TOPIC: COMMUNITY STRUCTURE

Community Structure

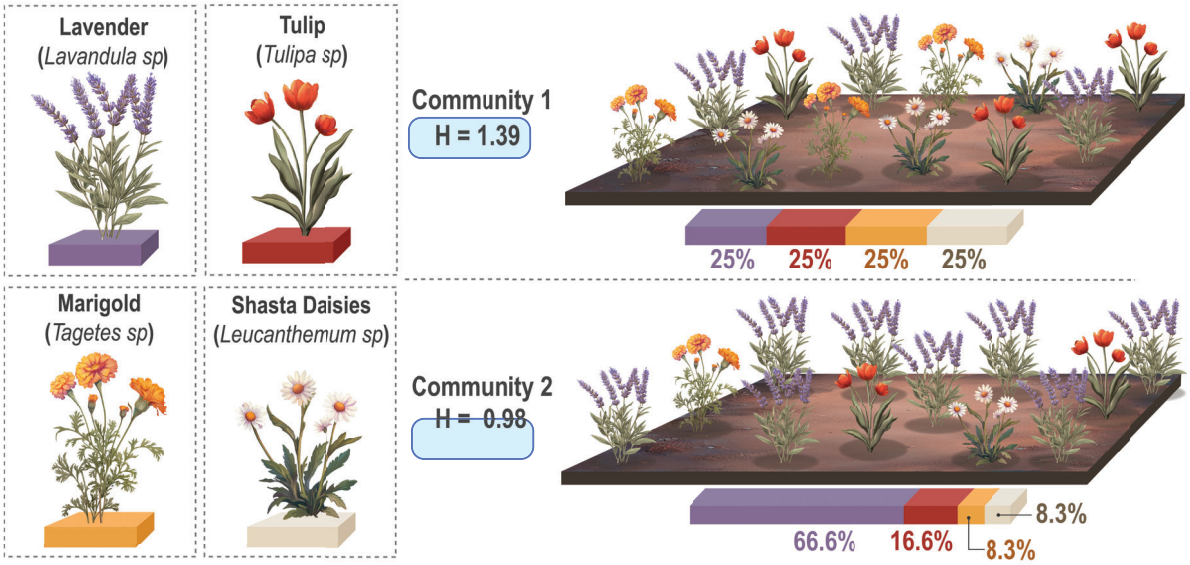
◆ **Community Structure:** the make-up of a community — has _____ key attributes:

1. **Species Richness:** total _____ of different species.
2. **Relative Abundance:** _____ of each species in relation to ALL individuals.

} **Species Diversity** *Shannon Diversity Index (H)*

3. **All of the Interactions** between organisms.
4. **Physical Attributes** (biotic & _____ factors) including species distribution.

Which community is more diverse? _____



NOTE: _____ species diversity leads to higher productivity & stability of communities.

EXAMPLE

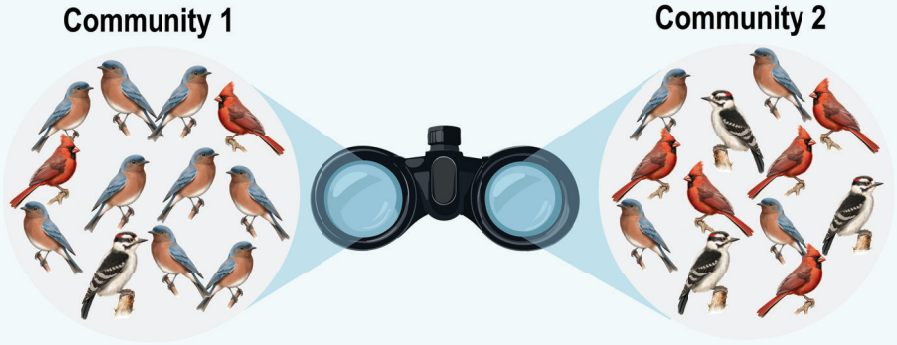
Based on the image below, which of the following communities has a greater species diversity & why?

a) Community #1 because there are many birds which are the primary organism in this community.

b) Community #1 because the relative abundance of its three species are unequal.

c) Community #2 because it has three different species.

d) Community #2 because its three species have a more equal abundance than in Community #1.

