

## ECOSYSTEMS – Wolves in Yellowstone

# The Return of *Canis lupus*?

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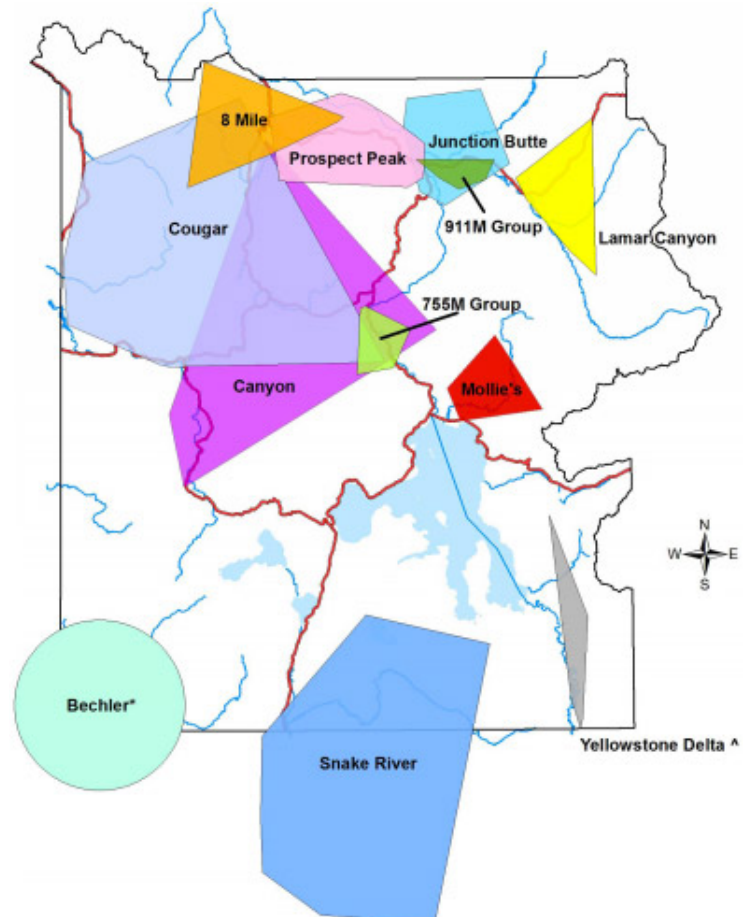
Adapted from

### Background

Two hundred years ago, around 1800, Yellowstone looked much like it does today; forest covered mountain areas and plateaus, large grassy valleys, and open sagebrush hills. There were numerous herds of elk, antelope, native alpine bison, deer, and mountain sheep. The apex predator (top of the food chain) was the wolf, as it had been for thousands of years. We don't know exactly how many wolves were in the Yellowstone region at that time, but a good guess is between 300 and 400. They were gray wolves of the sub-species *Canis lupus irremotus*, the Rocky Mountain gray wolf. Weighing in around 70-135 lbs (32-62 Kg), they are among the largest wolves and a successful predator of the bigger ungulates — hooved grass eaters such as elk and bison.

These packs of wolves once roamed throughout North America. Gradual loss of habitat from westward expansion as well as extermination programs by local and national governments led to their demise and eventual extinction in the United States (Smith et al. 1999). These programs were implemented because wolves were viewed as dangerous predators.

However, it is argued that predators provide benefits to a naturally functioning ecosystem. One of the natural ecosystems that seemed to be missing the impact of wolves as major predators was the Greater Yellowstone Area, specifically Yellowstone National Park (YNP). By 1926, there were no gray wolf packs in YNP.



As might be expected, after wolves were removed, elk herds increased in population, reaching new highs during the mid-1930's. The increased number of elk apparently resulted in overgrazing in parts of Yellowstone. In periods where the elk flourished, the aspen trees in the park declined, which contributed to the disappearance of beaver that rely on aspen for a primary food source. Meanwhile, other things happened: Coyotes survived the extermination programs and without the wolf competition, increased in numbers throughout Yellowstone and became the dominant predator. However, more coyotes meant fewer rodents and other small



game, which reduced the population of foxes, hawks, and eagles.

