

# Yellowstone Science

A quarterly publication devoted to the natural and cultural sciences



20,000 Leagues Under Yellowstone Lake  
Predators and Thermophiles  
Finding Fishers  
Wolf Summer

Volume 3

Number 4



## Thanks!

With this issue of *Yellowstone Science*, we complete our third year of publication. There are at least two reasons that's worth mentioning here. The first is that we want to thank all the people who have helped us put this publication together and keep it going. Yellowstone's former superintendent, Bob Barbee, and current superintendent, Mike Finley, have given the project the endorsement it has needed. The Yellowstone Association's annual grants to cover printing and production costs have been indispensable. Many Yellowstone National Park staff members have helped out in ways beyond counting. And of course the many re-

searchers who have generously donated their time to write articles, give interviews, make suggestions, and provide information for news stories have made *Yellowstone Science* a vital and helpful publication.

We're gratified and sometimes even surprised at the interest this little magazine generates, and how far it reaches in the Greater Yellowstone community and beyond. We hope that doesn't sound self-congratulatory, because it isn't meant to; the real congratulations go to all the people whose participation and enthusiasm have kept the idea of a science-based Yellowstone periodical thriving.

As you may have already noticed, we're now entering a new phase in this publication project. We can't fairly expect the Yellowstone Association to maintain its current funding level indefinitely, and so we're going to ask for your help in keeping the presses running. We might be more hesitant to do this if we hadn't already received literally hundreds of requests from people who are willing to pay to receive *Yellowstone Science*. This level of interest is heartening, not only because it suggests that the magazine is well received, but also because it gives us hope it can become more self-sustaining.

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Volume 3

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Bob Lindstrom



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*On the cover: A gathering of predators; a montage of images prepared to celebrate this year's predator conference, by Renee Evanoff.*

*Above: Thermophile conference organizer Anna-Louise Reysenbach of Rutgers University collecting "black filaments" at Calcite Springs.*

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*Yellowstone Science* is published quarterly, and submissions are welcome from all investigators conducting formal research in the Yellowstone area. Editorial 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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# Stalking the Elusive Fisher

*Finally, the existence of this rare predator is confirmed*



YES



by Steve Gehman

It was mid-February 1985. My friend Michael Osgood and I had spent three days skiing from West Yellowstone to Shoshone Lake, and were just settling into our sleeping bags inside the quinzhee that we built for shelter within a mile or so

of the Shoshone Geyser Basin. In the early evening darkness we heard a clanging of pots from our snowshelf kitchen outside. We slid out of our bags, down the entrance tunnel, and out into the darkness with flashlights clenched between

our teeth, to see a medium size, dark animal bounding away with a two-pound block of cheese from our food bags.

As we shouted and moved toward the animal, it dropped the cheese and disappeared into the nearby forest. We re-

trieved the cheese and the remainder of our food and cooking equipment and returned to the comfort of our snowhouse. Within a few minutes, as we sat discussing our encounter and wondering about what we had just seen (it seemed too large and too dark to be an American marten), the animal came bounding into our quinzhee and perched itself at the base of the sleeping platform. From less than six feet away, illuminated by flashlights, we saw the dark brown fur, long bushy tail, and red eyeshine of a fisher. We sat motionless and stared at this creature, mesmerized by its boldness and beauty. After five or ten seconds, the fisher turned and disappeared into the darkness from whence it came. So began my interest in fishers in the Yellowstone Ecosystem.

During the winter of 1992-93, I had the opportunity to become involved in the Northern Yellowstone Carnivore Study, a cooperative project between Yellowstone National Park and Yellowstone Ecosystem Studies (YES), a non-profit research organization based in Bozeman, Montana. The effort was initiated by Sue Consolo Murphy of the National Park Service (NPS), Mary Harter (NPS), and Bob Crabtree (YES) in an effort to expand our knowledge of medium-size mammalian carnivores in the northern portion of the Yellowstone Ecosystem. The objectives of the study are to evaluate various inventory and monitoring techniques for carnivores, to determine presence and distributions of carnivores, and to assess habitat relations of the various species. Although we are interested in all carnivores, our primary target species include some of the lesser studied animals such as American marten, fisher, wolverine, lynx, and mountain fox.