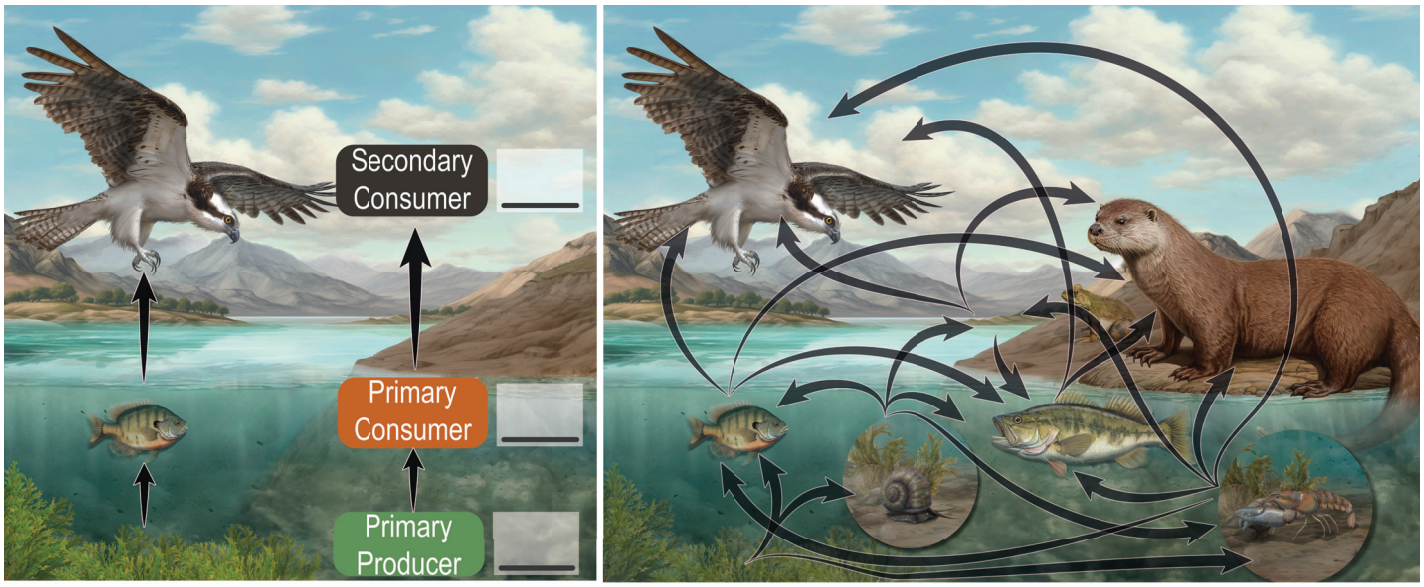


TOPIC: COMMUNITY STRUCTURE

What is Trophic Structure?

- **Trophic Structure:** _____ relationships between organisms in a community; who eats who?
  - **Food Chain:** _____ sequence of organisms where each is eaten by the next.
  - **Food Web:** complex _____ of *interconnected* food chains in a community.
  - **Trophic Level:** an organism's *position* in a food chain/web (e.g. primary producer → quaternary consumer).

Food chain | **Food web**



NOTE: Length of food chains are _____ by *very inefficient* (~10%) energy transfers between trophic levels.

EXAMPLE

Fill in the blanks using the options below to complete the food chain (not all options will be used).

Mouse, ←, Grass, Snake, →, Octopus.

[ ] [ ] Grasshopper → [ ] → [ ]

PRACTICE

If a forest contains 47,000 kg of plant material, how many kg of *tertiary* consumers can it support?

a) 4700 kg.
c) 470 kg.
b) 47 kg.
d) 4.7 kg.

TOPIC: COMMUNITY STRUCTURE

Species Impact on Community Structure

- Certain species have *significant* _____ on their community:
- **Foundation Species:** has strong community-wide effects (e.g. provides habitat/food) due to its _____ biomass.
- **Keystone Species:** has _____ biomass but plays a _____ ecological role that's *disproportionate* to its abundance.
- **Ecosystem Engineer:** influence a community by significantly *altering* its _____ environment.

Foundation Species	Keystone Species	Ecosystem Engineer
		

EXAMPLE

In 1995, 15 Alberta gray wolves were introduced to Yellowstone National Park. Now their population has expanded to over 100, & they have brought about significant changes: they primarily prey on elk, so the elk population has remained stable since the wolves' introduction. The leftover elk carcasses provide food for ravens, eagles & bears, & the reduction in elk numbers has allowed more vegetation growth which provided habitats for birds & beavers, allowing their respective populations to grow. How would you describe Alberta gray wolves in Yellowstone National Park, & why?

a) Foundation species – they are the largest/most abundant predator & have a big impact on the community.

b) Keystone species – they're not abundant, but their presence has a large impact on the community.

c) Ecosystem engineer – Trickle-down effects have caused the community's physical structure to change.

d) All of the above.

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PRACTICE

Match each of the following species to their role in their respective communities:

Beaver: builds dams in rivers/lakes, significantly altering habitats in the area.

