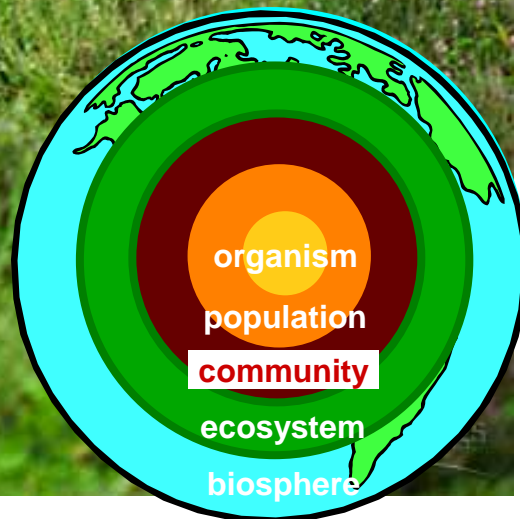




Community Ecology



Community Ecology

- **Community**

- ◆ all the organisms that live together in a place

- interactions

- **Community Ecology**

- ◆ study of interactions among all populations in a common environment

**To answer:
In what way do the
populations interact?**



Niche

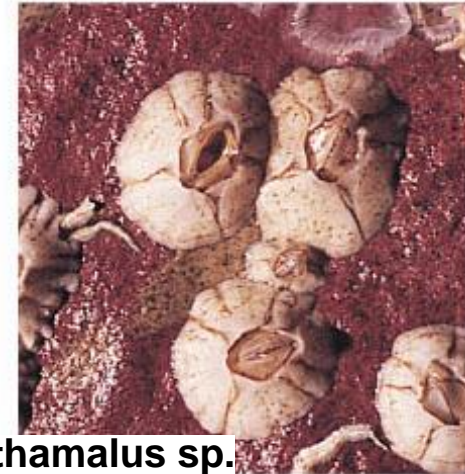
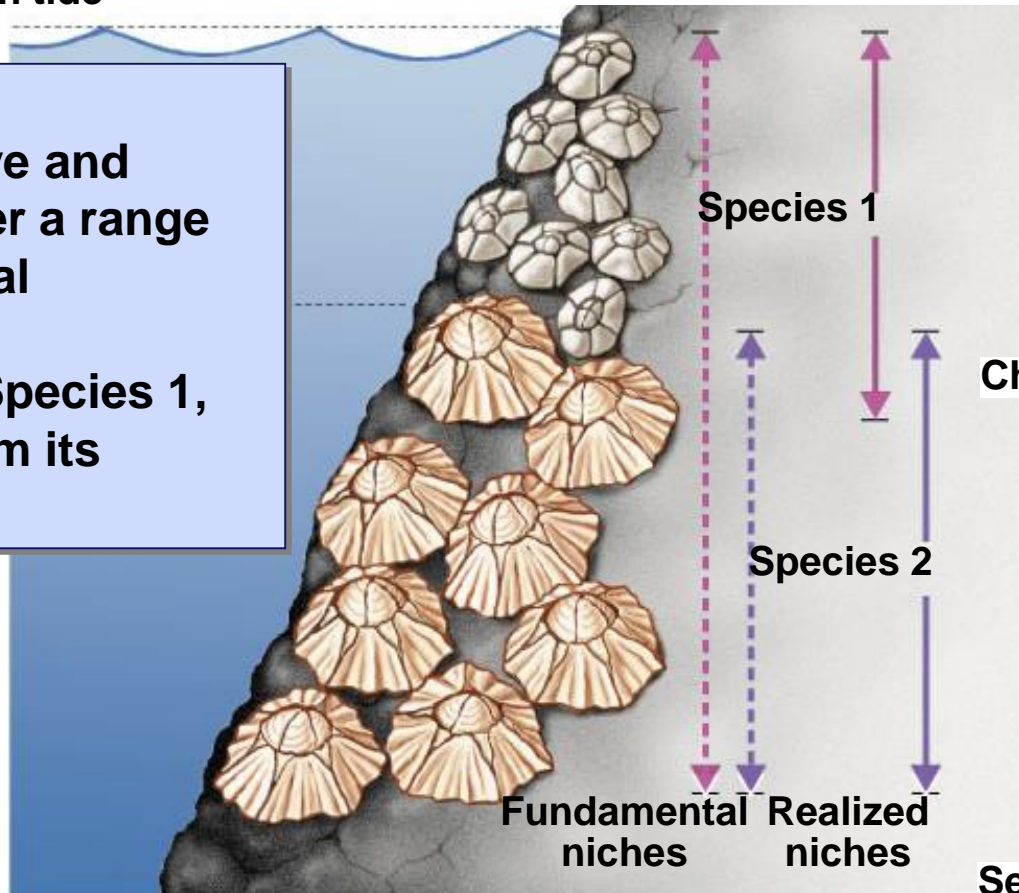
- An organism's niche is its ecological role
 - ◆ **habitat = address vs. niche = job**