Over the past three winters, numerous people have participated in operating remote camera stations, maintaining hair snaring devices, and conducting snow track transects in efforts designed to learn more about these animals. Mary Harter and Sue Consolo Murphy developed and implemented field techniques for the study in the winter of 1992-93, with assistance from YES personnel Rob Ahl, Ammy Gillesberg, and me. During the past two winters, I have served as project leader for YES, and have received help in the

field from numerous student volunteers, interns, and YES staff. In particular, interns Rob Ahl and Betsy Robinson deserve special acknowledgment for contributions of time and energy to the project. During each of the three winters of study, we have also received field assistance and support from YES "research volunteers" (approximately 25 individuals) who volunteered a week or more of their time participating in YES's "Searching for Carnivores" research expedition.

One highlight of the study occurred this past winter, when fishers were captured on film at two of our remote camera stations in the Cooke City area. The first fisher photo was taken on the morning of January 9, 1995, in the Republic Creek drainage south of Cooke City. We had been tantalized by the prospect of fisher presence in the area since early in 1993, when a photo from one of our first camera stations showed us the rump and tail of a nearly black mustelid digging in the snow and facing away from the camera. Bob Crabtree and I suspected it to be a fisher, but could only cautiously label it as a "possible" fisher in our project reports and discussions.

During the remainder of that first winter and throughout the second winter of study, we worked hard to confirm what we suspected, but came up only with a few sets of probable fisher tracks (there is potential for overlap in track size between marten and fisher, so confirmation of fisher presence from tracks alone is questionable). Needless to say, we were quite excited to see the unobstructed profile of a fisher on our film from the Republic Creek site. In late February 1995, a second fisher was photographed at a camera station along the northeast boundary of Yellowstone National Park, at Wolverine Pass (approximately 6 miles northwest of the Republic Creek site). This photo was of a lesser quality than the one from Republic Creek, but nevertheless provided a conclusive view of a fisher.

These photos leave no doubts in our minds that fishers occur in the northeastern portion of the Yellowstone Ecosystem. The dark brown color of the animals, the lack of any orange coloration showing along the edges of the neck, chest, or belly (a typical pattern in martens, the most likely alternative animal),

the large bushy tail; the relatively blunt, rounded shape and low profile of the ears; and the relatively robust appearance and large size of the body, all support our conclusion that the animals in the photos are fishers and not martens.

To confirm our identifications of these animals as fishers, Betsy Robinson and I made estimates of the body and tail lengths of the animals by careful scrutiny of the photographs and the camera sites. We revisited both camera sites and made numerous measurements of the areas photographed and of vegetation included in the photos. We also took photographs of rulers and an 18 x 18-inch grid placed in the locations of the photographed animals. These photos were then used to compute correction factors that were applied in estimating the actual sizes of the animals from measurements of the animals on the original photos (see Vol. 2, No. 1 of *The Tracker*, a YES publication, for more specific descriptions of size estimation techniques and results). Resultant estimates indicated that the animals' bodies and tails were within normal ranges for fishers, and were larger than comparable measurements for marten.

After a century of both speculation and doubt about the presence of fisher in the Yellowstone Ecosystem, we are extremely pleased with these confirmations. These recent sightings, probable tracks in classic fisher habitat, historical sightings, and two fisher specimens from unknown locations in the Yellowstone region all point to a probable historic population.

This information raises some fascinating questions. For example, how could a 5- to 10-pound predator go unnoticed for so long? How well distributed are they? Do fisher have a thriving, viable population in Yellowstone or are they isolated and threatened? One thing is for sure. There is no substitute for partnerships: pooling our resources and getting out in the field and looking. What else could be waiting for us to discover? We hope we can expand our efforts to learn more about distributions, abundance, and habitat use of these elusive carnivores.