Ochre Sea Star: preys on mussels, preventing them from overpopulating intertidal zones & dominating the habitat.

Red Mangrove Tree: stabilizes shorelines by reducing erosion, provides nurseries for fish in coastal regions.

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a) Beaver: keystone species. Ochre Sea Star: ecosystem engineer. Red Mangrove Tree: foundation species.

b) Beaver: ecosystem engineer. Ochre Sea Star: foundation species. Red Mangrove Tree: keystone species.

c) Beaver: foundation species. Ochre Sea Star: ecosystem engineer. Red Mangrove Tree: keystone species.

d) Beaver: ecosystem engineer. Ochre Sea Star: keystone species. Red Mangrove Tree: foundation species.

PRACTICE

Consider an ocean community where corals are the most abundant species, where they "build" new habitats using calcium carbonate deposits, creating a coral reef. Which of the following terms can be applied to corals in this community?

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a) Foundation species only.

b) Keystone species only.

c) Ecosystem engineer only.

d) Both a & b.

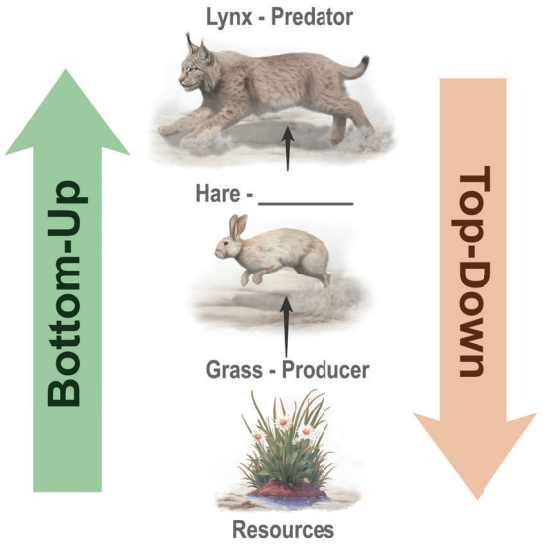
e) Both a & c.

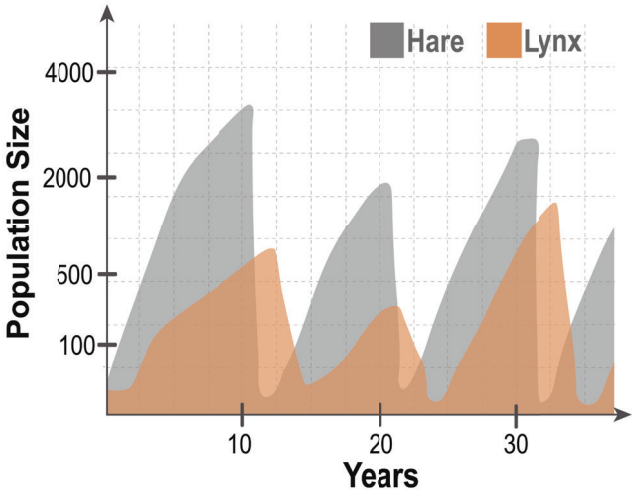
f) Both b & c.

TOPIC: COMMUNITY STRUCTURE

Bottom-Up & Top-Down Effects on Community Structure

- Some population sizes _____ due to interspecific community interactions. Cycling can be explained from ↑ or ↓.
- **Bottom-Up Control:** cycles influenced by *resource* or "*food*" *availability* at _____ trophic levels (e.g. producers).
- **Top-Down Control:** cycles influenced by *organisms* at _____ trophic levels (e.g. predators).
  - So which is correct? Turns out it's situational, but in many cases, both apply!





EXAMPLE

Imagine you're a farmer and a surge in the Colorado potato beetle population has taken its toll on your potato crops. Using the information in the food chain below, how could you go about reducing the Colorado potato beetle population while keeping your potato crops healthy?

Potatoes → Colorado potato beetle → Ground beetle → Northern cardinal

a) Remove all the potato crops to exert bottom-up control on the Colorado potato beetle population.

b) Introduce northern cardinals to the farm to exert top-down control.

c) Introduce ground beetles to the farm to exert top-down control.

d) Remove ground beetles from the farm to exert top-down control on the Colorado potato beetles.

PRACTICE

Which of the following could be characterized as top-down control in a community?

a) Otters keeping the sea urchin population down by consuming them.

b) Sea urchin population getting smaller means less food for otters, causing the otter population to shrink.

c) Sea urchin population expanding because of an abundance of kelp, their primary food source.

d) Ideal climatic conditions for kelp growth causes their population to increase.