High tide

Tolerance

Ability to survive and reproduce under a range of environmental conditions

out-competes Species 1, excluding it from its potential niche.



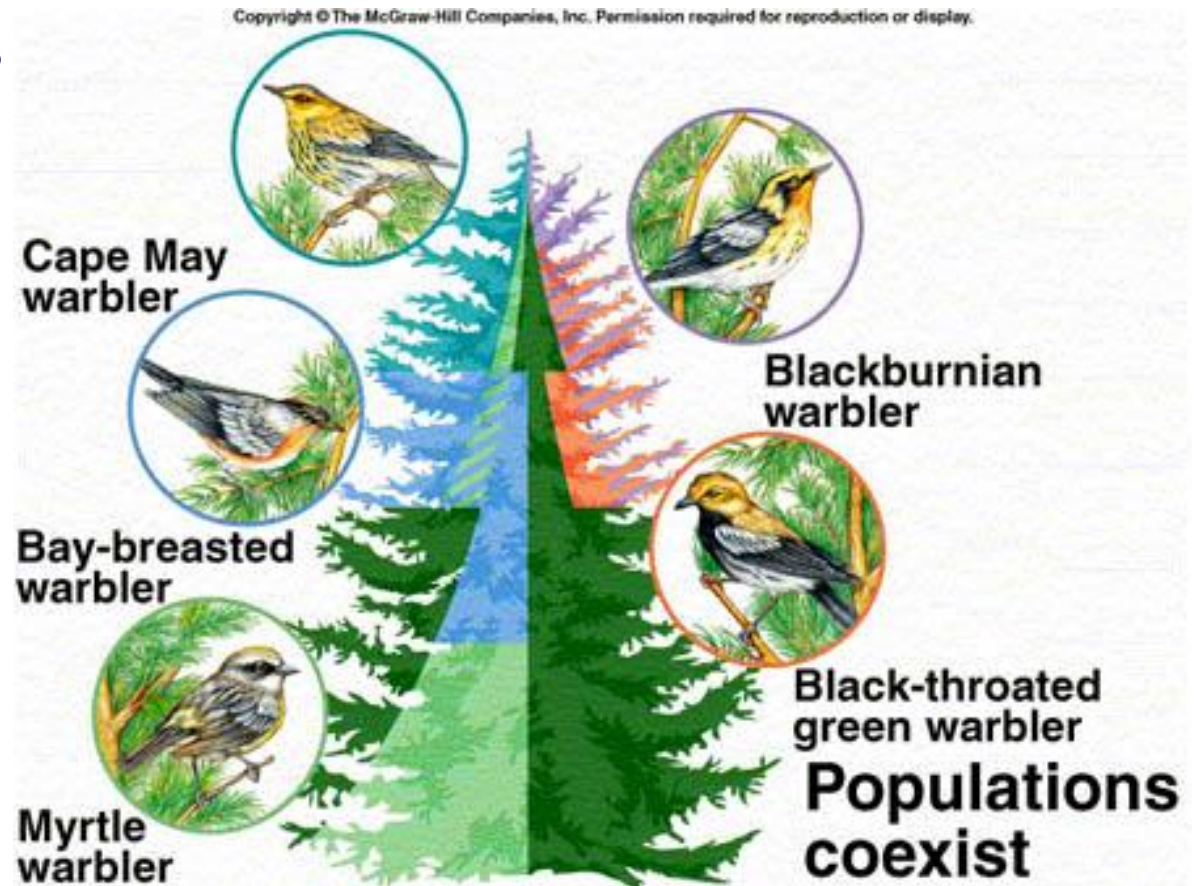
Niche & competition

- **Competitive Exclusion**
 - ◆ No two similar species can occupy the same niche at the same time



Resource Partitioning

- Divide up the resources so that each species uses similar but yet different resources



Interspecific interactions

■ Symbiotic interactions

◆ competition (-/-)

- compete for limited resource
- competitive exclusion!

◆ predation / parasitism (-/+)

◆ mutualism (+/+)

- lichens (algae & fungus)

◆ commensalism (+/0)

- barnacles attached to whale



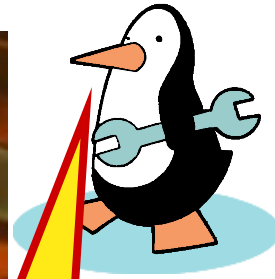
Symbiosis



commensalism **+ / 0**



mutualism **+ / +**



...not very funny
for a clown fish



predation **+ / -**



competition **- / -**

What relationship is this?



Predation drives evolution

- **Predators adaptations**
 - ◆ locate & subdue prey
- **Prey adaptations**
 - ◆ elude & defend

horns, speed, coloration



spines, thorns, toxins



Predation provides a strong selection pressure on both prey & predator