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*Steve Gehman is a project leader with Yellowstone Ecosystem Studies. For more information on YES, see the interview with Bob Crabtree on page 4.*

# Information Warriors

*Creative approaches to getting science done in Greater Yellowstone*



*Yellowstone Ecosystem Studies president and founder Bob Crabtree, a few years ago in Logan, Utah, leading a group howl with captive coyote pups. Linda Broome photo.*

*Dr. Robert Crabtree is perhaps best known among Yellowstone researchers for his recently completed six-year study of coyotes, but his research and education interests have broadened considerably since he launched that important study. In this interview, conducted at his Bozeman, Montana, office in August, he explains not only the origin of the coyote study but also the much more wide-ranging emphasis of his current efforts. Readers may find Bob's ideas and experiences of special interest because of the current political climate, with its aggressive attention to reducing agency budgets and encouraging partnerships of various kinds between resource professionals, institutions, and the public.*

## Starting With Coyotes

**YS:** How did you get interested in doing research in Yellowstone?

**BC:** When I was a kid coming to Yellowstone, or hearing about it, or seeing about it on T.V., I just fell in love with the place. I knew I wanted a Ph.D. in wildlife from the time I was in the 6th grade. In 1974, the summer between my sophomore and junior year in high school, I was a bus boy at the Old Faithful Inn.

**YS:** It was coyote research that eventually brought you here as a researcher. How did you get involved with coyotes?

**BC:** I always loved dogs, and I thought that I would love to study coyotes since I first saw them, in 1974. Years later, I did

my first study of coyotes on the Hanford Nuclear Reservation [*in southern Washington state*], for my Ph.D.

**YS:** What made Hanford special? Why study them there instead of somewhere else?

**BC:** Because that was the first study of a natural, undisturbed, unexploited population of coyotes.

**YS:** You might elaborate on why that matters.

**BC:** Almost all coyote populations are exploited, which means that humans are killing them. When a wildlife population is under that kind of pressure, its social and biological character is probably very different than it would be if all mortality was natural. Without knowing how the

population would behave without human exploitation, we can't really understand how our exploitation affects it.

**YS:** So what did you learn?

**BC:** A lot. Because it's known that many animals compensate for exploitation by producing more offspring, I just figured that the litter size at birth in this unexploited population would be very low, but litter size at birth was normal. It was the litter *survival* that was extremely low.

There are a lot interesting things that happen when you let a coyote population go without human interference. Their average age is much older, and they become socially stable because humans aren't constantly disrupting their packs by killing so many of them. But I also learned a lot about research and how it works.

**YS:** For example?

**BC:** There are those neat things you see by studying something five years in a row. It takes that kind of continuity to begin to learn about complexity. For example, here in Yellowstone, we're in our sixth year of studying the coyotes on the Northern Range, and it takes that long to get even a glimpse of how things work.

**YS:** Can you be more specific?

**BC:** In Yellowstone, I caught a pup in a den in June 1990, and we've been able to follow his progress through coyote society ever since. He just picked up Alpha status this year and his pack had its first litter. That was after he twice failed to take over the territory of another Alpha male in the last two years. You don't get to see that stuff unless you follow an animal for a long time.

But to get back to your question of how I got here, that Hanford study brought me to Yellowstone, which also has an unexploited coyote population I could study. Besides wanting to study another coyote population, I also hoped that I could really sink my teeth into something long-term and bigger scale. Studying an entire community ecosystem, rather than just one species, really has always been on my mind.

**YS:** A lot of people are probably curious how a scientist comes into an entirely new area and launches a study. With your Yellowstone coyote study you could read what had been written by earlier research-

ers, especially Adolph Murie's 1940 monograph *Ecology of the Coyote in Yellowstone*, but where do you start out in the field? What do you do first?

**BC:** Some of it is actually very simple. For example, I went out to various places on the Northern Range and listened to the vocalizations of the packs, and from that I could get a general idea of how the packs were spread around, and what their territories were.

*Renee Evanoff*



*A contented coyote photographed in Yellowstone's Lamar Valley the winter following the fires of 1988.*

On the other hand, when I was doing something that informal, I limited my mind to those things that you can capture in a sort of snapshot first impression. Beyond that? I felt I really had to have no preconceptions of what was going on.

**YS:** So what kind of things can you capture in a snapshot?

**BC:** Basically just a spatial layout of things.

**YS:** How does that work? How did you determine what the spatial layout of the packs was?

**BC:** If you're experienced with coyotes, you can pretty much figure out that two different vocalizations you're listening to—that is, the vocalizations of two different groups of coyotes—are probably happening on opposite sides of the boundary that separates the territories of those two packs.

