Where Markets Meet the Environment

PERC REPORTS

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Special Issue

YELLOWSTONE: ECOLOGICAL MALPRACTICE

by Charles E. Kay

Photographs from his independent study

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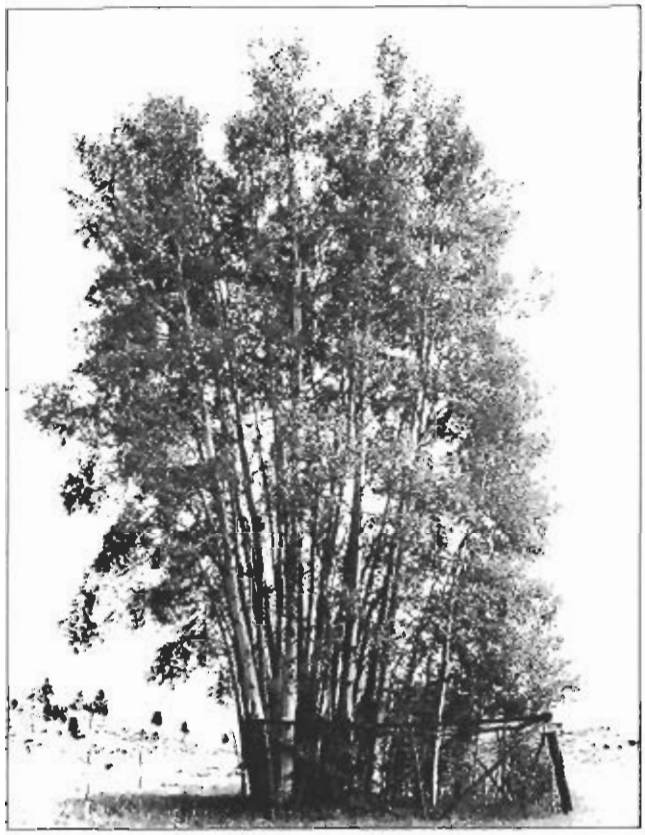

Trees grow where the elk can't browse.

INSIDE: EXCLUSIVE PHOTOGRAPHS

This issue features photographs showing the ecological decline of Yellowstone National Park. These photos astounded congressional representatives when Charles Kay presented them in testimony.

"NATURAL REGULATION"

Kay's study of Yellowstone is an independent analysis of the park's "natural regulation" management. His photographs show the condition of the park's rangeland over the past century.

THE "SMOKING GUN"?

Kay's photographs show how browsing by elk and bison has stunted willow and aspen and wiped out the beaver. To some observers, these are the "smoking gun" of "natural regulation."

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PERC
SPECIAL REPORT

Foreword

by Terry L. Anderson, PERC Executive Director

During the cold, snowy winter of 1997, bison from Yellowstone's northern herd began migrating from the park in search of food, creating a political nightmare. Because many of the park's bison carry brucellosis, a disease that causes domestic cattle to abort, Montana ranchers forced state and federal officials to kill the infected animals. The killings aroused public anger and spurred protests by animal rights activists. In fact, one woman expressed her outrage by throwing bison innards at Interior Secretary Bruce Babbitt and Montana Governor Marc Racicot as they met to discuss the problem.

The publicity over bison management had one favorable result: It provided an opportunity for a number of biologists to speak out about the way the park is regulating its elk and bison. These biologists argue that populations of elk and bison on Yellowstone's northern range far exceed the range's capacity. They say that the ungulates—an elk herd estimated to number 20,000 and a bison herd estimated at 4,000 (before the ravages of the 1997 winter)—are overgrazing the northern range of Yellowstone and causing severe ecological damage.

From 1920 to the 1960s, the Park Service trapped, transported, and culled elk to keep their numbers in check. However, in 1968 this program was replaced by "natural regulation." The National Park Service now contends that the thousands of elk and bison on the northern range are part of a natural progression that will be self-correcting if and when numbers get too high.

One of the growing number of biologists who question Yellowstone's management philosophy is Charles Kay, Adjunct Assistant Professor in the Political Science Department of Utah State University. For more than a decade, Kay, who has a Ph.D. in wildlife ecology from Utah State University, has conducted an independent analysis of the park's "natural regulation" paradigm. This special issue of *PERC Reports* features examples of the graphic evidence he has compiled. Comparing turn-of-the-century photos of Yellowstone habitat with today's pictures of the same places, he provides persuasive arguments that it is time to abandon "natural regulation."

Other scientists agree with Kay's assessment of Yellowstone's northern range. Wayne Hamilton, a Ph.D.

geologist who worked in the park for twenty-five years, says that overgrazing is "being camouflaged."[1]

Richard Keigley, an ecologist with the federal Biological Resources Division, also believes that the park is being overgrazed. He recently was denied a permit to do research in Yellowstone. When he was asked to testify before the House Parks and Public Lands Subcommittee, Interior Secretary Bruce Babbitt denied the request. The committee then issued a subpoena, and Keigley testified that elk and bison are damaging the park. Says Keigley, "Bureau of Land Management range managers have told me they would consider the northern range overgrazed. If the northern range is truly a healthy ecosystem, the BLM (cattle grazing) permittees should be allowed to make their grazing allotments just as healthy."

Bob Ross, a retired Soil and Conservation Service range specialist who conducted research in Yellowstone in the 1960s, is perhaps even more outspoken. "Their [the Park Service's] research is practically all prostituted. The Park Service has covered their own backs and feathered their nest by baffling the people for years and years. They're peer reviewed by the same people looking over each other's shoulder."

The Park Service counters with claims that "natural regulation" is working as predicted. Yellowstone Park Superintendent Mike Finley asserts that "though the ungulates consume large quantities of grasses and forbs on the northern range, none of the traditional signs of overgrazing are being found." He contends that "aspen have always been a marginal species in Yellowstone," despite the fact that there are healthy stands just outside Yellowstone's border. To support his position, Finley sent a 13-pound pile of research papers to key reporters. "Virtually all of this science supports the idea that the northern range is not overgrazed and that natural regulation is working very well," said Finley in his letter.[2]

The report by Charles Kay that follows does not weigh thirteen pounds, but in this case, "a picture is worth a thousand words." If Charles Kay and other scientists are correct, the system is broken and it needs fixing. The incentives are wrong, and we need to get them right if we are to preserve our national parks unimpaired for future generations.

[1] This and the other quotes from scientists are found in S. McMillion. Some scientists say overgrazing a reality in park. *Bozeman Daily Chronicle*, April 17, 1997. p. 8.

[2] Finley quoted in S. McMillion. Park officials dispute claims of overgrazing. *Bozeman Daily Chronicle*, April 17, 1997. pgs. 1, 8.

A Selection of Photographs and Text from

YELLOWSTONE: ECOLOGICAL MALPRACTICE

by Charles E. Kay

■

These photographs and text are excerpted from my manuscript on management in the Yellowstone ecosystem. That work, entitled *Yellowstone: Ecological Malpractice*, will include twelve chapters on ungulates, range condition, and grazing, and will summarize the thousands of vegetation measurements that I have personally made over the last fifteen years. There will also be chapters on grizzlies, wolf recovery, black bear, bison, and the 1988 wildfires. These will be followed by two chapters that will deal with environmental politics and the press. In addition, there will be an extensive chapter on the misuse and corruption of science by government agencies and others. In the final chapter, I will offer a new perspective on ecosystem management based, in part, on my recent work for Parks Canada.

