Keystone Species

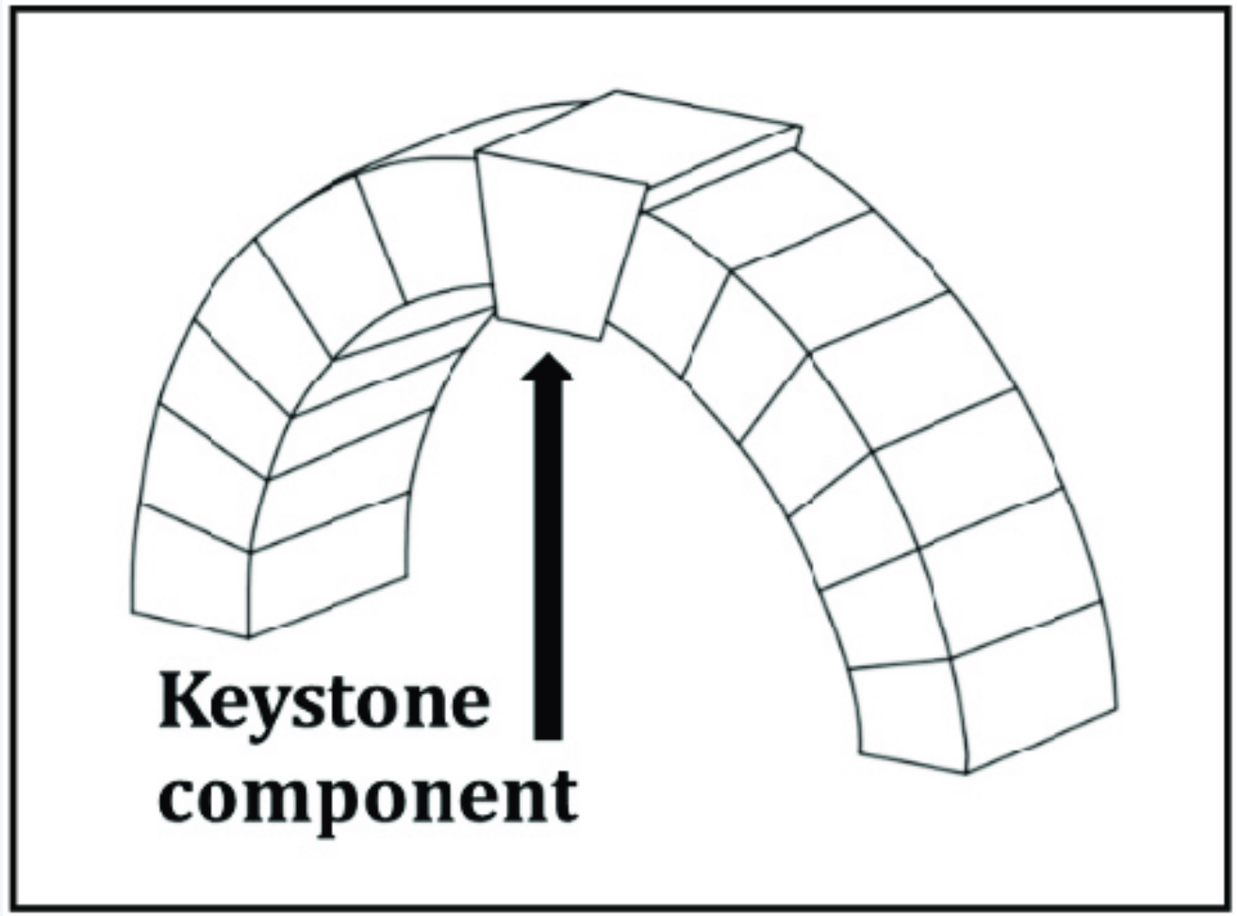
What is a keystone species and why are they important?

KEYSTONE SPECIES

DEFINITION

An organism that helps define an entire ecosystem.

- without the keystone species, the ecosystem would dramatically change or not exist



3 CATEGORIES OF KEYSTONE SPECIES

Top Predator

Top-down influence on organisms below it in the food chain.

Ecosystem Engineer

Modify and create new habitat within an ecosystem.