**YS:** How can you be sure you're hearing a pack and not just some random coyotes out there wandering around?

**BC:** If they do what is called a group yip-howl, they're a pack, period. And once you know where the packs are, you can work out their territorial boundaries.

Boundaries between packs frequently follow some physical feature that is obvious on the landscape, like a stream or a cliff, and so by looking around it's possible to begin to get an idea of where the pack territories are.

That's really important information for my study, too. Ninety percent of all captures of coyotes occur outside of their territorial boundaries, so just by listening to the packs, I had a pretty good idea of where to set my traps.

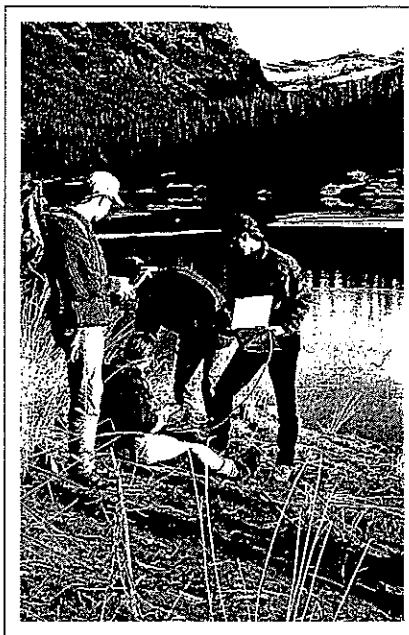
**YS:** You say that most coyotes are most often captured outside their own territory? How can that be?

**BC:** They are a lot harder to trap when they're at home. They seem to be extremely averse to anything abnormal in their territory. If they come across anything unusual, like a scent, or a hole, or anything else associated with a trap, they completely avoid it.

On the other hand, when they leave their own territory, they're very exploratory. They're curious about what's going on outside their territory, so they spend a lot of time reading signals and signs and marks from other coyotes. The same thing happens in other coyote studies; we know that if we want to catch a coyote, we better move a couple of miles away.

**YS:** How did you get from studying one species to studying the whole system?

**BC:** There was a point during my study when I asked myself, should I be going other places in my career, or really try to jump into a long-term ecological study of the coyote here? The timing seemed good because John Varley [*then-Yellowstone chief of research*] was encouraging so much ecosystem-type work here, and the interest and amenities provided by Yellowstone were so strong. It was tough to decide but I decided to stick with the coyotes and do what was really needed, a long-term study. It takes a lot of time to really capture the dynamics of a population, with a bunch of packs. Coyotes live 10 or 15 years, and a lot of those packs are stable, with the same Alpha pair for six years on the average. My goal is to look at all the elements of that, so that I can develop a complete picture of what makes it tick. But the coyote is a great way to look at the bigger picture. The coyote, in Yellowstone as well as across North



*Crabtree and YES interns recording data on coyote observations, and the YES team during alpine lake survey.*

America, has its hands in many places. Just studying the coyote in the Yellowstone Ecosystem brings you to so many other related ecosystem components and places that it can't help being interesting and fruitful.

### Launching a Bigger Project

**YS:** When you decided to go for the bigger study, rather than just putting in three or four years and leaving, how did you go about developing the necessary administrative machinery to carry it off. To put in place a long and complex study, you have to become a bureaucrat, don't you?

**BC:** True, and that process was the birth of Yellowstone Ecosystem Studies (YES). I had taught at an elderhostel when I first got here and I was really impressed with the quality of students in that group. I've spent a lot of time with kids—high school, special Olympics, boy scouts, and so on—and I thought "My God, these are the best students I've ever seen, and they want to do this so much they're paying for it." From there, I got involved in Earthwatch as a way to augment funding and go on some Earthwatch expeditions and learn how it was done. That was really good experience. I saw all these people doing good work, and I just thought "Wow, this is a really great way to educate people and get some good research done!"

**YS:** This question applies both to your coyote study and to your work with YES. How do you find such good participants? You attracted some very fine graduate students to your coyote study, and it's going to produce a great number of graduate papers and publications. How do scientists go about finding such people?