My research in Yellowstone National Park was funded by the Welder Wildlife Foundation of Sinton, Texas. It is the only independent analysis of the park's "natural regulation" program that has ever been conducted.

■

1

Elk and Bison Starvation

■

Yellowstone National Park is currently administered under what is termed "natural regulation," or hands-off management. According to the view of nature underlying this approach, predators have no effect on ungulate populations; instead, the number of elk and bison is determined by the available food supply. When these animals exceed the available food supply, the weaker ones die. In other words, the Park Service contends that it is natural for thousands of elk and bison to starve to death.

Historical evidence, however, contradicts these claims. In the past, Native American hunters kept the numbers of elk, deer, and bison low, so that there was no overgrazing. As a result, Yellowstone's rangeland could support a great variety of plants and animals.

Today, Yellowstone's northern range is overpopulated by elk and bison. Their overgrazing has denuded the range, destroying plant communities and eliminating critical animal habitat. The result has been a drastic decline in Yellowstone's biodiversity.

■

1a. This is one of 5,000 elk that starved to death in Yellowstone during the winter of 1988-89. Note how the animals, in their search for food, have destroyed the tall willows along the banks of the Gardiner River. Shown is Fred Wagner, Associate Dean, College of Natural Resources at Utah State University. Photo by Charles E. Kay.

1b. This is another of the thousands of elk that have starved to death in Yellowstone over the years. The photograph shows how starving animals have destroyed the aspen community. Contrast this with Figure 14, which shows how the park's aspen communities once looked. The tall willows in the background are within a fenced area where elk are excluded (see Figure 4). Photo by Charles E. Kay.

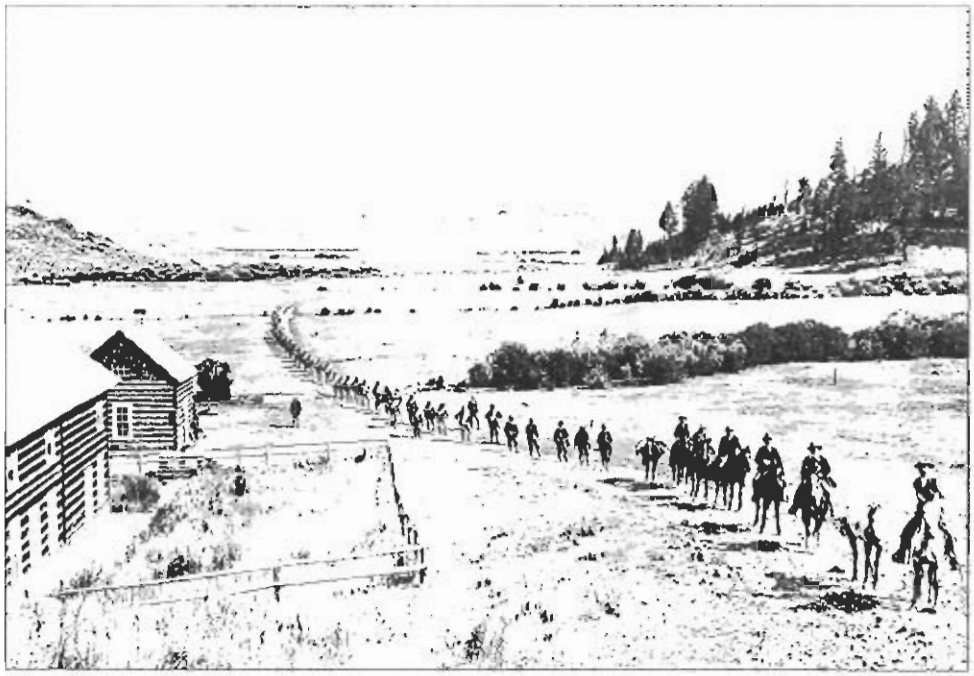
2

Willow Decline

■

Riparian areas, the land alongside streams and rivers, have the greatest biodiversity of any habitat type in the West and thus are critical to range and ecosystem management. Yellowstone's burgeoning elk and bison populations, however, have destroyed the park's willow communities by repeatedly browsing those preferred plants. Examination of 44 sets of repeat photographs indicates that tall willows on the northern range have declined by more than 95% since Yellowstone was established as the world's first national park in 1872.

■



2a. In 1893, tall willows like those across the center of the photo were common on Yellowstone's northern range. Shown is Yancey's Hotel and Company D of the Minnesota National Guard on patrol along the old park road. The military administered Yellowstone Park from 1886 to 1916, when the National Park Service was established. Photo courtesy Haynes Foundation Collection, Montana Historical Society, Helena, Montana.

2b. In this picture of the same area 100 years later, tall willows have been completely eliminated. The old hotel was burned down by the Park Service and the new facilities are used by a concessionaire for stagecoach rides and steak cook-outs. Photo by Charles E. Kay.

3

Willow Disappearance

■

Outside the park where there are fewer elk, tall willows are still abundant and have actually increased in some repeat photographs published elsewhere. Since the general climate is the same inside and outside the park, this suggests that Yellowstone's willows have not declined due to climatic change as postulated by the Park Service. In addition, willow communities burned by the 1988 wildfires have not been able to regenerate in the park because of excessive browsing.

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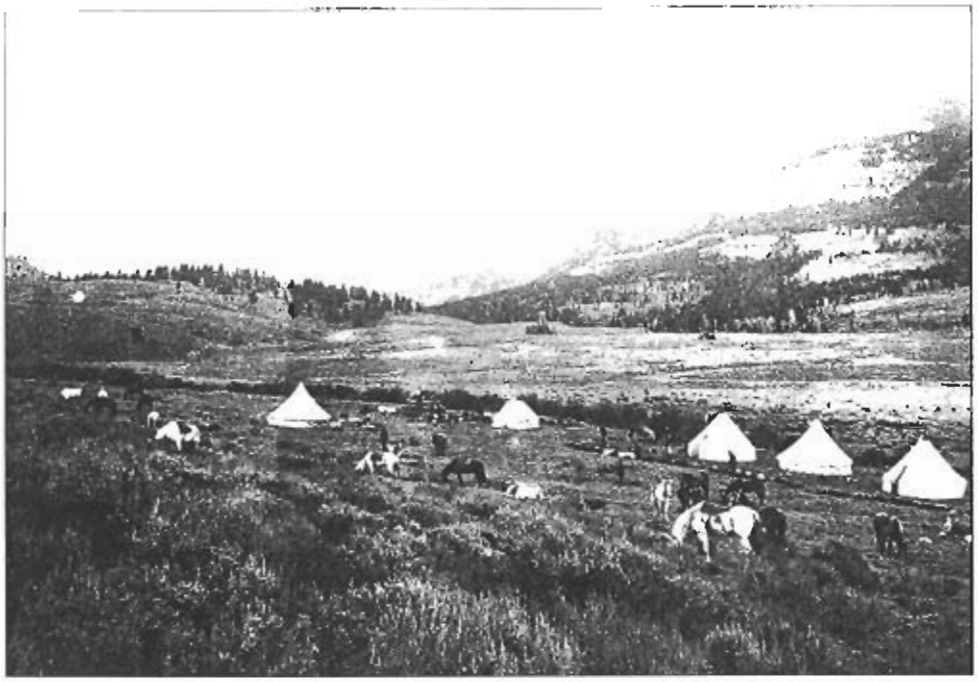

3a. This military expedition on patrol on Yellowstone's northern range in 1897 frequently encountered tall willows, such as those behind the tents. Photo courtesy of the A.E. Bradley Collection, K. Ross Toole Archives, University of Montana.