In Yellowstone the acceptance of ecological principals prompted a slowly developing re-evaluation of how to manage the park's plant and animal life. Partly because study of Yellowstone as an ecosystem was beginning to reveal just how complex and variable the system could be; more and more ideas were floated about 'restoring the natural balance'. That meant, as much as possible, supporting natural regulation; letting natural forces take their course. Among the ideas on how to do this was the reintroduction of the wolf to control the elk population. In 1995, following years of extensive planning, wolf restoration to YNP began when wolves were brought from Canada to YNP to be released. This decision was not without major controversy, which continues today.

### Pack Behavior

Wolves belong to family groups called packs, they usually consist of eight to fifteen-members. Wolf packs can have very large range (6 to 600 miles). The alpha pair has the greatest amount of social freedom among all the pack members, but they are not "leaders" in the human sense. They have the most freedom in choosing where to go, what to do, and when to do it. The rest of the pack usually follows. In larger packs, there may be also be a beta wolf or wolves, who also experience more freedom.

While most alpha pairs are monogamous with each other, there are exceptions. An alpha animal may preferentially mate with a lower-ranking animal, especially if the other alpha is closely related (a brother or sister, for example). The death of one alpha does not affect the status of the other alpha, who will quickly take another mate. Usually, only the alpha pair is able to successfully rear a litter of pups (other wolves in a pack may breed, and may even produce pups, but usually they lack the freedom or the resources to raise the pups to maturity). All the wolves in the pack assist in raising wolf pups, but a pack also has a baby-sitter, and he/she is usually young, more puppy than wolf.

### Sources

1. The Return of *Canis lupis*, Center for Case Study Teaching in Science [http://sciencecases.lib.buffalo.edu/cs/files/wolf\\_reintro.pdf](http://sciencecases.lib.buffalo.edu/cs/files/wolf_reintro.pdf)
2. *Wolves in Yellowstone: A Short History*, Yellowstone Insider. <http://yellowstoneinsider.com/2009/05/03/wolves-in-yellowstone-a-short-history/History of Wolves in Yellowstone>, Wikipedia.
3. Hebblewhite, Mark; White, Clifford A.; Nietvelt, Clifford G.; McKenzie, John A.; Hurd, Tomas E.; Fryxell, John M.; Bayley, Suzanne E.; and Paquet, Paul C., "Human Activity Mediates a Trophic Cascade Caused by Wolves" (2005). Biological Sciences Faculty Publications. Paper 288. [http://scholarworks.umt.edu/biosci\\_pubs/288](http://scholarworks.umt.edu/biosci_pubs/288)

## Collection of data surrounding the reintroduction of wolves into YNP.

Table 1 — Number of wolves and number of packs at the end of each year\*

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
# Wolves	21	51	86	112	118	119	132	148	174	171	118
# Packs	3	9	7	11	11	8	10	14	13-14	16	13
	2006	2007	2008	2009	2010	2011					
# Wolves	136	171	124	96	97	98					
# Packs	13	11	12	14	11	10					

*1995–1999 data represents Greater Yellowstone Area (GYA); 2000–2011 data is specific to Yellowstone National Park.*

Table 2 — Predominant prey species \*

Species	2011 Wolf Kills
Elk	78%
Bison	4%
Deer	5%
Moose	<1%
Pronghorn	<1%
Bighorn sheep	<1%
Badger	<1%
Jackrabbit	<1%
Coyote	4%
Raven	<1%
Wolves	2%
Unknown	4%

Table 3 — Livestock predation\*

	Cows	Dogs	Goats	Sheep	Foal
1997	6	0	0	68	0
1998	3	1	0	0	0
1999	4	6	0	13	1
2000	7	8	0	39	0
2001	22	4	0	117	0
2002	37	1	0	74	0
2003	42	0	10	85	0
2004	74	4	2	81	0

Note. The following vocabulary will help you interpret the graphs on the back of this page.

### Definitions

*Browsing* - eating of trees and shrubs

*Grazing* - the eating of grasses

*Riparian* - area near water; in Yellowstone they tend to be open areas.

