher, wolverine, and lynx) are present in the northern portion of the ecosystem.

The northern Yellowstone carnivore study was begun by Sue Consolo Murphy

Map showing locations of remote camera stations and study area used by the authors.





Two photos of what have been identified as wolverines captured with infrared cameras at the remote camera sites. Photos in this article courtesy of the authors.

of Yellowstone National Park's Center for Resources using hair-snagging devices, then expanded by Dr. Robert Crabtree of Yellowstone Ecosystem Studies (YES), under whom we have been conducting the study. We have employed three methods in searching for our target species: hair-snares, remote camera stations, and snow-track transects.

Hair snares consisted of barbed wire spirals surrounded and encased by cylindrical tubes of wire mesh. Snares were placed under fallen trees, root systems, or dense branches to minimize snow accumulation on them, and were baited with small amounts of ungulate flesh, fish, or processed sardines. Commercial trapping lure was applied to vegetation near each site to lure animals.

Each remote camera station consisted of a Trailmaster Infrared Game Monitoring System, a bait package, and an application of trapping lure. The camera was triggered when an animal broke the infrared beam position under the suspended bait. The system was capable of daytime and nighttime photographs, and recorded the date and time of all animal visits.

We used two types of transects to collect carnivore track data. Detection or reconnaissance surveys were conducted primarily to cover as much distance as possible in areas of suspected high-quality habitat. Enumeration surveys were conducted to document all carnivore tracks observed while following predetermined transect routes, so that track densities could be compared among habitat categories and among years.

Results of Our Search Efforts

Wolverines or their tracks were detected 19 times during the first five winters of YES survey efforts. No confirmed wolverine hairs were collected during 2,668 nights of hair-snare operation at 42 sites. However, Consolo Murphy did collect a wolverine guard hair from a snare located on the north slope of Mt. Washburn during the winter of 1989-90. Wolverine was one of six carnivore species to visit our 55 camera stations. During 2,600 total nights of camera operation, wolverines made two visits and were photographed eight times. Most of our wolverine data were obtained from track observations. Wolverine tracks were observed five times during 140 snow transects that covered 403 miles (648 km), and an additional 12 times during other aspects of the project.

Our first wolverine photos were obtained during the winter of 1993-94 in Cinnabar Basin, approximately 3 miles (4.5 km) north of the park. We had received several reports of wolverine activity in that area, and decided that it would be a good place to test our skill at using the camera system. After 51 nights of camera operation, a wolverine showed up and took two photographs of itself. This incident taught us a valuable lesson about the level of patience required to obtain data on these wide-ranging animals. In January 1997, we obtained a second set of photographs of a wolverine, taken south of Cooke City approximately 3.7 miles (6 km) from the park boundary. Betsy discovered the tracks while on her way to check a remote camera, and followed them into the camera site. The camera system indicated that the wolverine had investigated the site at 10:30 a.m. the previous day.

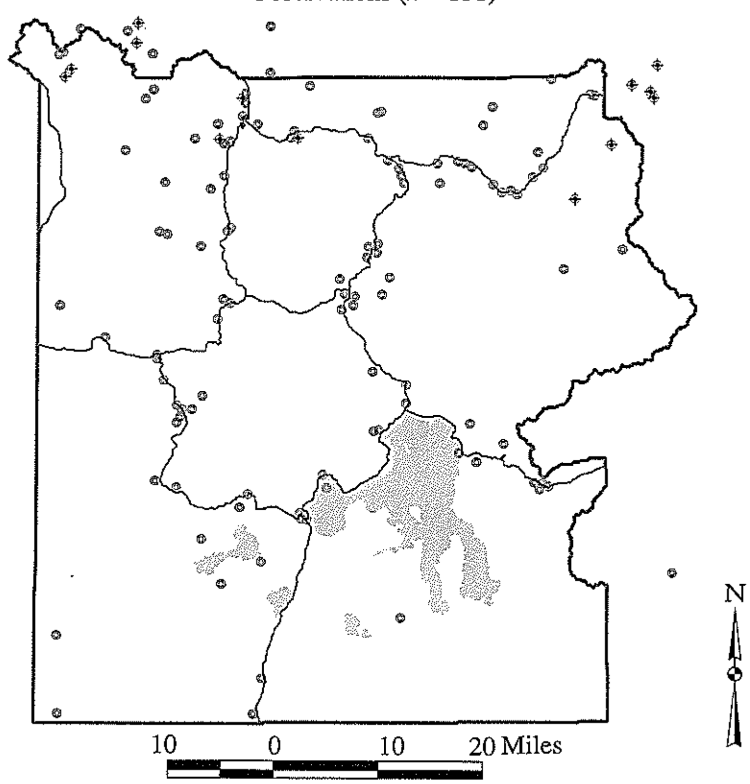
In December 1997 we shifted our carnivore survey efforts from Yellowstone's northern range to the northwestern corner of the park and nearby portions of the Gallatin and Madison ranges. Between December 3, 1997 and March 18, 1998, we used 10 camera systems at 20 sites, and conducted 53 track transects covering 155 miles (250 km).