**BC:** There's a little bit of recruitment on my part, but Yellowstone does a lot of the work itself. For example, in 1990 I put one letter in the Animal Behavior Society newsletter, saying that I was seeking interns, and I still get letters inquiring about that. I think I got more than 350 responses, and more than 300 of those were from people with college degrees, seeking field experience. Yellowstone's a great place for that experience.

**YS:** There's a fair amount of skepticism in some scientific circles about using volunteers—that is, people without all

the formal training you have yourself—to gather data. There's an opinion out there that the results aren't as scientifically rigorous or trustworthy. How has that worked for you?

**BC:** I don't think there's anything magical about unleashed graduate students out there collecting field data on their own. There's nothing that automatically makes them better at doing science than anyone else. In my experience with both graduate students and many YES volunteers, the road to quality information is a matter of being excited about it. That means that the people are nurtured to do good work, they get supervision 100 percent of the time, and they are given attainable goals. You don't ask someone without training in wildlife biology to do something that is beyond them. If you keep your expectations sensible, you get great results. We've done blind tests of the data gathering, and the quality of the data from the volunteers is as high or higher as it is from people with degrees in the field being studied.

### Integrating Ecosystem Research

**YS:** Give us an example of what you would have folks like that do. Say somebody came in and they happened to have a bachelor's in geography or something at least remotely connected to your work.

What kind of information would you be training them and turning them loose to get?

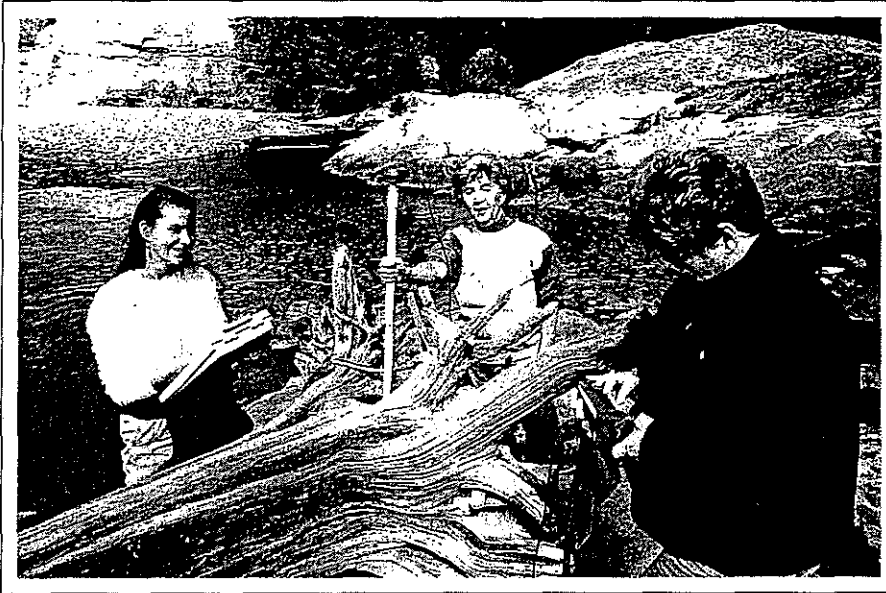
**BC:** Pebble counts along streams, collecting scats on trails, operating a global positioning system, clipping vegetation, observing wildlife and recording what they're doing, and a lot of other things. The point of this is that the kind of research that's coming on the horizon is baseline inventory monitoring, the sort of work that will tell us how these wild ecosystems are holding up under our use, and it doesn't take a rocket scientist to do it. If the supervision is good, and the group works together well, then these folks can make a big difference.

Let me put this another way. When it came to the broad-based research I wanted to achieve, academia wasn't enough. The traditional, university-based research approaches weren't handling that kind of thing. This ecosystem-scale community-level research I had in mind needed a broader approach. YES and programs like it are a whole new format.

**YS:** It's also pretty adventurous for all the people associated with the traditional research bodies, like the agencies and the universities.

**BC:** There has been a lot of talk of partnerships, but it's programs like YES that are really pioneering some of them. Believe me, it's difficult. I'm not saying





*YES researcher Patricia Zuwerink with YES volunteers and staff establishing GPS location of woody debris on Soda Butte Creek in northeastern Yellowstone National Park.*

maybe get some academic or corporate funding? Is there high-tech assistance available in global positioning systems? Then we laid it all out on the table so we could see the gaps, and tried to fill them. Of course if you're running a number of studies at once, you find that sometimes they fill each other's gaps.

