

Bison TROUBLE WHERE THE ~~BUFFALO~~ ROAM

By Jay F. Kirkpatrick

Jay F. Kirkpatrick is a Senior Staff Scientist with the Deaconess Research Institute in Billings, Montana. He also holds positions as Associate Professor of Physiology at Eastern Montana College, Research Associate with the Toledo Zoo, and Adjunct Professor in the Department of Reproduction, School of Veterinary Medicine, University of California-Davis. He earned the Ph.D. degree in reproductive physiology at Cornell University, in 1971. Dr. Kirkpatrick's current areas of research include immunoneutralization of feral horses, white-tailed deer, and exotic zoo ungulates, and a study of reproductive self-regulation among the Yellowstone bison.

The North American bison (*Bison bison*) is clearly one of the flagship species with respect to American conservation biology. Herds of millions were reduced to fewer than 1,000 by the turn of the century, primarily through unrestrained market hunting and a planned program of annihilation by the U.S. Government, which was designed to eliminate the Northern Plains Indian as an impediment to westward expansion. Since that time America's bison herds have grown to greater than 100,000 animals as a result of captive breeding programs, the establishment of reserves, and a recent upsurge in commercial bison ranching. Today, almost anyone in the U.S. can view the hemisphere's largest native land-dwelling mammal within a reasonable drive from home.

It is only appropriate that the world's first national park harbors one of our largest bison herds in the U.S. Size alone however, is not the most unique feature of the Yellowstone bison herd, which today numbers between 2,500 and 3,000 animals. These wild creatures are the nation's only unmanaged bison and for the most part they do pretty much what they please with-

out interference from humans or predators. The story of the bison in the U.S. is not only a classic story of conservation but also one of irony. At the turn of the century the Yellowstone herd consisted of fewer than 100 animals and only the intervention of the U.S. Army—the same organization that was largely responsible for the species' demise in the first place—saved the small group of remaining animals.

Ultimately, the majority of these animals were captured, sent off to the Bronx Zoo, entered into a captive breeding program, and finally returned to the valleys of Yellowstone National Park, where they were joined by a small group of bison from western Montana and a few more animals from a private collection in Texas. From that tenuous beginning we have the magnificent herds that today roam the park's 2.2 million acres.

The Yellowstone bison herd is not a single discrete population. In reality it consists of three populations which pretty much stay to themselves. The largest population is the Mary Mountain herd, consisting of about 1,500-2,000 animals which roam the vast sage-covered hills of the Hayden Valley,

and west across Nez Perce Creek to the Firehole and the Madison Rivers. The Northern Range herd lives primarily along the Lamar River Drainage in the northern third of the park and consists of about 520 bison. Finally, there is the Pelican herd, living along the Pelican Valley just north of Yellowstone Lake. This is a small herd of several hundred bison about which little is known. Contact between these three herds is rare although a small group of the Pelican animals occasionally pass through the Northern Range herd during the summer months.

Very little is known about the reproductive biology of the bison, a fact that should not be too surprising when one considers the size of these animals—up to 2,000 pounds—and their intractable nature. It is not an easy task—or a safe one—to investigate the intricacies of their reproductive process with the same approaches we use on dairy bulls or beef cows. At the same time, effective management of free-ranging wildlife species relies upon a sound understanding of reproduction. Evaluation of sexual maturity, fertility, fecundity (birth rates), and fetal survival are useful for forecasting

the success or failure of a breeding group. Beyond reproductive potential, the general health and stability of a population is a reflection of its capacity to reproduce, because this non-life-threatening aspect of adaptive physiology is usually the first physiological loss resulting from severe stress.

In order to learn more about the reproductive biology of Yellowstone's bison, my colleague Dr. B. L. Lasley, at the University of California, Davis, postdoctoral student Diane Gudermuth, and I have taken a very different approach. We were interested in how bison regulate reproduction and produce more calves when environmental conditions are good and fewer calves when conditions deteriorate.

We hypothesized that differences in reproductive success had something to do with ovulation rates, pregnancy rates, fetal survival rates, or calf survival, but measuring the first three in wild bison could not be done with blood hormones, as usually is the case with the more tractable species. Instead, we decided to evaluate these parameters of reproduction by measuring reproductive hormone metabolites in urine and feces, something we had been very successful in doing in feral horses in recent years.

