

The Wolves of Yellowstone

“The wolf is a monstrosity of nature...possessing the cruelty of Satan himself.”
—*The Dillon Montana Examiner, 1921*



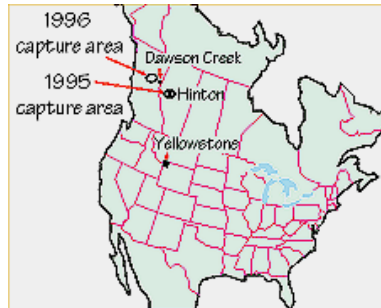
Perhaps no other large predator is more deeply embedded in our psyche than the wolf. Vilified throughout history in both legend and literature, humans had effectively eradicated wolves from Europe by 1850. In the United States, the government declared a war of extermination against gray wolves (*Canis lupus*) beginning in the early 1800s. Hunters, ranchers, and farmers eagerly enlisted, using lethal traps and meat laced with strychnine and ground glass as weapons. But it was government bounties that spelled the end of *Canis lupus*. Between 1883 and 1914 bounty hunters killed 81,000 wolves in Montana alone. By the 1930s, only a few hundred of the original population of 2-3 million wolves remained in the United States.

Over the next few decades, a growing number of studies repeatedly showed that wolves were not responsible for the decimation of game species, and in fact kept populations of deer, elk, and moose at healthy levels. Nor did wolves cause any significant damage to livestock as had been universally assumed.

Despite intensive research, biologists were also unable to document a single instance of wolves causing the death of a human being anywhere in the world. Still the slaughter went on. Not until the

Endangered Species Act was passed in 1973 did the killing of wolves become a crime punishable by a \$50,000 fine and up to a year in jail. But by then wolf populations, which had once inhabited an area stretching from Alaska to Mexico, were largely extinct in the lower United States save for small populations in Minnesota and Michigan.

The Endangered Species Act not only offered protection to species threatened with extinction, it also provided for their reintroduction into former habitats. In 1987 the Northern Rocky Mountain Wolf Recovery Plan recommended that



the gray wolf by reintroduced into Yellow Stone National Park.

Created in 1872 by an act of Congress, Yellowstone was the Nation’s first national park. In total, 8893 square kilometers were set aside to preserve “natural curiosities and wonders”, and all “wanton destruction” within the park was prohibited. Unfortunately this restriction did not apply to Yellowstone’s wolf population. In 1914 Congress appropriated funds for “destroying wolves, prairie dogs, and other animals injurious to agriculture and animal husbandry.” By 1926 the last two wolves remaining

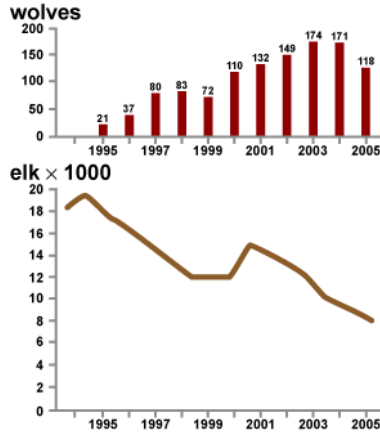
in Yellowstone were killed after they were lured to a bison carcass.

In 1995, following eight years of litigation in federal courts, the Defenders of Wildlife and the US Fish and Wildlife Service finally won a legal mandate to begin the Yellowstone wolf restoration program. On March 21 fourteen wolves captured in Alberta, Canada, were released into the park. A year later, eleven more wolves were air lifted from British Columbia and set free in the northern range of Yellowstone. By 2003 the Yellowstone wolf population had grown to 16 packs and 174 individuals.

The successful reintroduction of gray wolves into Yellowstone is one of the most important wildlife conservation projects ever undertaken. The Yellowstone ecosystem now contains all of its original large predators: wolves, coyotes, mountain lions, grizzly bears, and black bears. Major prey include seven species of native ungulates: elk, mule deer, white-tailed deer, moose, bison, bighorn sheep, and pronghorn antelope.

For the past ten years biologists from around the world have been studying the impact of wolf predation on the Yellowstone ecosystem. The effects have been profound, rippling through the food web in a cascade of changes. At the center of this web lies the predator-prey relationship between wolves and elk.