A ski trip along the Specimen Creek drainage in February, 1998 yielded some exciting and mysterious findings. After discovering fresh tracks made by a group of four or five wolves in the lower reaches of the drainage, we skied on and found tracks of a wandering wolverine that intersected the trail three times in a 1.2-mile (2-km) segment. Upon reaching our camera station located approximately 4.3 miles (7 km) up the trail, we immediately noticed something amiss. All that remained of the infrared transmitter unit was its back plate and nylon strap that held it to a tree. The main body of the transmitter had been broken off, though four stout screws had originally attached the back of the unit to the main body. There were no human tracks in the vicinity of the camera site, and all other components of the camera station remained undisturbed. What animal could have done the damage? Perhaps a moose or elk kicked it. But then the transmitter body should have been lying nearby in the snow; we searched the area thoroughly, digging down through the top 16 inches (40 cm) of snow, but found nothing. Perhaps the wolverine whose tracks we saw earlier in the day was the culprit; its tracks came within 0.3 mile (0.5 km) of the camera site on that day; maybe it had visited the site two to three weeks earlier when the damage was done. Unfortunately the camera system was malfunctioning at the time of the incident and no photographs were obtained of the de-

Wolverine Observations

Yellowstone Area

Observations (n = 151)*



⊕ Data collected during authors' surveys (1992-1998) n = 14

⊚ Others (1944-1997) n = 137

* Park records contain some reports without sufficient data to display a map location.

Suggested Reading

Auchly, B. 1995. Devil bear. Montana Outdoors. Montana Dept. Fish, Wildl. and Parks. Sept/Oct.

Consolo Murphy, S., and M.M. Meagher. In press. The status of wolverine, lynx, and fisher in Yellowstone National Park. Proc. Third Biennial Science Conference, Yellowstone Natl. Park, Wyo.

Copeland, J. 1996. Biology of the wolverine in central Idaho. M.S. thesis. Univ. of Idaho, Moscow. 138pp.

Hash, H.S. 1987. Wolverine. Pages 575-585 *in* Wild furbearer management and conservation in North America. Novak, M., J.A. Baker, and M.E. Obbard, eds. Ontario Ministry of Nat. Res.,Toronto, Ontario.

Hornocker, M.G., and H.S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Can. J. of Zool. 59:1286-1301.

Schullery, P., and L. Whittlesey. 1992. The documentary record of wolves and related species in the Yellowstone National Park area prior to 1882. Pages 1-3 to 1-173 *in* J.D. Varley and W.G. Brewster, eds. Wolves for Yellowstone? A report to the United States Congress, vol. 4, research and analysis. NPS, Yellowstone Natl. Park, Wyo.

structive animal. We will never know what happened, but we place our bets on the skunk bear.

We documented an additional three wolverine track sets during our efforts this past winter: a second set in the Specimen Creek drainage, and two sets in the Gallatin National Forest within 22 miles (35 km) of the northwest corner of Yellowstone National Park.