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tion, we are now in the process of comparing these four reproductive characteristics of two of the Yellowstone bison populations, the Northern Range and Mary Mountain herds. Animals are observed from early July through early September, and in each herd we count the number of sexually mature cows (two-years and older), the number of calves, and the number of yearlings.

During July, bulls, which spend most of the year separated



In 1850, tens of millions of bison, commonly called buffalo, roamed the Great Plains in herds exceeding those known for any other mammal ever. (Photo by Robin Smith)

from the cows, begin to drift into the cow groups in anticipation of the annual breeding season and, in late July or early August the rutting season begins with an amazing suddenness. This past year on August 3rd, in the Lamar Valley, we witnessed only a single tended cow (a cow in estrus, being closely attended by a mature bull) but by the morning of August 4th about 20% of the total cows were being tended.

During the first 14 days of the rut, which lasts about a month, we observe cows with calves and those

without and collect urine or fecal samples from them. The urine samples are collected by locating the urine-soaked soil (after the bison has moved on!) and centrifuging the urine from it. The fecal samples are collected and stored frozen. Later, in my laboratory in Billings, we can measure hormone metabolites which tell us whether or not the cow has ovulated. During November, we do the same thing and the hormone tests tell us if the cow is pregnant. In this way

we can determine important facts about reproduction without disturbing the bison or subjecting them to the stress of capture or immobilization.

We have learned some interesting facts about reproduction among the Yellowstone bison after only two years of this study. First, we see that cows

with calves do not play a significant reproductive role for any given year, and they do not, as a rule, ovulate or become pregnant. About 85% of the total pregnancies occur in cows without calves. This implies a significant cost of reproduction and an every-other-year breeding pattern. By comparing fall pregnancy rates with spring calving rates we can also estimate fetal loss and it appears there is very little loss among these bison. That is very interesting because about half of the Yellowstone bison test positive for the disease brucellosis, a disease which caus-

es abortion in cattle. This is a subject we will explore later.

Finally, we see that calf survival, to age one, runs about 50% and seldom higher than 60%. The severe winter conditions of Yellowstone take their toll, and the high calf mortality may signal that the Yellowstone bison herd has already exceeded its optimum size in the park. We do not fully understand why the cows with calves do not ovulate, nor do we understand why there is so little fetal loss, but in this safe, non-stressful and humane way, we are learning more about reproduction in these wonderful animals.