Elk are the preferred prey of Yellowstone wolves, comprising about 92% of all kills. Between 1995 and 2004, Yellowstone wolves killed 1-2 elk per month per pack. From 1981 to 1995, the northern Yellowstone elk herd averaged 15,000-16,000 individuals. After the introduction of wolves, numbers dropped to the 11,000-14,000 range, reaching a low of 8,000 in 2005. As the elk population declined, profound changes began to occur in the ecosystem's vegetation. In particular, willow,



Pictures from 1991 (top) and 2002 (bottom) along Soda Butte Creek in Yellowstone National Park. In 1991, before wolf introductions, growth of cottonwoods (low shrubby vegetation in foreground) was suppressed due to high levels of elk herbivory. In 2002, six years after wolves were introduced, the cottonwoods had grown into meter tall bushes.

aspen, and cottonwood trees began to thrive.

Photographs taken in the early 1900s show that young aspen and willows were abundant. But during the 1930s these species stopped regenerating. By the 1990s only very old trees grew in Yellowstone and there was concern that both willows and aspen would die out. Cores taken from 98 aging aspen trees showed that they had essentially ceased to grow during the 1920s, at about the same time that the last wolf packs had been eliminated. But after the reintroduction of wolves, the dwindling aspen, willows, and cottonwoods began to increase in size and more young trees started to appear, particularly along river beds and other exposed areas.

The wolf-effect theory states that these changes in Yellowstone plant community are the direct result of increased predation on elk. After wolves were extirpated from the Yellowstone, elk populations soared and parts of the ecosystem, such as the Lamar Valley, were virtually denuded of vegetation. Many species, such as songbirds and beavers, disappeared as a result. The reintroduction of wolves reduced the elk population in the northern Yellowstone two-fold and caused a dramatic drop in the consumption of vegetation. The resurgence of trees has been most pronounced in areas where browsing elk are more exposed to wolf predation. Elk now avoid feeding in open, low lying areas, especially along small streams such as the Soda Butte creek (see photos on left), and forage preferentially on higher ground where they can better detect and escape from wolves.

The resurgence of tree growth in the Yellowstone ecosystem has allowed beavers to invade their former habitats. The re-growth of willows has provided a long absent source of food, and beaver dams are starting to appear throughout the park. These dams in turn have



had a profound effect on species diversity. The pools of water behind the dams further encourage the growth of trees, shrubs, and succulent vegetation which provided food and shelter for dozens of other species such as insects, rodents, warblers and other song birds. Beaver ponds also create new habitat for otters, muskrats, moose, and numerous fish species.

Besides elk, another species dramatically affected by wolves has been the coyote. Before the reintroduction program began, coyotes were abundant with an average density of .5 individuals per km². Within two years of the release of wolves into the park, wolf attacks had caused a 90% decline in coyote abundance within wolf pack territories.

Once again the reduction in numbers of one species within the Yellowstone food web caused a radiating wave of effects on other species. The main prey of coyotes – voles, mice, and other rodents, have undergone a population explosion. This has had a positive impact on the competitors of the coyote such as foxes and birds of prey. The survival of pronghorn fawns, a favorite food of coyotes, has also increased and pronghorn numbers are starting to grow.

When wolves kill a large prey species, they typically consume only about half of their victim. The remains are eaten by a variety of scavengers. Soon after the return of wolves to Yellowstone, park biologists noted an increase in many of these species including magpies, ravens, eagles, and grizzly bears. Wolf kills are an especially important source of food for ravens, and they have benefited the most from

the presence of wolves. The number of ravens attracted to a wolf kills illustrates the beneficial interaction with wolves: the average is 30 individuals, with 135 being the largest number recorded to date.

The Yellowstone wolves have greatly enhanced our understanding of ecosystem functioning and the central role of top predators in maintaining ecosystem integrity. Like any complex system, however, Yellowstone has many com-