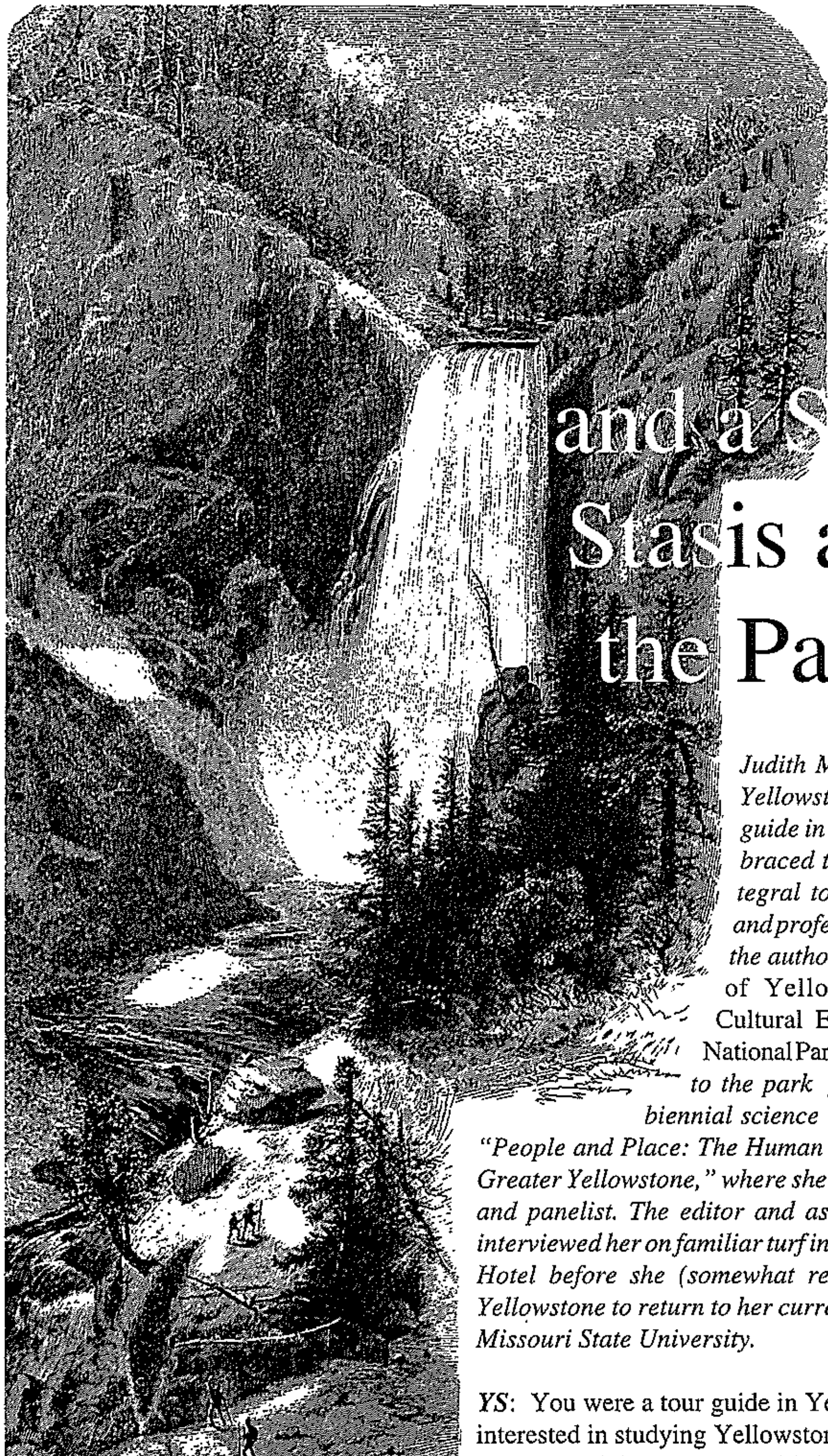
Since mid-1995 the park has received 19 reports of 24 wolverine sightings and two additional reports of tracks, bringing the total to 164 observation records—only slightly more than one for each year of the park's history.

The Future of Wolverines in Greater Yellowstone

Wolverines have the potential to be important indicators of ecosystem health and integrity. We know that, like other carnivores, they have been affected by human activities. Their historic numbers and distribution were drastically reduced, probably as a result of some combination of factors such as decimation of prey populations, widespread predator control programs, and habitat alteration and fragmentation. Recently, Copeland documented a wolverine abandoning her den in response to a skier traveling through a mountain bowl where her den was located, indicating the wolverines' vulnerability to human presence.