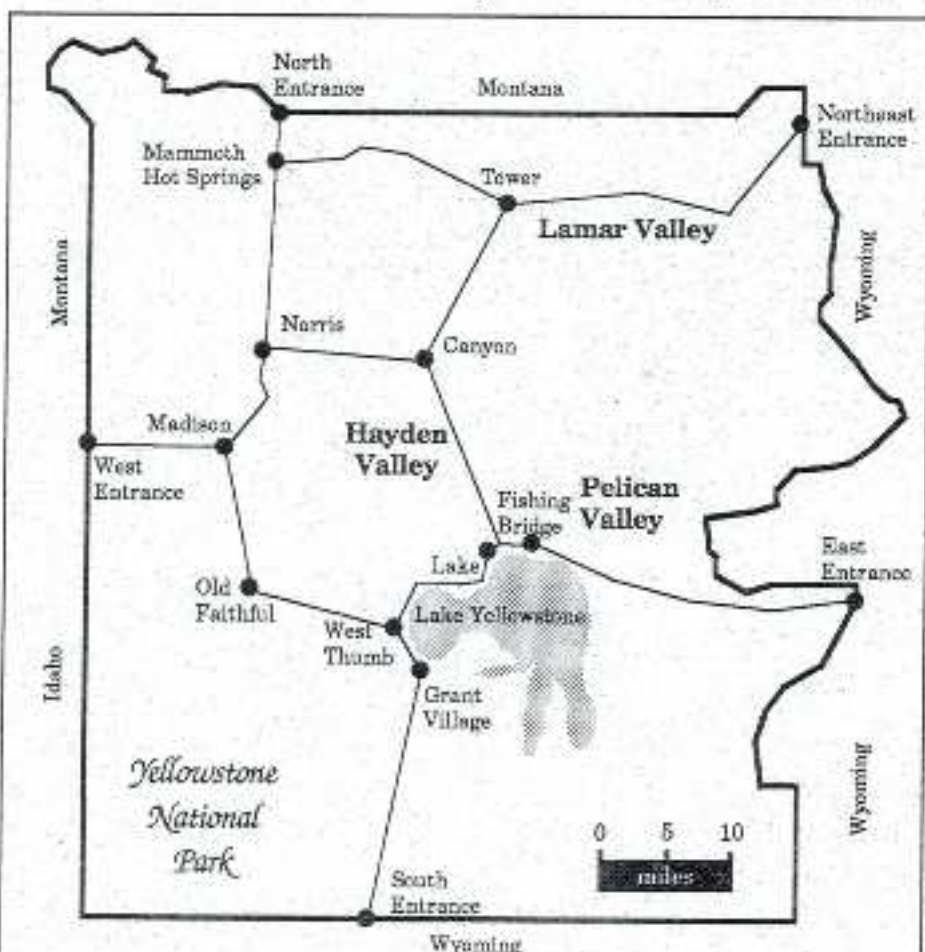
There are many who properly grasp the story of the Yellowstone bison as a great conservation success story, but fewer who realize the value of these animals as a scientific resource as well as an aesthetic one. Being our only unmanaged herd of bison, it provides us with our single opportunity to examine the biology of a social North American wild ungulate without the manipulating hand of humans impressed upon them. However, this population of bison lives with the threat of human intervention and it grows more serious every year.

In the decade preceding the great fires of 1988, the Yellow-

stone bison migrated from the park in ever-increasing numbers during the winters. Small groups from the Mary Mountain herd were found on rangeland on the western border of the park, near the town of West Yellowstone, and the largest numbers, from the Northern Range herd, migrated north out of the park along the Yellowstone River, north of the town of Gardiner. No one is quite sure why they did this. Yellowstone National Park biologist Dr. Mary Meagher believes the migration was at least in part the results of learned behavior, and that the animals found it easier to travel the plowed roads to Mammoth and Gardiner rather

than negotiating the deep snows. Others have attributed the winter exodus to ancient migratory urges, and still others to the search for new food supplies. This last theory may be the most credible. Prior to the great Yellowstone fires of 1988, significant numbers of Northern Range bison left the park during the winter months. Food supplies during those years were limited because of the size of the herd (approaching 1,000) and marginal range conditions.

In the three years following those fires, grasses have increased and in many areas revegetated what had obviously been relatively unproductive pine forests. Since the increase in quality and quantity of grass in the park, almost no bison have left the park in the winter. Of course, two mild winters may have confounded this theory. At the time of this writing, about 200 bison from the Mary Mountain herd were poised to leave the western border of the park, in the aftermath of a severe early winter storm. Regardless, at the present time there is more food in the park than the bison can use.