3b. One hundred years later, the tall willows have been completely eliminated by excessive ungulate browsing. Photo by Charles E. Kay.

4

Willow Exclosures

■

That the decline of tall willows in Yellowstone National Park is due to excessive browsing, not other factors, is shown at the park's "exclosures"—fenced plots that exclude elk and other ungulates. When the park and surrounding areas were studied in 1986, browsed willows on permanent plots outside park exclosures averaged only 13 inches tall, had only 14% canopy cover, and produced no seeds. In contrast, protected willows averaged nearly 9 feet tall, had 95% canopy cover, and produced over 300,000 seeds per square meter of female canopy cover. (Willows have separate male and female plants.) The condition of the protected willows is close to the condition that they would be in throughout the park if there were no overgrazing. Moderate grazing does not harm willows and may in fact encourage their growth.

Not only have Yellowstone's willow communities been severely degraded, but they are among the most overgrazed in the entire West. This overgrazing has had a devastating impact on riparian songbirds and other animals. If this had happened on public grazing allotments outside the park, it would be a clear violation of U.S. Forest Service and Bureau of Land Management grazing standards.

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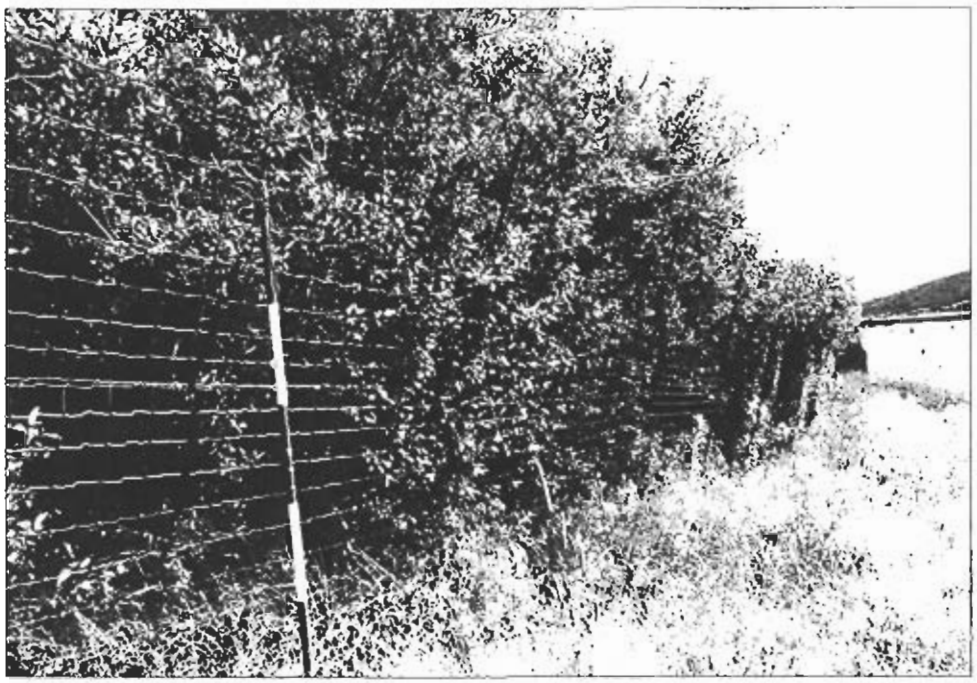

4. The fenceline contrasts willows inside (left side of photo) and outside the Lamar-West exclosure on Yellowstone Park's northern range. The exclosure was built in 1962 and this photograph was taken in 1986. To appreciate the scale of the picture, note the 6-foot tall survey pole. Photo by Charles E. Kay.

5

Aspen Decline

■

Yellowstone's burgeoning elk population has also had a dramatic impact on the park's aspen. Aspen grows as clones, in which all the trees in a stand are genetically alike, having arisen from a common root stock. Due to aspen's demanding seed-bed requirements, aspen clones have not been established from seed for several thousands of years in the western U.S. Instead, the present trees regenerated primarily by root suckers, which are new shoots that emerge from the tree roots. Now, however, all those new shoots are repeatedly browsed by elk. This has prevented aspen regrowth and eliminated aspen from large areas of the park. Examination of 81 sets of repeat photographs indicates that the area occupied by aspen has declined by more than 95% since Yellowstone Park was established. This has had a drastic effect on the park's biodiversity because aspen stands support more species than any other forest type in the West.

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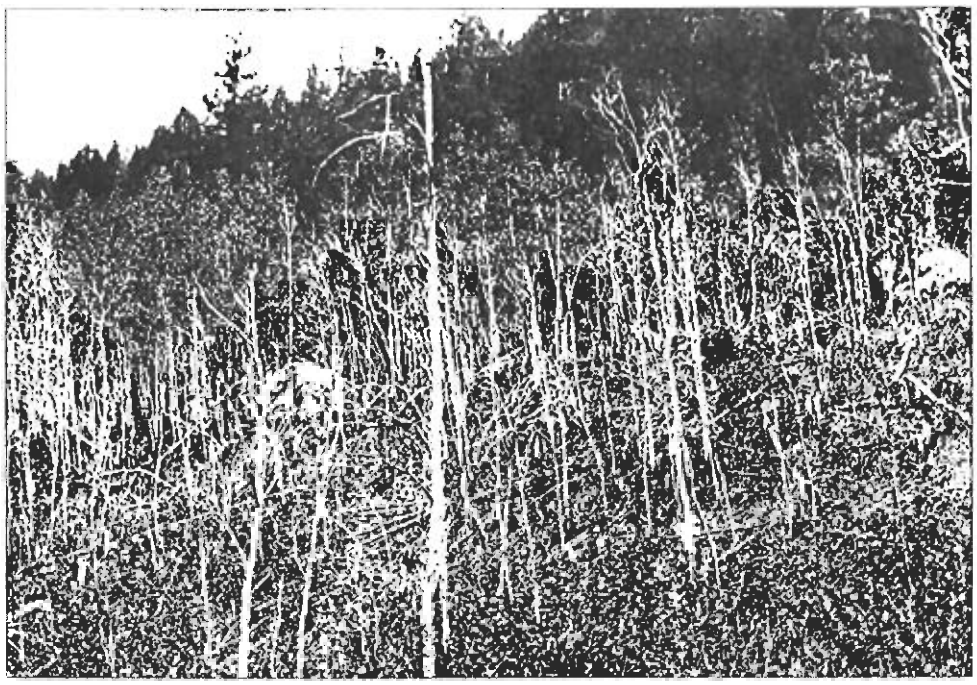

5a. Aspen in this 1922 photograph on Yellowstone's northern range were being felled by beaver (see Figure 9), but there was a profusion of new aspen suckers. Notice the two large boulders behind the aspen stand. Photo by Edward Warren, SUNY ESF, Archives.

5b. Sixty-six years later, aspen has been eliminated due to excessive ungulate browsing. The two large boulders match those in the original photograph. Photo by Charles E. Kay.