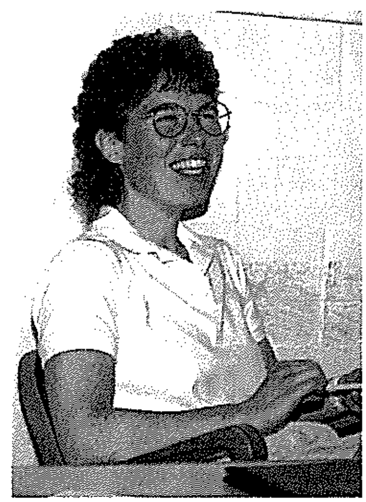
With increasing pressure being placed upon wildland habitats by recreationists, industry, and land developers, the potential for further impacts to wolverine populations is significant. In August 1994, the U.S. Fish and Wildlife Service was petitioned by several environmental groups to list the wolverine as a threatened or endangered species under the Endangered Species Act. Ironically, the petition was refused in April 1995 on the grounds that not enough information existed regarding their current distribution and population status. In order to use the wolverine as an indicator species, we must first develop a more complete database on its abundance and distribution. Our goal is to assist in the compilation of such a database; we hope to spend the next ten winters helping to survey the wildlands of the Yellowstone ecosystem for wolverines, as well as for fishers and lynx. The more we learn about these rare carnivores, the better we will be able to protect them and their habitat for long-term survival in greater Yellowstone.

Betsy Robinson and Steve Gehman are self-employed wildlife biologists based in Bozeman, Montana. Both authors instruct college-level field ecology courses for the Wildlands Studies program of San Francisco State University, and lead natural history tours in the western United States. Steve has worked on various research projects in greater Yellowstone since 1984, and has been the lead project scientist on the northern Yellowstone carnivore study since 1992. Betsy has been involved in several research projects on mammalian carnivores in greater Yellowstone and Alaska, but describes her passion as birding.



Yellowstone Science Interview:
Judith Meyer

Yellowstone and a Sense of Place: Stasis and Change in the Park Experience



Judith Meyer came to Yellowstone as a tour guide in 1980, and embraced the park as integral to her personal and professional life. As the author of The Spirit of Yellowstone: The Cultural Evolution of a National Park, *she returned to the park for the fourth biennial science conference on "People and Place: The Human Experience in Greater Yellowstone," where she was a speaker and panelist. The editor and associate editor interviewed her on familiar turf in the Mammoth Hotel before she (somewhat reluctantly) left Yellowstone to return to her current position as a geography professor at Southwest Missouri State University.*

YS: You were a tour guide in Yellowstone, and because of that, you became more interested in studying Yellowstone academically.

JM: My arriving as a tour guide in Yellowstone is a classic example of how one little chance event—initially insignificant or unrelated to what happens later—sets in motion a whole series of events that later result in something completely different. I was first hired as a tour guide not because of any particular interest in Yellowstone or national parks or nature interpretation, but because in the early 1980s, the dollar was weak relative to the French franc and the German mark, and a lot of Europeans were taking vacations to the United States. Hence, global economics created a market for foreign-language-speaking tour guides in American national parks, and I could speak German, so I got a job in Yellowstone. However, once here, it was the strangest thing. Although I'd traveled quite a bit, I had never really felt at home anywhere. But I got off the bus here at Mammoth, and for the first time in my life, I felt I didn't want to leave. I felt I belonged here.

After three summers in the park, I enrolled in a master's program in environmental communication at the University of Wisconsin-Madison and took my first geography course as an elective. The course was "Space and Place" with Yi-Fu Tuan. Tuan introduced me to geography as an academic discipline and to the idea that one could study not just the impact people have on the landscape, but the impact the land has on people. Tuan suggested that literature, music, and paintings—media often considered too subjective to provide any real or quantifiable information about the world—can and should be studied by geographers because of what these things reveal about the relationship between people and places. So, I quickly finished an M.S. in environmental education and moved across campus to do a Ph.D. in geography, all the while following for fun the writings of Stephen J. Gould and his punctuated equilibrium model of biological evolution. All of a sudden, things started to come together.