So we would work with all these available resources, trying to fill in the holes from various places, and providing a sizeable labor force.

#### Who Does the Work?

**YS:** When it comes to the labor force—your volunteers, or participants, or whatever you might call them—have you found that they prefer only the glamorous work? Aren't some of your studies a little abstruse for them?

**BC:** That hasn't been a problem. We attract an amazingly diverse group of people, and some prefer the more famous kinds of studies, but we do dilute the glamour with the serious dose of hard work they all do. Just being in Yellowstone is enough for them, really; it re-

this just happens. Politically it's very challenging and scientifically it's very challenging.

You have these four basic groups of people: the management and regulatory agencies, the academic community, the corporate world, and the lay public. All four groups are going to be involved in the future of the resources in this ecosystem, and all will have some say in how the resources get used.

**YS:** They're not known for getting along well.

**BC:** Right, but what is starting to make it work now is the common denominator among them: they all need information. They all may want it in order to prove different things, but at least they all agree they need it. That universal need is what led to the establishment of YES, in 1993.

**YS:** How do you decide what you are going to focus on? It seems like almost every resource out there is in contention between at least two groups. Where do you start?

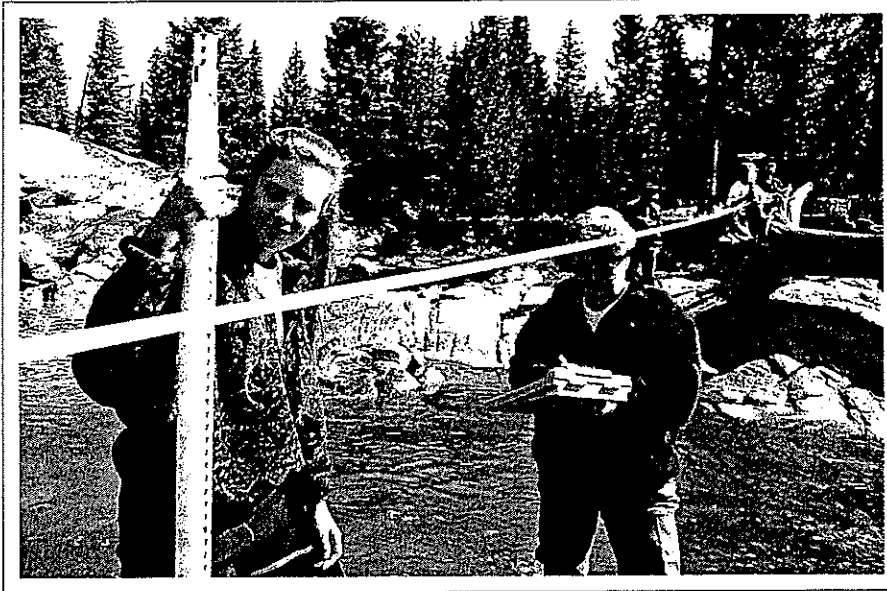
**BC:** We start with initial surveys, formal and informal, of the research management agencies of the Yellowstone Ecosystem. We took what they told us, synthesized it, and looked at the common needs of the agencies and the academic community.

We also focused on the studies that were underway, ones that had made a good start but were running out of funding. These were especially important to us, because, as I said earlier, we want

long-term information, and these studies might give us an opportunity to build on something that already existed. You might say we took an inventory of how big or broad the study was and how long it had been going, and then decided if it could be kept going with our kind of minimum funding. We would look at a study and ask ourselves a lot of questions about it: Can we get the necessary permits and permissions to continue it? Can we scrounge some radio equipment from an agency, maybe find some temporary quarters for staff from some other agency,

*YES staff biologist Steve Gehman (center, with intern and volunteer looking on) examines a whitebark pine tree for possible blister rust.*





*YES researcher Patricia Zuwerink and her team of volunteers conducting stream transect studies.*

wards them.