6

Aspen Disappearance

■

Aspen was able to maintain its abundance in Yellowstone for thousands of years prior to park management, but if present trends are allowed to continue, aspen will be ecologically extinct in Yellowstone National Park within our lifetimes—that is, aspen as a species will no longer fulfill its former role in the biological community. Something is clearly different today than at any point in the past. As noted previously, aspen provides the highest biological diversity of any forest type in Yellowstone, so its loss has ramifications far beyond the elimination of a single species. This is why aspen is considered a critical indicator of ecological integrity.

■

6a. Aspen in this 1952 photograph were declining due to excessive browsing by elk and other ungulates. National Park Service photo.

6b. Today those aspen clones have been completely eliminated. Overgrazing has also had a dramatic impact on understory plants, completely changing species composition. Photo by Charles E. Kay.

7

Aspen Exclosures

■

That the decline of aspen in Yellowstone is due to excessive browsing, not other factors, is shown at the park's exclosures. At all fourteen exclosures in the Yellowstone ecosystem, protected aspen has successfully regenerated, producing stands like those seen when Yellowstone Park was first established (see Figure 14), while browsed stands have continued to decline.

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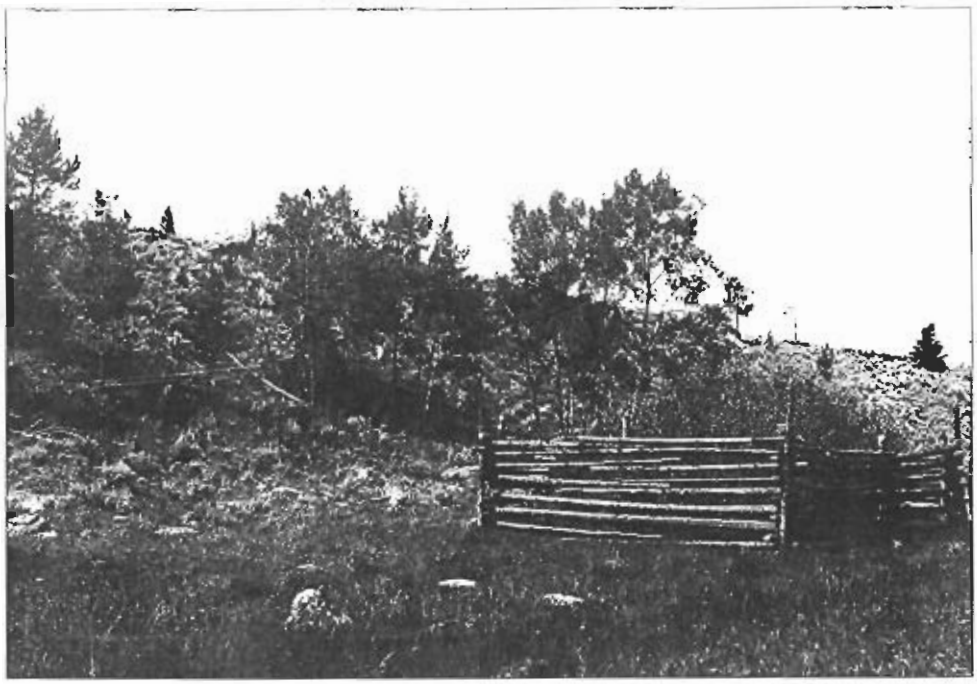
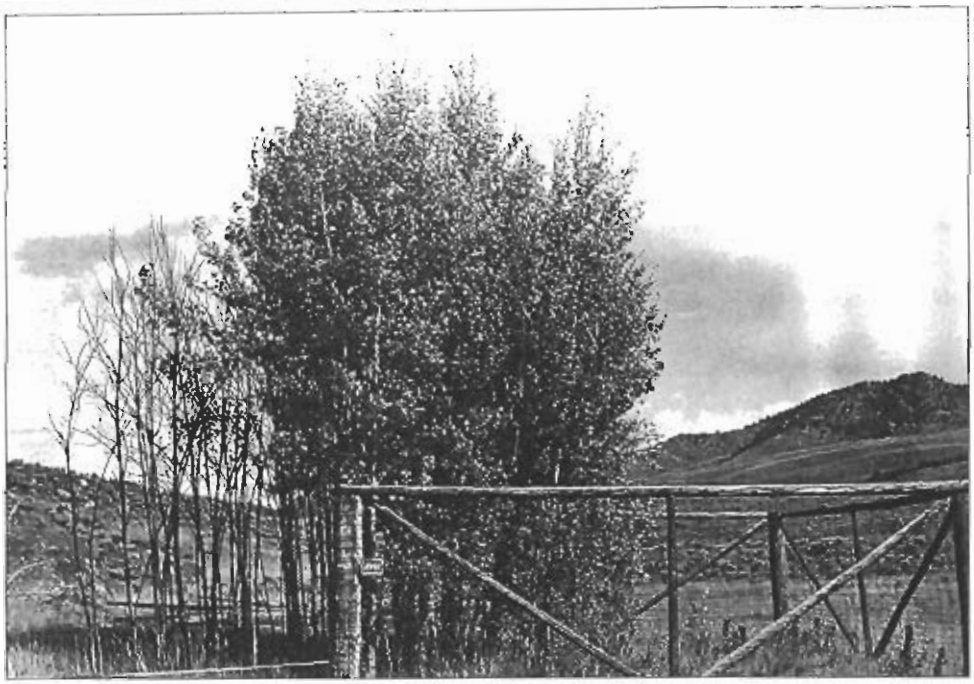


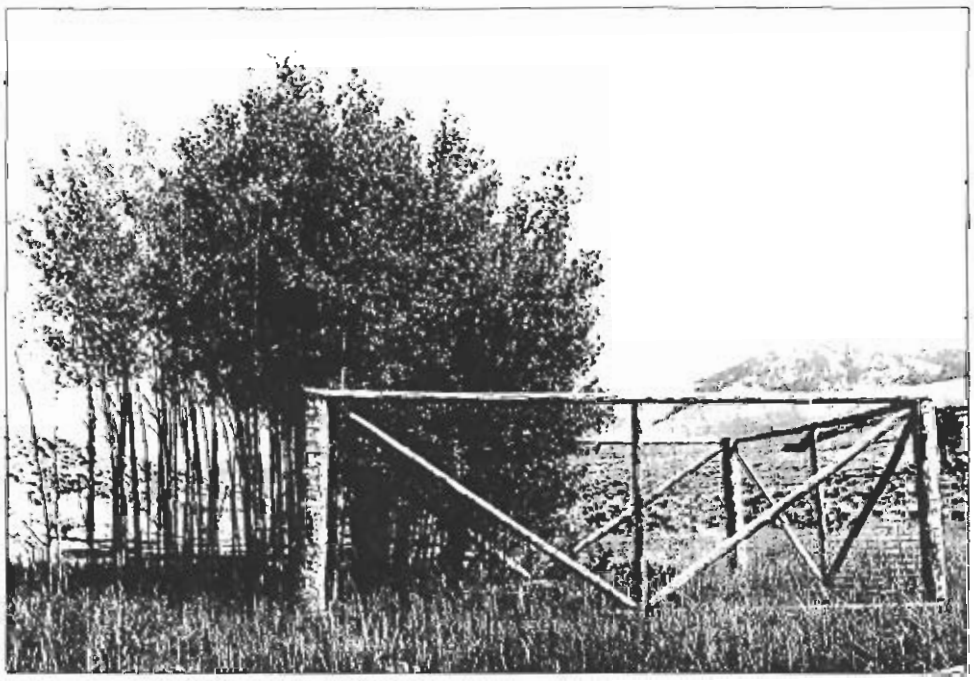
7a. This 1932 photo shows aspen that has regenerated inside an old, unused hay corral on Yellowstone Park's northern range. The roots from the aspen on the hillside had produced suckers inside the corral, where the new shoots were protected from browsing. National Park Service photo.