Mutualist

Two or more species engage in mutually beneficial behaviors.

Cougars as Keystone/Umbrella Species

Let's take a look at some case study examples of keystone species!

Wolves as Top Predators in Yellowstone Natl. Park

Beavers as Ecosystem Engineers in Acadia Natl. Park

Hummingbirds as Mutualist Pollinators in Patagonia

Wolves as Top Predators in Yellowstone Natl. Park

History of Wolves in Yellowstone

- once ranged from the arctic to Mexico, extermination programs in the 1900s greatly declined population
- listed under Endangered Species Act in 1973 and designated Greater Yellowstone Ecosystem (GYE) as recovery area
- 41 wolves from Canada and NW Montana reintroduced to Yellowstone between 1995-1997
- established territories and packs over time
- January 2023, ~108 wolves in the park in 10 designated packs

Wolves as Keystone Species in the GYE

Exist in low population numbers relative to their prey, but disproportionately impact balance of ecosystem

TROPHIC CASCADE - an ecological phenomenon triggered by the addition or removal of a top predator and results in reciprocal changes in the relative populations of other predators and prey

So the wolf population numbers determine the population numbers of all organisms below them in the food chain?

Wolves being hunted and losing habitat. = Less wolves on the landscape. =

- more deer and elk
- less vegetation
- more erosion
- changes in hydrology
- warmer water temperatures
- less trout and aquatic species