**YS:** What else attracts them?

**BC:** I think it's this feeling that they want to do something different with their vacation time. They make a tax-deductible donation to YES, and then they work on a project. They can see results. They often say something like, "You know, I've been getting tired of just getting my glossy magazines [from conservation organizations] in the mail, and I'm not sure where my contribution to Organization X went last year. This was a chance for me to not only have a great experience in a world-class ecosystem, but to know where my money is going."

**YS:** How long do they typically work?

**BC:** Anywhere from 8 to 13 days. Some stay for several projects, say for over a month, and the return rate is quite high.

**YS:** How many were involved in YES projects last year?

**BC:** About 100.

**YS:** How many different projects were they working on?

**BC:** We have 22 projects, so its an average of about four or five volunteers in a group.

**YS:** How are these projects set up? How do you supervise them?

**BC:** We have a volunteer to staff ratio of 3:1. We never violate that. We never have more than 8 volunteers in a group. Here's the makeup of a typical team. We have a leader who is an academic or a

person with a masters- or Ph.D.-level education. Often there will also be a logistics person, sort of field manager, who is well-versed in backcountry skills or natural history, and often is also an emergency medical technician (EMT). There may be an intern, too, someone who has a degree but is sort of a learning apprentice in the program; a fraction of the volunteer contribution also goes to sustaining the intern's room and board. The internship program is another exciting aspect of YES. The interns are cream of the crop kids that really need field experience in order to further their education or seek employment. They work for two to six months, depending upon the needs of their program and the project they take on; each of them spends their whole internship focused on one project.

**YS:** The interns are from universities? You find them through your academic contacts?

**BC:** We get two or three resumes a week. They just roll in, we interview the top ones, and we get wonderful people. The result is that in the projects that also have interns, the ratio of volunteers to staff is really 2:1. We'll have the leader, the logistics person, the intern, and then six volunteers.

#### **What is Being Studied?**

**YS:** Describe some projects.

**BC:** We're in the third summer of an alpine lake survey, working in cooperation with the U.S. Forest Service. We've taken on the Absaroka-Beartooth Wilderness Area, and we monitor air quality, acid precipitation, and so on. And we're using that opportunity to expand the breadth of the work, so we're surveying insects and small mammals and songbirds while we're up there. I figure if you're in there, you have a duty to try to help, so we're part of the National Fish and Wildlife Foundation's Partners in Flight program. That means we're out there trying to monitor species lists and neotropical migratory songbirds. That's all part of what you do if you're on the alpine lake survey. It's pretty inclusive.

Another one is trying to evaluate high-resolution technology as an aid to developing a long-term monitoring strategy for grizzly bears and other large mammals. Here we have one-meter resolution satellite imagery, and we're trying to be able to see if this technology can help us develop landscape profiles, in order to better predict where bears and other large mammals might go by matching up what is on the ground in terms of habitat requirements with high-resolution spectral signatures from satellites. It may be a much more efficient way of telling us what's available at any given time for these animals. And while we're there, we're running transects to look at white-bark pine surveys, which is helping the forest service and the park service out with their surveys of that sensitive species, which is a very important food source for grizzly bears.

I might add that a big goal of this work is to make it as nonintrusive as we can. We're really trying to help develop techniques that facilitate passive research of these secretive carnivores. We don't want to interfere with them while we're studying them. So we're looking at where they've been, recording what they've dug up and eaten, collecting scats, and all those things that will help us learn how they live.

Another project is one started by Wayne Minshall of Idaho State University. He and his colleagues started a research project just before the 1988 fires, to study how the burns would affect a variety of stream ecosystem processes. Again, YES

is focused on trying to make the most of some of these pre-existing ecological experiments, and Wayne's is perfect for us. Wayne started with funding from Yellowstone National Park, and actually he had been working that area before the fires, so there was a fabulous opportunity to study the same ecosystems before and after the fires. We're very excited about that; how many times in a continent's lifetime do you get a chance to study a wonderful fire like that? YES has now extended Wayne's work an additional three years.