7b. As an experiment, the Park Service removed the old hay corral in 1936 and built Range Plot 25 in a way that half of the aspen were exposed to browsing while the other half were protected. This photo was taken during construction. The aspen to the right of the post were protected inside Range Plot 25, while elk had access to the rest. National Park Service photo.

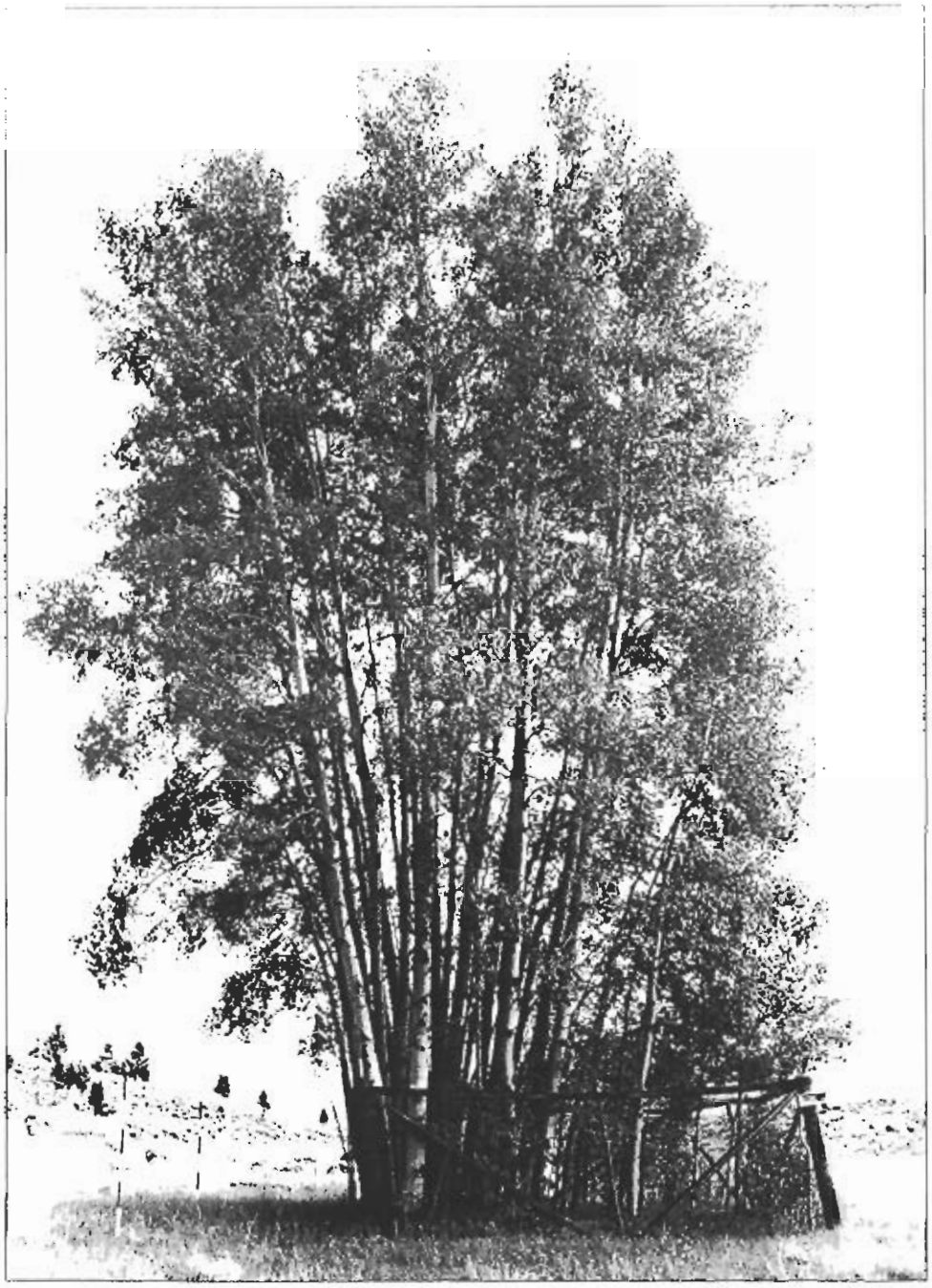
Note: Photos 7c and 7d were reversed in the printing process.



7c. Within one year, elk had consumed all the lower branches from the aspen as high as the starving animals could reach. This is termed "highlining" and is a sign of overgrazing wherever it occurs in the West. National Park Service photo.



7d. By 1941, virtually all the aspen outside the exclosure had been killed by elk, even though the tree's terminal branches were beyond the reach of those animals. Elk ate the lower bark from the aspen, and this killed the trees. National Park Service photo.



7e. In 1986, Range Plot 25 had aspen that were over 60 feet tall and nearly 10 inches in diameter. Like aspen inside all other exclosures, these trees show no signs of physiological stress, which suggests that the park is not climatically marginal for aspen, as the Park Service claims. The two survey poles to the left of the exclosure are 6 feet tall and mark the edge of the outside aspen plot. Photo by Charles E. Kay.

8

Aspen Burns

■

Under "natural regulation," the Park Service claimed that Yellowstone's aspen would successfully regenerate, despite high levels of ungulate browsing, if the clones were burned. Unfortunately, this did not occur. After the wildfires of 1988, I established 765 permanent plots in 131 burned aspen stands. The fire-killed aspen produced a profusion of new suckers, but elk and other ungulates repeatedly browsed those plants to within inches of the ground each and every year. This completely killed many of the park's aspen clones. Thus, burning plus repeated browsing only hastens the elimination of aspen, the exact opposite of what the Park Service told the public for more than twenty years.

