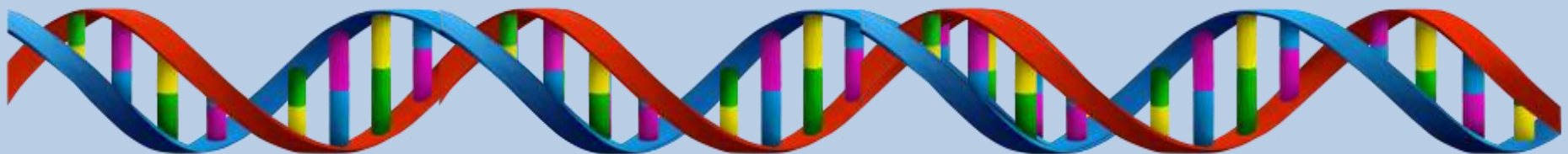


- 1. Give an example of a density-dependent limiting factor.**
- 2. Give an example of a density-independent limiting factor.**
- 3. What is the limiting factor we are studying in the foxes and bunnies lab?**



Logistics

- **Unit 2 Ecology Assessment is on THURSDAY, Nov 7th**

Logistics

- **Don't rush your work, IT IS YOUR RESPONSIBILITY TO MAKE SURE YOU ARE ACTUALLY UNDERSTANDING AND NOT JUST GOING THROUGH THE MOTIONS**
- **Ask for help if you need it!**

Population Growth

- **Take 10 minutes to finish your foxes and bunnies data collection**
- **Stay on task!**

Keystone Species

- **Species that has a disproportionately large effect on its environment relative to its abundance**



Keystone Species

- **Energy flow**
- **Matter cycles**
- **Biotic and abiotic changes in an ecosystem**
- **Population growth**
- **Limiting factors**
- **Ecosystem services**

Keystone Species

- <https://www.youtube.com/watch?v=ysa50BhXz-Q>

WOLVES KEEP YELLOWSTONE IN BALANCE



Ⓣ IN THE 1920S, government policy allowed the extermination of Yellowstone's gray wolf — the apex predator — triggering an ecosystem collapse known as *trophic cascade*.

Ⓜ IN 1995 — through use of the Endangered Species Act — the conservation community reintroduced the gray wolf to restore balance.

The impact is dramatic.



Ⓣ Elk populations exploded without their primary predator, resulting in severe overgrazing of willows and aspen needed by beavers for food, shelter and dam building.

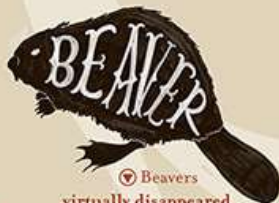


Ⓣ Various scavenger species suffered without year-round wolf kills to feed on.

Ⓜ Today, biodiversity is enriched and scavenger species reap the benefits of regular, wolf-supplied meals.



Ⓣ Without wolves, the coyote became an apex predator, driving down populations of pronghorn antelope, red fox and rodents, and birds that prey on small animals.



Ⓣ Beavers virtually disappeared in the northern range. Dams disintegrated, turning marshy ponds into streams. Massive loss of mature willows and aspens. Heavy stream erosion. Many plant and animal species affected.



Ⓜ After wolf reintroduction, in the northern range, elk numbers drop and beaver colonies increase from 1 to 12. Insects, songbirds, fish, and amphibians thrive.



Ⓜ As the wolf returns, coyote numbers drop by half, allowing antelope, rodent and fox populations to increase.



Keystone Species

- **Observe the pictures carefully:**



Keystone Species

- Observe the pictures carefully:



Keystone Species

- **Sea otter**

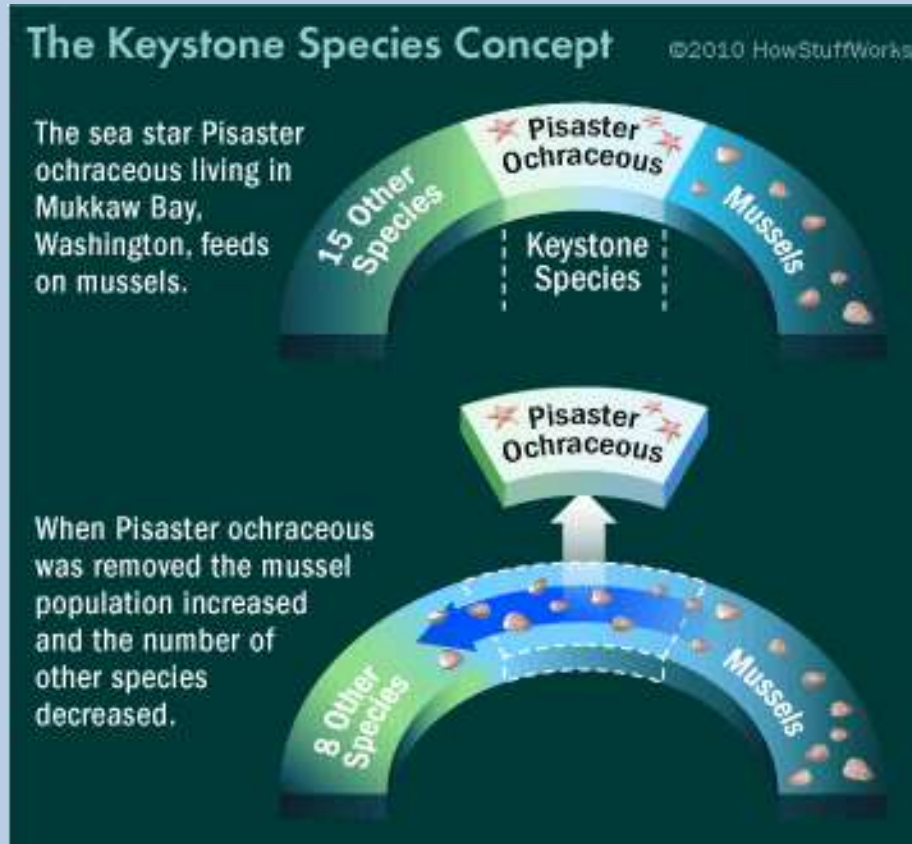


Keystone Species



Removal of the **keystone sea otter** : sea urchins overgraze kelp and destroy the kelp forest community.

Keystone Species



Keystone Species

- **Things you need to know:**
- **Keystone Species are often (but not always) top predators**
 - They keep the population of primary consumers in check, so that there can be more producers, more other consumers, more biodiversity, more connections in the ecosystem, creating a more stable ecosystem
- **They affect biotic AND abiotic factors**

Keystone Species

- **What is biodiversity?**