YS: Was it your dissertation that culminated in the book, *The Spirit of Yellowstone*?

JM: Yes, the book is my dissertation, thinly disguised.

YS: Did you base your conclusions on interviews with people, on the historic record, or on other kinds of documentation?

JM: On the historical record. I think the difference between history and geography is that with history you're looking at a sequence over time, and geographers look at events in a place, but still over time–how did the passage of time affect this place.

YS: I was sparked by the comparison you made between Stephen J. Gould's punctuated equilibrium theory of natural evolution and human cultural evolution. Can you explain that a bit more?

JM: I began every chapter of my dissertation with a quote from Gould explaining one more piece of the punctuated equilibrium model—at least the pieces that related to what I perceived as Yellowstone's evolution as a place (as opposed to the space around it). Punctuated equilibrium (I think the groupies now call it "punk eke"!) suggests that the evolution of different species on the planet can be explained, at a very broad scale, by long periods of stasis (equilibria) and brief episodes of change (the punctuations). Most speciation occurs during and following the punctuations, the times of environmental change, whereas most of geologic time has been spent in stability. Until the idea of punctuated equilibrium appeared, most biologists explained evolution in terms of the changes, the divisions, the points at which species appear or disappear. Gould and his partner, Niles Eldridge, were the first to suggest that the long periods during which nothing happens should be considered important, too.

At the same time, geographers were grappling with how to study the relationship between people and places. We know that every place is unique, but should we just describe individual places—this place here, that place there—or should we attempt to categorize them somehow? Can we generalize about the types of houses built by people living in the tropics, or the types of agriculture developed by people living on grasslands? What set the evolution of these individual places or cultures or landscapes in motion? Do all industrializing nations go through a period of exploiting nature and then later begin protecting it? I started thinking about how Gould might explain how Yellowstone evolved from *terra incognita* to what it is today: an internationally recognized place. If the world is just a collection of discrete places that have no unity, then what does that say about the national parks? Should each park be managed autonomously, or should they all be managed out of Washington, D.C.?

YS: Was that the fundamental question you asked in your dissertation?

JM: Well, not the fundamental question; there were several questions, but that's an important one. First of all, I have to put in a disclaimer regarding punctuated equilibrium as an explanation for cultural evolution. Biological evolution is driven by natural selection; cultural evolution is driven by human forces: greed, politics (which may be the same thing), religion, love, compassion, and so on. But punctuated equilibrium emphasizes stasis. Gould made people pay attention to the long periods of time during which species do not change, do not split off and evolve into other species. I looked at the academic literature on the national parks, at Aubrey Haines' history of Yellowstone and all the Yellowstone histories, and found that the authors always focused on change: "This was a transitional time; this was when the car was introduced; this was when the first hotel was built." Very little attention was paid to the long periods of time during which *nothing changed.*

For example, for many people, Yellowstone is (or was) the place where one feeds bears along the road. Much has been written when and why feeding the bears started and ended, and whether it was good or bad, but few have tried to explain how integral this beggar bear image was to experiencing "the Yellowstone" and not "the Yosemite" or "the Grand Canyon." Why here? Why not there? Why is this image of Yellowstone so powerful and why has it been so powerful for so long? Gould suggested biologists should begin thinking about how long a species has existed, how well-adapted or fortuitous it must be to have been around for so long. Why did feeding bears in Yellowstone last such a long time and make such a lasting impression on the American public?

Another point Gould makes with punctuated equilibrium is the lack of determinism or progress in biological evolution. The ancestors of an amoeba in a primordial sea were not somehow predestined to ooze out of the ocean and evolve into dinosaurs or human beings. Evolution is based on chance events. It was the culmination of a series of historically contingent but nonetheless chance events that formed the ozone layer and

"Maybe we should stop condemning history and accept it for what it was (and is). In Yellowstone's origins lay the potential of everything the park is and will become: beggar bears, horse-drawn carriages, automobiles, the "Let it Burn" policy, the wildfires of '88. We are stuck with this particular landscape, this geography, and this human history...there is much that the park has come to mean, and park managers need to be sensitive to this history and these meanings when enacting new policies."