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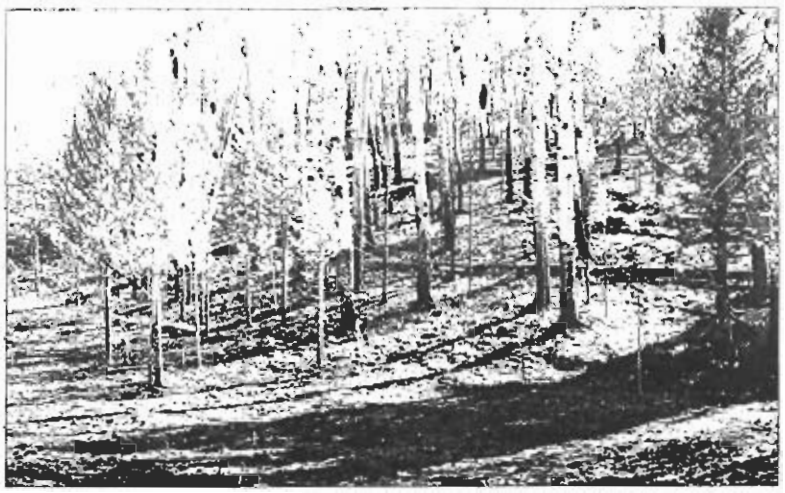
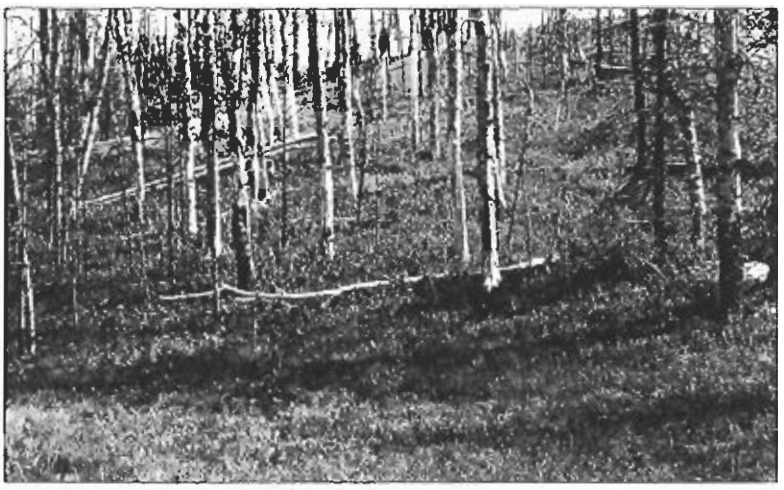


8a. This is one of 765 permanent plots that were established in aspen stands burned by Yellowstone's 1988 wildfires.

8b. That same site the following fall had a profusion of new aspen suckers, especially in the foreground.



8c. Two years later, however, repeated browsing had killed all the new suckers and completely eliminated this ancient, old-growth aspen community. All photographs by Charles E. Kay.

9

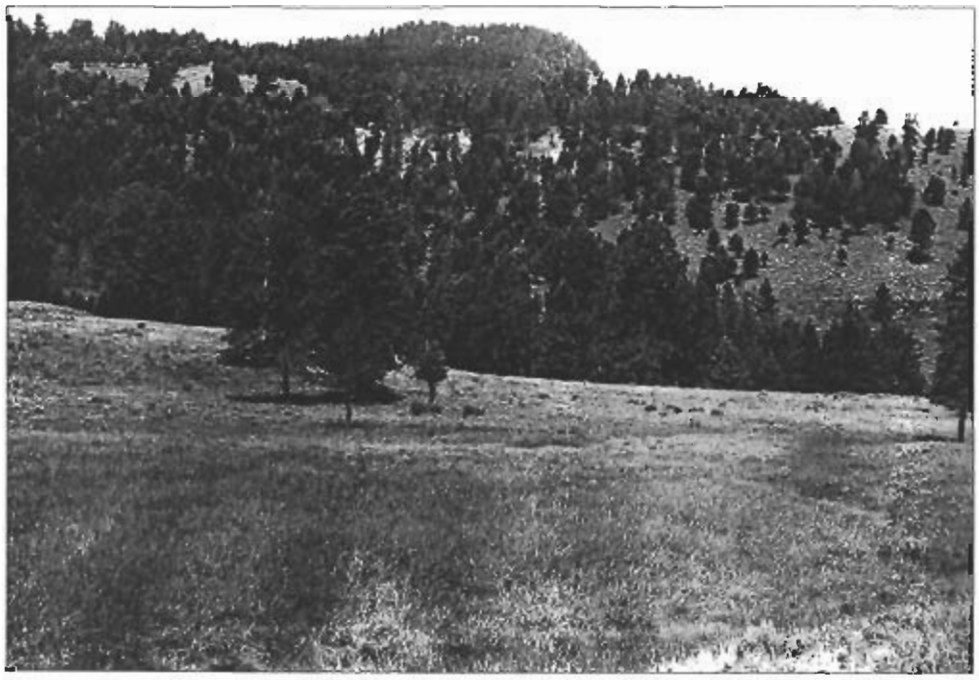
Beaver Disappearance

■

Beaver were once common in the park, but that species is now ecologically extinct (that is, they no longer fulfill their past ecological role) on the northern range because overgrazing has eliminated the aspen, willows, and cottonwoods that beaver need for food and dam-building materials. Beaver are what is called a keystone species because they are critical in structuring ecological communities. With the virtual elimination of beaver, the park has suffered a tremendous loss in biodiversity, unlike the Yellowstone of earlier times.

■

9a. Shown is a 1921 photograph of a beaver colony on Yellowstone Park's northern range. The beaver dam is at the right of the photo, while the lodge is on the left. Note the willows and aspen that the beaver were using for food and dam-building materials. Photo by Edward Warren, SUNY ESF, Archives.



9b. That same area 65 years later shows that excessive ungulate browsing has eliminated the tall willows and aspen. Beaver have not been able to occupy this or other sites in the park for many years. Notice how conifers have increased on the distant hillside (also in photo 2b) due to the elimination of burning by Native Americans. This part of the park once had a 25-year fire frequency. Photo by Charles E. Kay.

10

Stream Down-Cutting

■

Without beaver, park streams have down-cut, or deepened their channels, which has lowered water tables and destroyed riparian vegetation. By building dams, beaver not only prevent stream erosion; they actually create riparian habitat. This is one reason beaver is considered a keystone species. As beaver are now ecologically extinct on Yellowstone's northern range, many streams have eroded down to levels not seen in several thousand years.

■

10. Shown is Lost Creek on Yellowstone Park's northern range. Early photographs indicate that tall streamside willows were once common in this area and that the stream historically was not deeply incised. Due to repeated overgrazing, however, this stream has now cut a channel more than six feet deep. This has lowered the water table and eliminated what was once riparian habitat. Note the 6-foot survey pole in the creek for scale. Photo by Charles E. Kay.

11

Stream Bank Erosion

■

The roots of willows, aspen, and cottonwoods are critical in maintaining streambank stability. As elk have eliminated woody riparian plants from Yellowstone Park, major hydrologic changes have resulted. David Rosgen, one of North America's leading hydrologists, reported 100 times more bank erosion on Yellowstone's denuded streams than on the same willow-lined streams outside the park. Several streams in the park have now eroded down to Pleistocene gravels, something that has not happened in 12,000 years—all because the elk and other "naturally regulated" ungulates have destroyed the woody vegetation that once protected the stream banks. What has happened in Yellowstone is a clear violation of the park's Organic Act, the Endangered Species Act, and other federal legislation such as the Clean Water Act.