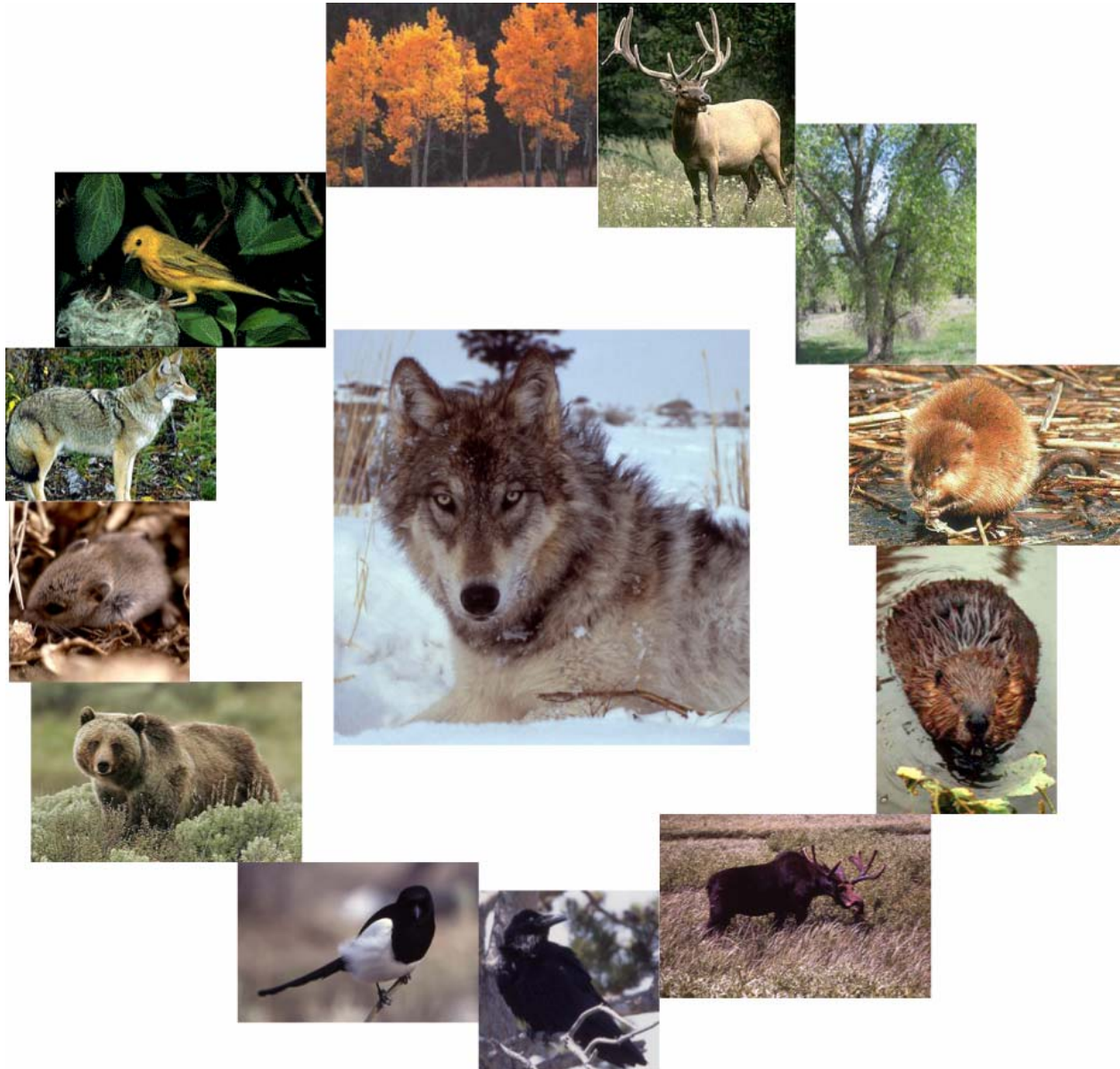
ponents that interact in myriad ways. In many cases the interactions are nonlinear, meaning that small changes can have big effects. Observed changes in the system can also result from multiple factors such as weather, disease, and random fluctuations in births and deaths, about which we have little or no information. Much remains to be discovered about the ecology of the Yellowstone and many more years of study are needed. Perhaps

the most important message from the wolves of Yellowstone to date is that in nature everything is connected to everything else.

References

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Smith, D., R. Peterson, and D. Houston. 2003. Yellowstone after Wolves. *BioScience* 53: 330-340



The reintroduction of wolves into Yellowstone has had far reaching effects, impacting the structure and diversity of the entire ecosystem. Besides being a conservation success story, the program has become a case study in the ecological importance of top predators. Some of the species in the Yellowstone food web affected by wolves: (clockwise from top): elk, cottonwoods, beaver, muskrat, moose, raven, magpie, grizzly, vole, coyote, yellow warbler, and aspen.