*Uplands* - thick conifer forests with few aspen, cottonwood, & willows

*DBH* - diameter of the tree at breast height—usually 1.3 meters

*Recruitment* - when juvenile organisms survive to join the population

*Ring area* - a measure of how well a tree grew that year

*Geyer and Booth* - two different kinds of willows

### Nature FACTS

- Willows and cottonwoods grow in wet soil
- Beaver feed upon willows.
- Beavers gnaw down some trees and build dams, which slow the flow of streams
- Wolves prefer to hunt in open areas

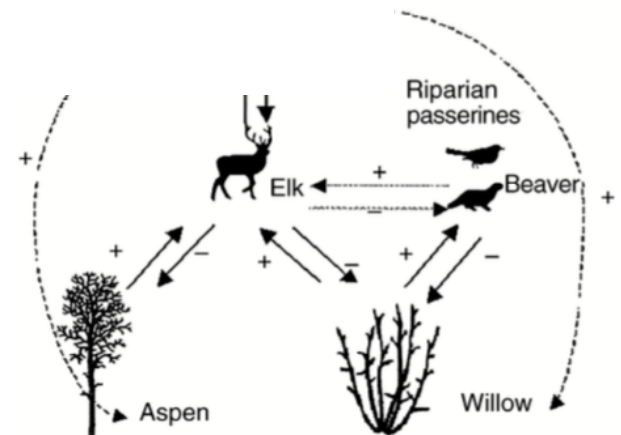
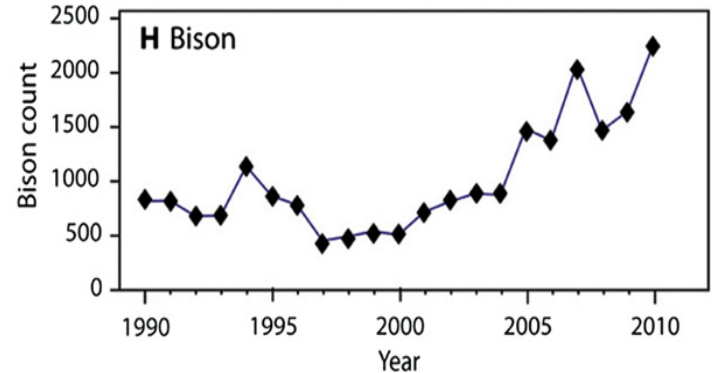
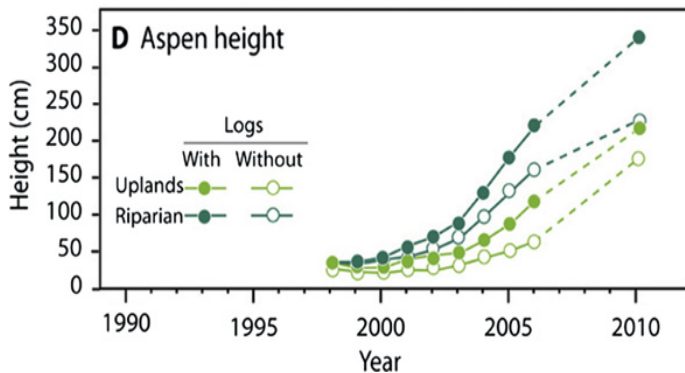
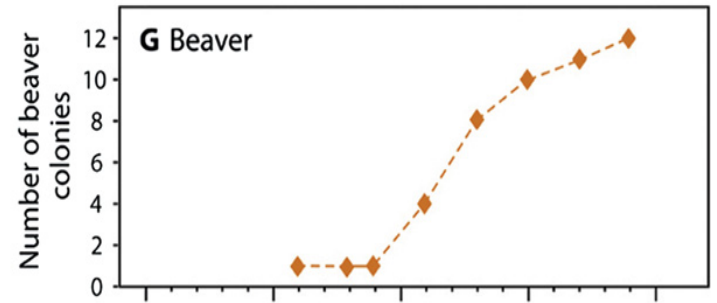
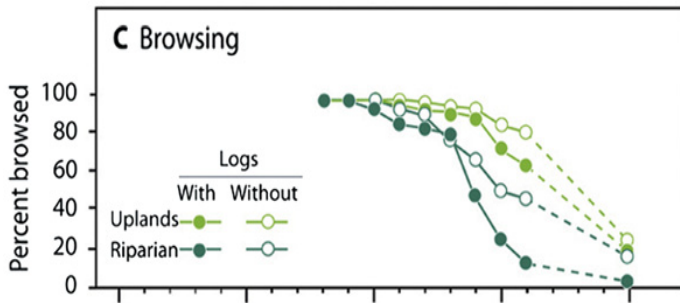
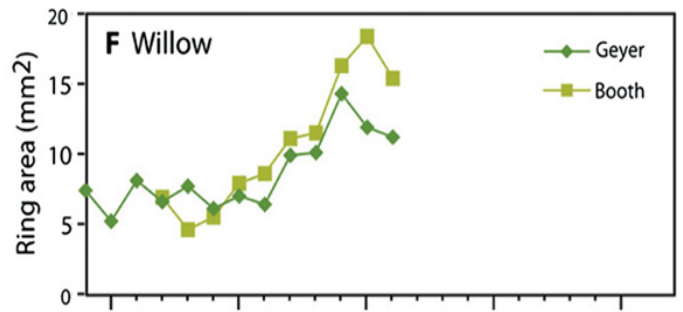
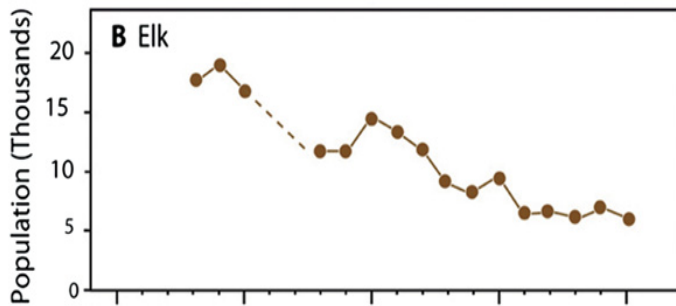
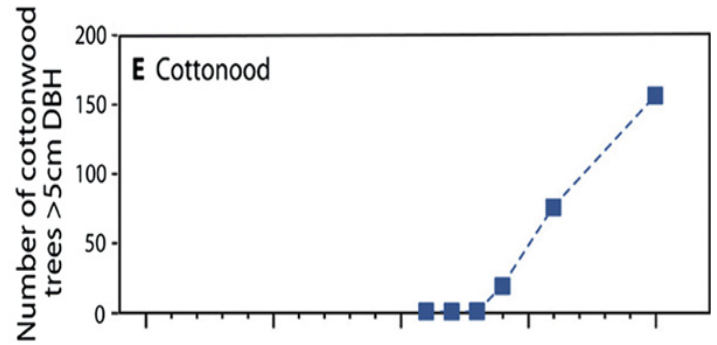
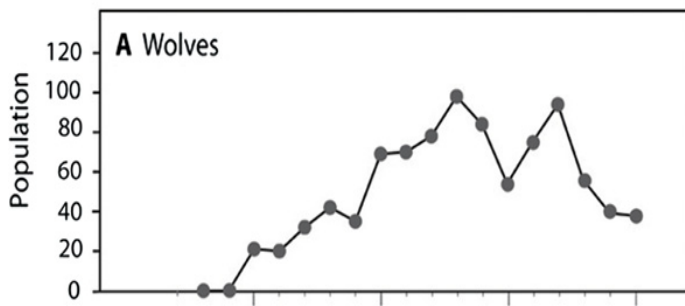


FIG. 1. Simplified trophic interactions model of the Bow Valley of Banff National Park, Alberta, Canada. Solid lines represent direct consumer–resource interactions: + for effect on upper trophic level, – for negative effect. Indirect effects are shown with dashed lines and represent an indirect displacement of wolves by human activity and indirect (exploitative) competition between herbivore levels.

- Fast-flowing streams erode riverbanks, exposing and drying out tree roots
- Elk are browsers and grazers
- Bison are primarily grazers

## Yellowstone: A Trophic Cascade



Graphs represent trends in...

- (A) wolf populations
- (B) minimum elk populations from annual counts
- (C) percentage of aspen browsed
- (D) mean aspen heights (early spring-time heights after winter browsing but before summer growth)

Graphs represent trends in...

- (E) cottonwood recruitment
- (F) willow ring area
- (G) number of beaver colonies
- (H) summer bison counts.