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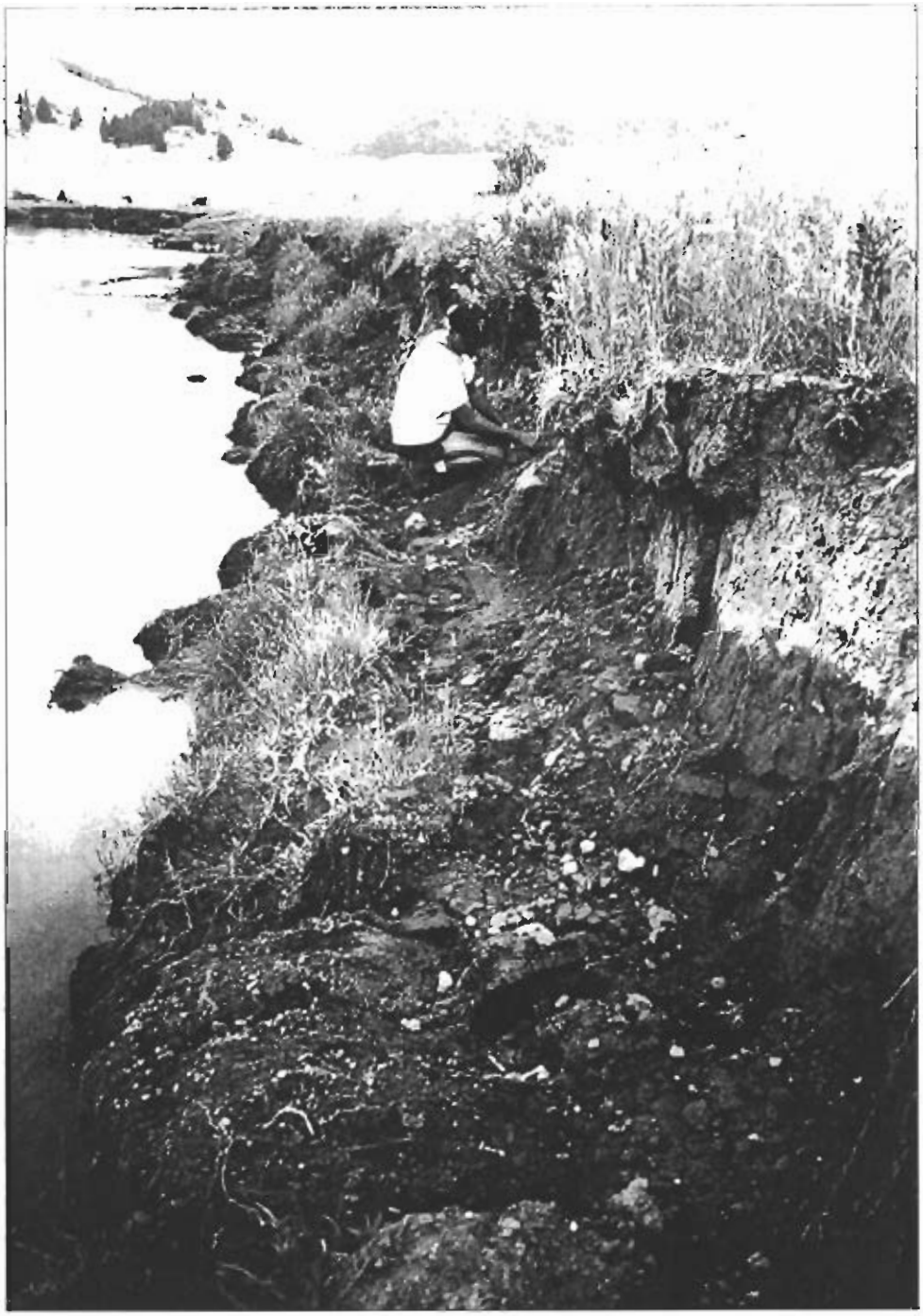

11. Today this stream bank on Slough Creek in Yellowstone National Park is severely eroding. Photographs from the late 1800s, however, show that these banks were once protected by the roots of dense willow, aspen, and cottonwood stands, which have since been eliminated by excessive browsing. Shown is Robert Beschta, hydrologist at Oregon State University. Photo by Charles E. Kay.

12

Stream Instability

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As Yellowstone's stream banks have eroded, material has been deposited in main channels, destabilizing entire hydrologic systems. After a recent trip to Yellowstone Park, Oregon State University hydrologist Robert Beschta said, "I couldn't believe the Lamar River. I've seen plenty of examples of streams degraded by domestic livestock. But this is among the worst [in the entire West]. It boggled my mind. It's changing the entire riparian flood-plain system. It could take centuries to repair. I left Yellowstone feeling terribly depressed. I couldn't believe that this is happening in a national park." This is the type of resource damage that has occurred under "natural regulation" management.

■

12. Unvegetated gravel bars, shown here, are now common in the Lamar River because "naturally regulated" ungulate populations have destroyed the willows, aspen, and cottonwoods that once protected the stream banks. Photo by Charles E. Kay.

13

Grizzly Bear Harm

■

Since bears are primarily vegetarians, overgrazing in the park has had a severe negative effect on Yellowstone's grizzlies. Unlike their counterparts in other ecosystems, Yellowstone's grizzlies eat virtually no berries, because repeated browsing by "naturally regulated" elk and other ungulates has destroyed those once plentiful shrubs. This forces the bears to seek food outside the park, where they often run afoul of humans and often are destroyed. The real cause of their destruction, though, is "natural regulation" management, because Yellowstone's burgeoning elk and bison populations have destroyed bear plant foods in the park. This is a direct violation of the Endangered Species Act.

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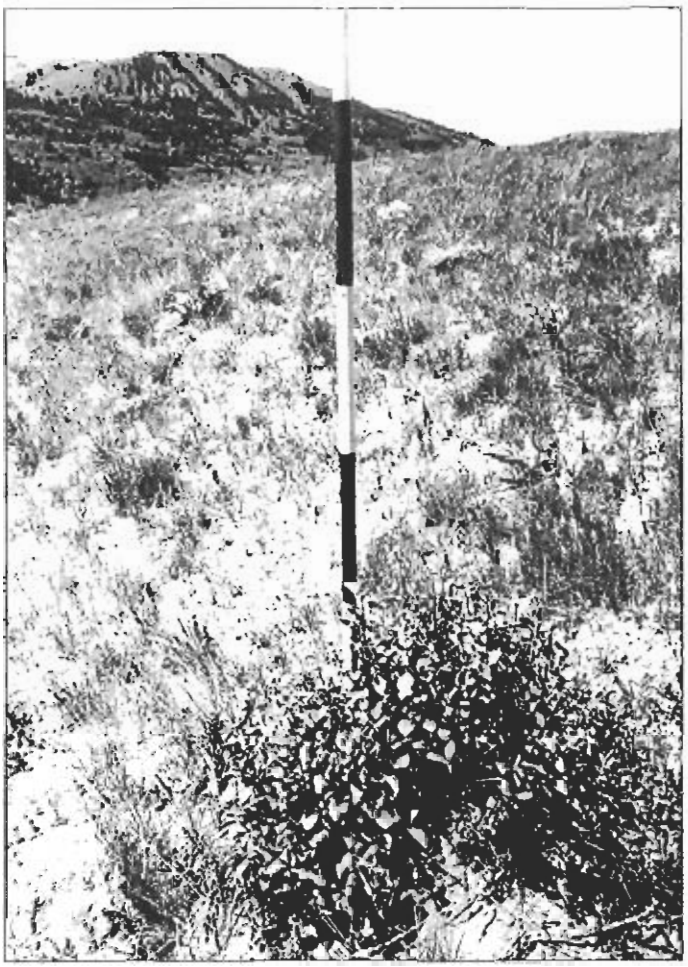
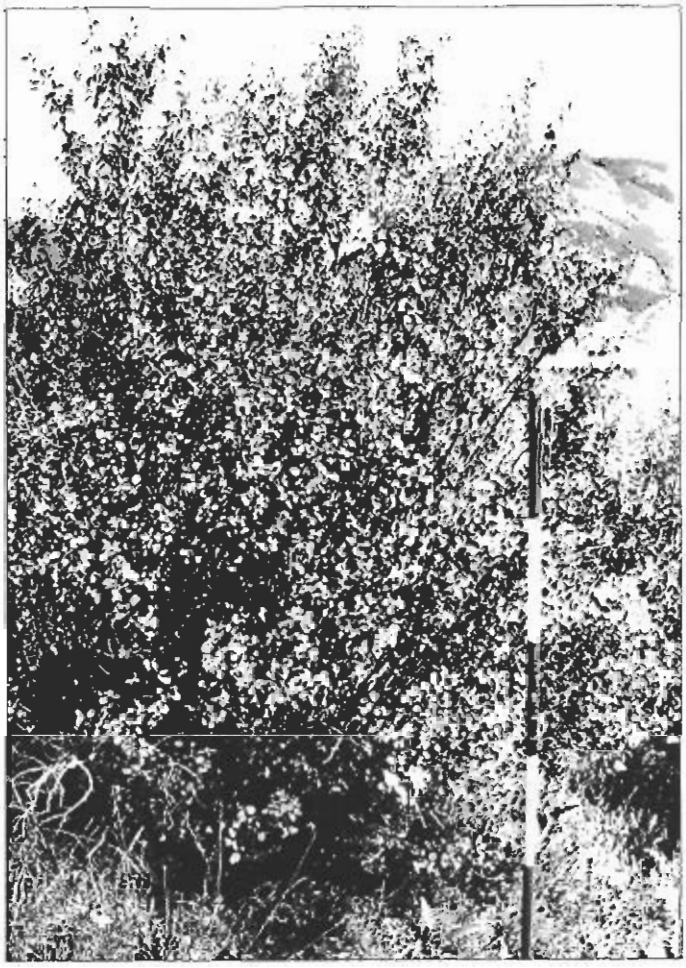