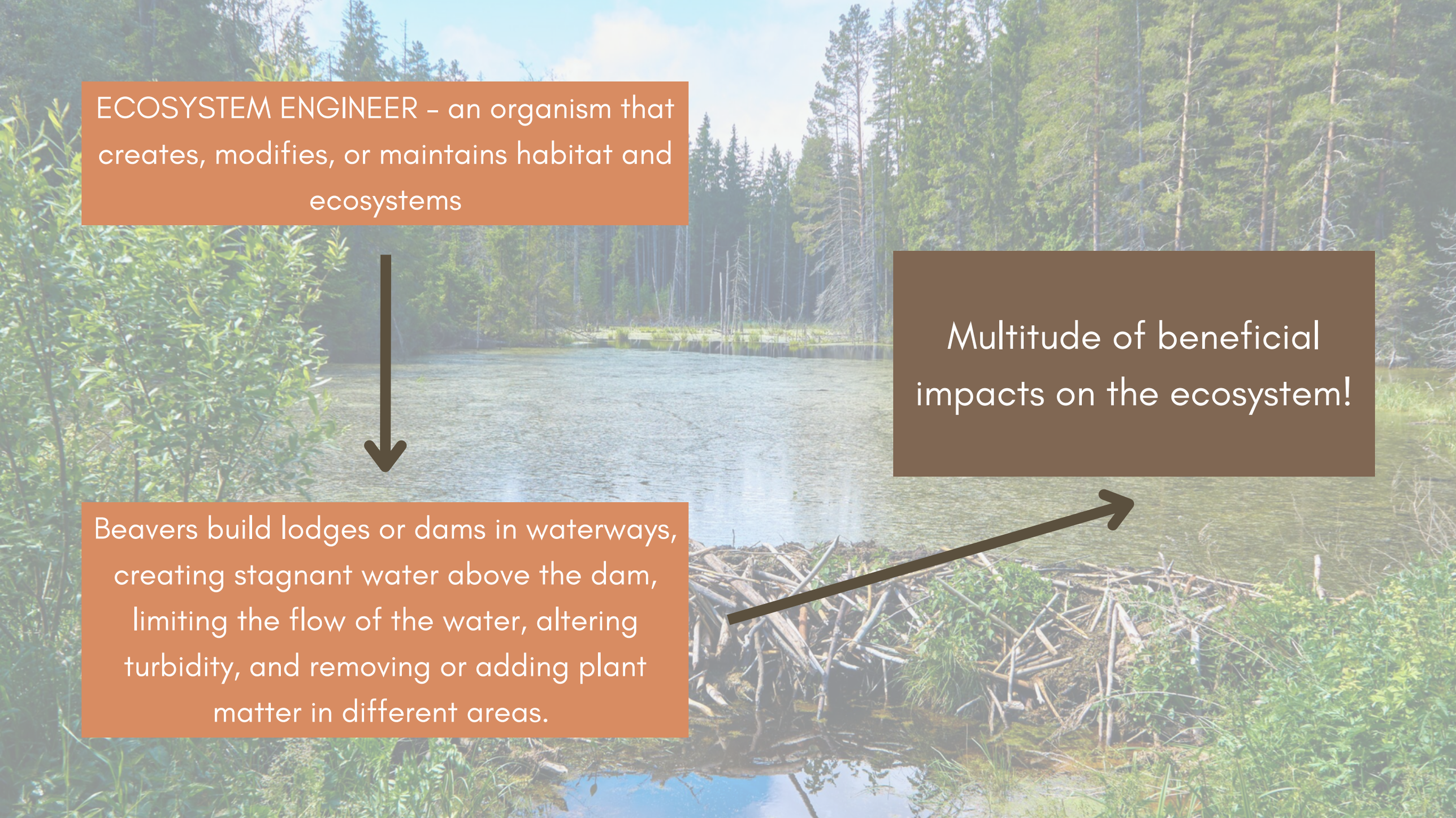
Return of wolves

Without wolves controlling the elk and deer populations, vegetation and all other organisms eventually suffered.

Beavers as Ecosystem Engineers in Acadia Natl. Park

History of Beavers in Acadia

- 1600s fur trapping greatly reduced beaver populations across America
- beavers reintroduced and population expansion in Acadia (1944-1997)
  - 89% increase in ponded wetlands within that time
- beaver colonization converting forested wetlands and riparian areas to open water and emergent wetland



ECOSYSTEM ENGINEER – an organism that creates, modifies, or maintains habitat and ecosystems

Beavers build lodges or dams in waterways, creating stagnant water above the dam, limiting the flow of the water, altering turbidity, and removing or adding plant matter in different areas.

Multitude of beneficial impacts on the ecosystem!

More beavers on the landscape creating dams.

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Altered flow and retention of water in the watershed and ecosystem.

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- maintain woodland by thinning older trees
- filter pollution
- store more groundwater
  - improve vegetation growth
- creating wetland habitat
  - provides breeding site for endangered amphibians and many other organisms
  - increased biodiversity
- preventing flooding
- adapting to climate change

Green-backed Firecrown Hummingbirds as Keystone Mutualists in Patagonia

History of Green-backed Firecrowns in Patagonia

- only hummingbird species found in temperate rainforests of southern South America
- adult males are territorial and females and juveniles forage opportunistically
- feeds on nectar and pollinates a large number of plant species

MUTUALISM - association between two different species in which each benefits

Green-backed Firecrown requires nectar to feed on, woody grasslands of Patagonia need pollination.

Plants provide nectar for hummingbirds, hummingbirds then pollinate the plants while foraging.

Indigenous plants evolved to only be pollinated by Green-backed Firecrown Hummingbirds.

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Green-backed Humminbirds necessary for the ecosystem to be upheld through pollination.

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- ecosystem would collapse without the hummingbirds
- they pollinate 20% of local plants
- vital mutualistic relationship for ecosystem function

Cougars as Keystone/Umbrella Species

History of Cougars in North America

- lost over 60% of original range in North America due to European expansion
- currently found in 15 western states and a genetically isolated population in Florida
- average territory size of 100 square miles

UMBRELLA SPECIES - a species with large habitat requirements whose conservation results in many other species being conserved

Protection of cougar habitat promotes recovery and conservation of many other speceis.

Protecting cougars and their habitat increases biodiversity.

Human mismanagement is the greatest threat to cougar survival.

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Need human advocates to push for conservation efforts to protect cougar populations.

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- increased cougars and their impact as top predators
- increase biodiversity of other plant an animal species
- more carrion left behind spread nutrients in soil and ecosystem, overall increase health and resiliency

Example in Zion Canyon

Loss of all cougars due to influx of human visitors.

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Deer population increased dramatically.

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Excessive browsing of cottonwoods, left stream embankments without shade and increased erosion.

Resources

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