That study has helped Wayne, and Wayne has gotten involved with Andrew Marcus [*Montana State University*], who is working on the geological processes that affect those same streams. So here you have a guy who studies the non-living parts of streams working with the guys studying the living parts of streams, and they worked together to find additional funding. We gave seed money to Andrew to get him going on Soda Butte Creek, which is a perfect paired watershed with Cache Creek; that means that now a burned and an unburned watershed, right next to each other, are being studied and compared. What started out as a fairly specific study has blossomed into something much broader, with the participation of all four groups I mentioned earlier.

**YS:** I'm sure you wouldn't mind elaborating on how your earlier coyote study fits into all this.

**BC:** Actually, to understand the coyote study you have to talk about wolf recovery. I give the park service a lot of credit for recognizing that we were going to need to know a lot more about a lot of species if we were going to get wolves, just as they recognized that one way or another, wolves were on their way. It's well known that wolves have a major impact on coyotes, and so it seemed important to understand the coyote before the wolves arrived. That foresight is still paying off, by the way; we now know, for example, that since the wolves of Yellowstone were killed off early in the century, the coyote has been the number one ungulate predator here. And so the coyote study was funded for six years by the park service, and YES has adopted the coyote study and has developed a moni-

toring program for measuring the four or five key parameters in the coyote population. Again, there's no overstating the value of continuing a long-term project. Just being out there to continue watching packs and individuals we've gotten to know for five or six years is worth it. We can passively do some really intensive research without having to trap the coyotes.

**YS:** What *are* those key parameters of the coyote population?

**BC:** One is litter size. Because of the radiotelemetry we did, we know that every pack has five or ten den sites, so we can visit those den sites and find the pups every year. Two others are pack size, in early winter and late winter. A lot of dispersal goes on between early winter and late winter. Others are things like recognition of individual pack members, by pelage characteristics or individual markings, and the behavior of the packs at carcasses.

Another project we're especially excited about is the medium-sized carnivore study. The forest service has a mandate to choose some indicator species, to help them monitor the health of the ecosystem, and they've chosen the medium-sized predators. It was Sue Consolo Murphy of the park service in Yellowstone who really got it started. A few years ago she experimented with putting out hair-snagging devices to try to identify which animals were out there, and I thought this was a great project for YES. We got involved, and a bunch of folks in the park were receptive, so right now we have three cooperative partnerships on paper, challenge cost-share agreements, involving Yellowstone National Park, Gallatin National Forest, the Targhee National Forest, Idaho Fish and Game, and YES.

By the way, these studies have caused some fascinating stuff to happen. I recently got a call from some folks in Cody that know a taxidermist who has a pelt from a fisher caught in the upper Clark's Fork area in 1888. People from the National Cancer Institute working with Montana State University are trying to extract DNA from it, so that if we ever do get a modern specimen we can see if it's a match to the earlier animal.

**YS:** Besides the wonderful time a lot of

people have, and the important scientific interchange you just described, what comes of all this YES activity? For example, scientists measure productivity in terms of publications; how are you doing there?

**BC:** Since the coyote study began, but mostly since YES was established, our work has resulted in a long list of publications: 6 M.S. theses, 6 scientific publications, 11 scientific reports to various management agencies, 1 popular book, more than 60 spoken presentations, 15 professional paper presentations, 1 nationally televised film, 3 YES newsletters, and 13 popular articles in magazines.

**YS:** One of the oldest debates in the scientific community is over what role scientists should take in the political dialogues. Some people see it as a matter of conscience to advocate certain political actions, and others see it just as much a matter of conscience to stay aloof of that process. YES works with people from so many institutions and agencies that it must be very complicated for you sometimes. How do you respond when someone asks you why you don't become political advocates on behalf of some good cause?

**BC:** I give them two reasons. First, I think everyone has a role to play, but that it's very difficult to play more than one role well. We stick to our one role, which is the gathering of information, and by doing so we do not blur our purpose.

Second, I think all those roles are important, but that at the foundation of all the elements of the dialogues is information. Information from the ecosystem is what needs to be listened to most. I guess that if we had a motto it would be something like, "The earth is speaking, and we're trying to listen to it."

So we're warriors for nothing beyond information and having that information collected objectively so that all four of the groups I mentioned—the agencies, the universities, the corporations, and the general public—know the same things and make decisions based on the same information.

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*For more information about Yellowstone Ecosystem Studies, write to P.O. Box 6640, Bozeman, MT 59711.*