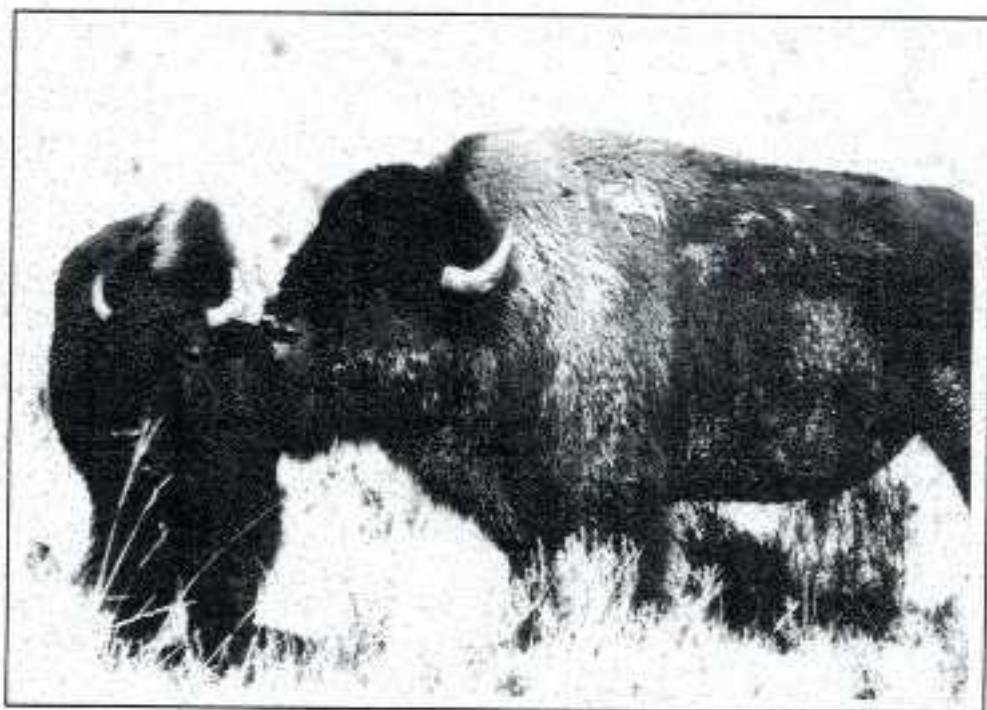
Yellowstone Bison Herds

NAME	PRIMARY LOCATION	SIZE OF HERD
Pelican Valley Herd	Pelican Valley	200-300
Northern Range Herd	Lamar Valley	520
Mary Mountain Herd	Hayden Valley	1,500-2,000

None of this would matter if it were not for *Brucella abortus*, an organism which is thought to infect the Yellowstone bison and which causes abortion in cattle. Blood tests from hunter-killed animals indicate that about 50% of the Northern Range bison have been exposed to the organism; note that these tests do not prove whether an animal is actually infected. We really have no idea how many animals, if any, actually have the disease. Montana has spent many millions of dollars to eradicate the disease among its cattle herd and is currently classified as a brucellosis-free state. The fear that the bison would spread this disease to domestic cattle on the lands adjacent to the park prompted the State of Montana to establish a legal bison hunt in 1985.

Until this past year, bison which left the park were "hunted" and shot. The numbers killed increased steadily and reached a peak during the winter of 1988-89, when record numbers of bison left the park following the 1988 fires and the temporary loss of winter range within the park. That terrible winter 589 bison, or about two-thirds of the Northern Range herd, were destroyed in the hunt. Because the hunt occurred on private lands outside the park, the National Park Service (NPS) could do little other than stand by and watch the killing.

Other federal agencies were less enlightened and it was almost as though the clock had been turned back one hundred years. Dr. James Glosser, a Montanan, and at that time the head of the USDA's Animal and Plant Health Inspection Service, publicly labeled the bison of Yellowstone as "those infected pests." Not to be outdone by a fed-



A cow in estrus being attended by a mature bull in Hayden Valley. (Photo by Robin Smith)

eral employee, fellow Montanan and State Representative Bob Gilbert, of Sidney, Montana (who holds the distinction of being the only state legislator to kill a Yellowstone bison), gave his own appraisal of the shaggy beast. "What bison are, in a nutshell," he said, "are big, ugly stupid cows. Their time has passed to roam free in the state. Their time was in history. To say it's all right for them to be free outside Yellowstone would be like bringing back the dinosaur."

With friends like these, the Yellowstone bison don't need enemies. Lawsuits by animal protection organizations, complaints by the Montana Department of Livestock, and heavy media coverage of the controversy have clouded the maelstrom and prevented the public from seeing clearly the issues at hand. Across Montana, the U.S., and even across the world, the destruction of those Yellowstone bison in 1988-89 were viewed with serious disapproval, probably for a variety of reasons. Some opposed the hunt because they oppose hunting in general. Others,

who generally approved of hunting, found the shooting of a bison, which stood broadside staring vacantly at its executioner 30 paces away, to be without any redeeming recreational features, damaging to the image of hunting, and downright disgusting. Still others, perhaps feeling the long-subdued guilt of our near extermination of the species a century before, became uncomfortable for reasons they may not have understood.