13a. This is a serviceberry plant on the open range outside an exclosure in the Yellowstone ecosystem. Serviceberries are readily eaten by grizzlies and other animals. One hundred of these plants produced just seven berries. Note 6-foot survey pole for scale. Photo by Charles E. Kay.



13b. This photograph shows a serviceberry plant less than 100 feet away, but inside a fenced plot where elk are not allowed to graze. One hundred of these plants produced 133,307 berries, a difference that is both statistically and ecologically significant. Is it any wonder that Yellowstone's bears cannot find any berries to eat? Note 6-foot survey pole for scale. Photo by Charles E. Kay.

14

Conclusion

"Natural regulation" is a failed ecological hypothesis that must be rejected as a valid scientific interpretation of the real world. Yet the Park Service continues to deny that Yellowstone is overgrazed, or, if it is, that "natural regulation" is to blame. The agency, though, has not been receptive to independent review of its "natural regulation" program. In the early 1990s, the Society for Range Management, the Ecological Society of America, the American Fisheries Society, and the Wildlife Society asked the Park Service for approval to conduct an independent review of the Yellowstone situation, but they failed to obtain permission. More recently, a group of eminent ecologists informed the Secretary of the Interior that they would be willing to serve, without pay, on a panel to review the entire Yellowstone matter, but the Secretary declined, as he did a second time in April 1997.

If the Park Service has nothing to hide, and actually has the research data to support its claims regarding "natural regulation," why has the agency not welcomed an independent review of Yellowstone's management? If, on the other hand, "natural regulation" is one of the greatest threats to Yellowstone Park, then it is easy to see why the agency would like to prevent Congress and the American people from knowing the truth.

"Natural regulation" is also a flawed environmental philosophy. Because of their devotion to this philosophy, many environmental groups have ignored the resource damage that has occurred in the park.

This problem is not confined to Yellowstone but is endemic throughout our national park system. Karl Hess, Jr., for instance, has documented how "naturally regulated" elk have overgrazed Colorado's Rocky Mountain National Park, while William Bradley documented the negative impacts that abnormally large elk populations are having on subalpine meadows in Washington's Mount Rainier National Park. Similarly, "naturally regulated" elk populations have had a dramatic impact on understory species composition and tree regeneration in Washington's Olympic National Park, while in

New Mexico's Bandelier National Monument, elk induced soil erosion is threatening the park's archaeological resources. Burgeoning white-tailed deer populations are also damaging many national parks in the eastern United States.

The simple truth is that ungulate populations will not internally self-regulate before having had a serious impact on vegetation. Elk and bison never historically overgrazed Yellowstone or other national parks because hunting by Native Americans kept ungulate numbers low, promoting biodiversity. Giving Yellowstone's bison additional areas to roam outside the park, for instance, will never solve the bison problem. For under "natural regulation," bison numbers will simply increase until the animals are again forced by starvation to move beyond whatever boundary has been set.

14. Company D of the Minnesota National Guard camped near a Yellowstone aspen community in 1893. Note the thick, lush grasslands and the dense, regenerating aspen, unlike conditions in the park today. Compare this with Figures 5, 6, and 7. Aspen is but one indicator of how "natural regulation" management has destroyed Yellowstone's original biodiversity. As Aldo Leopold noted at various times in his career, only active management will preserve Yellowstone unimpaired for future generations. Photo courtesy Haynes Foundation Collection, Montana Historical Society, Helena, Montana.

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SPECIAL REPORT

Recommendations

by Charles E. Kay

Congress should appoint an independent commission of qualified scientists to review "natural regulation" management and park science in Yellowstone. What is needed is a fair hearing for the available evidence. If we cannot straighten out Yellowstone, there is little hope for the rest of our national parks.

Congress should also mandate an independent park science program. This conclusion has been reached by every panel that has ever reviewed park management. Since the Park Service has never followed any of those recommendations, Congress must legislate the needed changes, for the agency has repeatedly demonstrated its refusal to comply with anything less. Because of the politics over Yellowstone, Congress should also appoint an independent panel of eminent scientists to set priorities for park research and to review competitive research proposals.

Moreover, if independent scientists are to critically evaluate various aspects of park management, then Congress must establish a mechanism to directly fund that research. This need not come from new appropriations but from a reapportionment of existing funds. Without adequate funding there will be no independent evaluation of park management.

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For Further Reading

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YELLOWSTONE IN PERSPECTIVE

by Jane S. Shaw

Does the Park Service's "natural regulation" preserve wildlife habitat? Or has it damaged Yellowstone's northern range by allowing elk and bison to proliferate beyond the park's capacity to feed them?

This special issue of *PERC Reports* offers a perspective different from that of the National Park Service, which recently released a collection of research papers on Yellowstone's northern range. Inside this issue, a selection of photographs shows Yellowstone before and after years of "natural regulation." The pictures dramatically illustrate forces that have affected the park's vegetation. Congressional representatives were amazed by these photographs when Charles Kay presented them at a hearing in February, 1997.

These photographs are a small sample of those taken and compiled by Charles Kay for his study, *Yellowstone: Ecological Malpractice*. Among other subjects, this book will discuss ungulates, range condition, and grazing, and will summarize the thousands of vegetation measurements personally made by Kay over the last fifteen years.

Charles Kay is an Adjunct Assistant Professor in the Political Science Department at Utah State University and an environmental scholar with the Institute of Political Economy. He received his Ph.D. in wildlife ecology from Utah State University. His research on Yellowstone has been widely published and the Oxford University Press will publish his book *Aboriginal Overkill: The Role of Native Americans in Structuring Western Ecosystems*.

We are grateful to PERC Senior Associate Randy Simmons, who heads the Institute of Political Economy, for bringing Charles Kay's work to a broad audience.

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