In any case, the Montana Department of Fish, Wildlife and Parks, recognizing the damage the bison hunt was doing to the public image of hunting, lobbied to eliminate the public hunt. However, the Montana Legislature voted down a bill to end the public hunt. Governor Stan Stevens, recognizing the nationwide view of a tarnished Montana image and fearing a tourism boycott lobbied hard to have the public hunt stopped, and in 1991, in a second vote, the Montana Legislature took the public hunt off the books. However, the policy that replaced the hunt was a masterpiece in confused logic. In

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the future, bison which leave the park cannot be killed by hunters but instead will still be destroyed, either by Montana game wardens or NPS rangers. This should be immensely satisfying to the bison! The best part of the new policy is yet to come. Calves will be captured and sold to commercial bison operations—despite the threat of brucellosis, which prompted the hunt in the first place, and which was based on the rationale that we need to protect animals outside the park! That, at least, takes care of the public hunting issue, but we must not lose sight of the fact that neither the stand of Montana's Department of Fish, Wildlife and Parks nor that of Governor Stevens had anything to do with the welfare of the bison.

Of course, brucellosis is still an issue. But now we are confused. If these animals have the disease, why don't we see significant fetal loss? Perhaps not very many of the animals actually have the disease. This is something we still don't know, but it is worth mentioning that the year that Montana hunters killed 569 bison the State of Montana could have answered that question with appropriate studies from the killed animals—but it didn't. Other than blood testing for exposure to the disease, which tells us virtually nothing of importance, the State of Montana did not collect the many tissues necessary to carry out definitive tests for the disease. The Department of

Livestock didn't carry out any studies, nor did Montana State University, the state's land-grant college, which is a mere 75 miles away. The Department of Fish, Wildlife, and Parks claimed they didn't have the man-power or the time to collect the necessary tissues, and the other agencies simply remained silent on the issue. This is strange behavior for a state that presumably feared its entire beef cattle herd was on the brink of destruction.

Another possibility is that the bison, which have tested positive for exposure to this disease for 74 years, really do have the disease but are immune to it. Still another possibility is that they have the disease but the organism is a subclinical strain—one which can infect animals but can no longer cause the symptoms of the disease. More research is needed to answer these important questions, but the real issues are still hidden beneath the miasma of hysteria and misinformation.

The main concern is with the Northern Range herd and its migration down along the Yellowstone River valley. This valley is about 15 miles long and constricted at the north end by Yankee Jim Canyon, a defile that bison are not inclined to move through. This valley is good winter range and a portion of it already has been purchased by Montana or by various public interest groups for winter

range for wapiti (elk). Why not let the bison share this small valley too? The answer of course, is that they will pass brucellosis on to Montana's cattle herd and destroy the state's economy.

Montana's cattle herd? Well, not exactly. Despite claims by the Montana Department of Livestock that there were 600-800 cows living in the valley, aerial counts conducted by The Humane Society of the U.S. during the winter of 1989-90, indicated that there were only 69 domestic cows living on private lands in the valley and aerial counts last winter showed there were 64. This in turn raises a new question. Why don't we just ship those 64 cows down to the Gallatin Valley in November, before the bison arrive, graze them on leased land, and return them in the spring, after the bison have returned home to the park? One large church-owned ranch in the valley already does this. The entire cost to do this, with money left over to repair bison-damaged fences, is less than that spent on a single court hearing over the matter last winter. The answer to this question has not been forthcoming.

It has always interested me that it is public knowledge that wapiti test positive for brucellosis too, but that there is little concern about them destroying the cattle industry despite the fact that there are many times more wapiti than bison. These wapiti leave the park by the thousands and they share private lands with cattle in the winter. Wapiti however, represent a major industry in the state in the form of big game hunting, so they are tolerated.

This, of course, brings us to the two remaining real issues. The first issue is who will ultimately have the say in the management of Yellowstone's resources? Will it be public opinion or the cattle indus-

try? This same question is at the center of the Yellowstone wolf reintroduction debate and extends far beyond the bison. The public sector has made it clear that they want wolves back in Yellowstone, but the livestock industry has, through political manipulations, delayed the reintroduction.

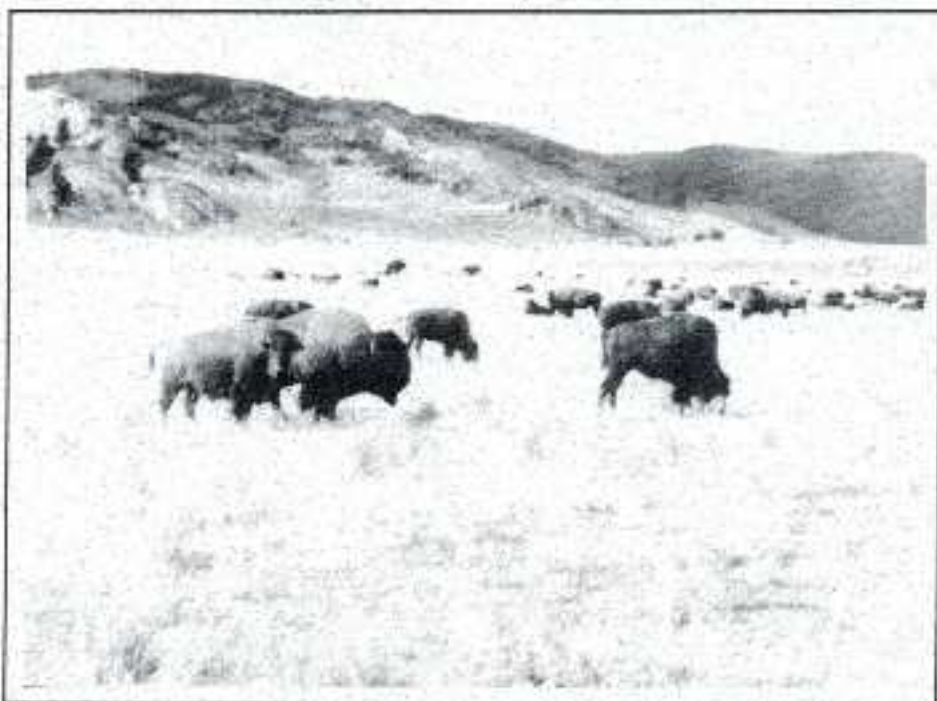
The second issue is how will the park's bison herd be managed? For the next several years that question might be avoided, but one day it will become *the* question. Since the regeneration of grasses after the 1988 fires, the bison have not left the park in great numbers. We don't know whether it's because there is just so much more food available in the park now, or the lack of impetus by the absence of hard winters, or perhaps the bison have just learned to avoid the valley—if they can learn to walk plowed roads they might be smart enough to stay away from hunters.

We have found the Northern Range herd is far more likely to be spooked by the presence of humans, even in the park, than the Mary Mountain herd, which has not had the same disastrous experiences with hunters. Whatever the cause, the real issue has been temporarily forgotten. Reproduction usually speeds up with improved nutrition and we believe we already see increased birth rates among the bison as a result of all the new fire-generated grasses. It is certain that population increases will occur during the next ten years and one day soon—at least by nature's clock—there will be too many bison in Yellowstone National Park. And, if hunting is unacceptable, and if there are no

more lands for winter range outside the park, what will be the fate of the bison?

The solutions are limited in number. One solution that has been suggested but which won't work is fencing the animals in the park. First, it is likely that anything short of the Berlin Wall would fall short of a successful barrier to these great beasts. Also, such a fence would block the normal migration of wapiti out of the park as well, and that wouldn't be acceptable to out-

that possibility completely out, the logistics are Herculean and at the very least daunting to even the most optimistic soul. Present vaccines are thought to be only about seventy percent effective in bison. Inoculating three thousand bison, even with remotely-delivered darts poses a logistical problem of no small dimensions. In addition, if this course of action was selected, we would also have to consider booster inoculations every several years.



Instead of shooting bison that wander out of the park, IDES is promoting the redrawing of park boundaries to include bison winter range and better reflect ecological boundaries rather than the arbitrary, political park boundary. (Photo by Jay F. Kirkpatrick)

fitters or hunters, or good for Yellowstone National Park.

Another solution that has been suggested is to destroy the entire herd—all 3,000 bison—and start over with a "clean" population. Unfortunately, unless we are willing to destroy the brucellosis-infected wapiti herd too, they will just pass the disease back to the new herd of bison.

Still another proposed solution is to inoculate the Yellowstone bison herd against *Brucella*. While I wouldn't rule

A sobering thought is offered by Dr. Don Davis of Texas A & M University, an expert in wildlife diseases. According to Dr. Davis, no wildlife disease has ever been eradicated without eradicating the species. That is surely a path that we, as a nation, are not ready to embark upon. We already tried that once!

It has been suggested that NPS employees could cull the herd within the park itself. This, in fact, was NPS policy during the

first half of this century, and has been attempted more recently with wapiti in Yellowstone during the late 1950s and early 1960s. Public disapproval was immense and the precedent of destroying animals in their own refuge is disturbing. This approach gains some support from the culling (killing) of elephants in Kruger National Park in South Africa to keep populations within the carrying capacity of the park. Nevertheless, in a time of changing societal values and greater concern for wildlife, it is unlikely to ever have public support.

One good possible solution to the problem is the acquisition of private lands outside the park, along the Yellowstone River south of Yankee Jim Canyon, and around West Yellowstone on the west side of the park, for bison winter range. These lands could be purchased by private groups, as the Rocky Mountain Elk Foundation has already done for winter range for wapiti, or by federal agencies such as the NPS or the Forest Service. In these days of budget cuts and deficit reduction that solution is unlikely, too. A reasonable alternative would be to transport all cattle out of the bison's winter range during the winter months. The cattle could be grazed on leased

lands north of Yellowstone in the Gallatin Valley and returned in the spring, after the bison have returned to the park. The costs for such a solution are less than attorneys' fees for the trials that have already resulted from this issue, and there would be money left over for repairing fences, too (bison are guilty of disrespect for fences!).

Another possible solution, would be the translocation of excess Yellowstone bison to the Centennial Valley of Western Montana. This valley, which is approximately 30 miles wide and 50 miles long has been described by some as the Serengeti of the U.S. More than half of the valley is already owned by the Federal Government, and there are fewer than a dozen homes and a dozen land-owners. Bison removed from the Yellowstone herd could be tested for *Brucella* and placed in this valley, creating a large, free-roaming, disease-free herd.

A final consideration is contraception of the animals. While this might at first sound bizarre, the NPS is already using fertility control to regulate population growth among feral horses on Assateague Island National Sea-

shore, studying the possibility of using it for controlling feral donkeys in Virgin Island National Park, and white-tailed deer on Fire Island National Seashore. The NPS has even investigated the feasibility of using contraception to control mountain goat populations in Olympic National Park. The technology to accomplish this Herculean task is just in the developmental stages, but experiments at the Cologne Zoo in Germany indicate that an antifertility vaccine, that could be delivered by dart, will probably work on bison.

Yellowstone National Park does not belong to Montana, or Wyoming, or Idaho, and its wildlife cannot be managed from the narrow perspective of livestock growers bordering the park. In a sense, Yellowstone and its wondrous wildlife does not belong just to the U.S. It is a remarkable resource adrift in a sea of rapidly decreasing wild areas, and, as the planet's first national park, it really belongs to the world, in much the same way Kenya's Amboseli National Park belongs to the world. Now is the time for public debate and consideration of the bison's fate, before the herds increase and it is too late for reasoned and humane policies to be put into place. □

Get Involved!

Several federal and Montana state agencies are currently in the early stages of developing a Bison Management Plan and Environmental Impact Statement. When completed, this plan will decide the issue of how Yellowstone bison will be managed when they leave the park. This spring, public meetings will be held in cities around Yellowstone National Park to obtain public input (the federal government calls this the Scoping process). People who do not live in the area and cannot attend the meetings can still participate in the Scoping process by writing to the following address and requesting to be placed on the mailing list for the Bison Management Plan:

Superintendent
Yellowstone National Park
P.O. Box 168
Mammoth Hot Springs, Wyoming 82190