A decorative graphic consisting of a horizontal blue line at the top, a vertical blue line on the left, and another horizontal blue line at the bottom. Small white circles with blue outlines are positioned at the top-left and bottom-right corners where the lines meet.

Snake and newt video

Anti-predator adaptations

- Hide from predators

- ◆ avoid detection
- ◆ camouflage

- Warn predators

- ◆ advertise how undesirable you are as prey
- ◆ aposematic coloration
 - *apo = away & sematic = sign/meaning*
 - Batesian mimicry
 - Mullerian mimicry



Defense mechanisms

- Camouflage
 - ◆ cryptic coloration



Convergent evolution

Mimicry

Batesian mimicry

palatable or harmless species mimics a harmful model



hawkmoth larvae



green parrot snake

Hawkmoth larva puffs up to look like poisonous snake

Convergent evolution

Batesian mimicry



Mullerian mimicry

two or more protected species look like each other



cuckoo bee



yellow jacket



Mullerian mimicry

ense?

may evolve innate avoidance

Common warning coloration

- Aposematic species come to resemble each other



black, red,
orange & yellow
means:
DON'T EAT ME!



What kind of mimicry?



**Coral snake
is poisonous**

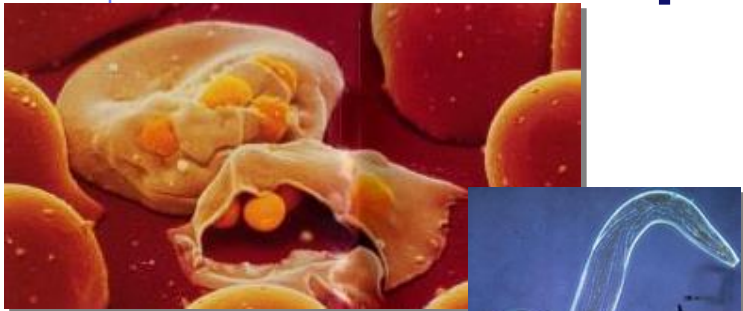
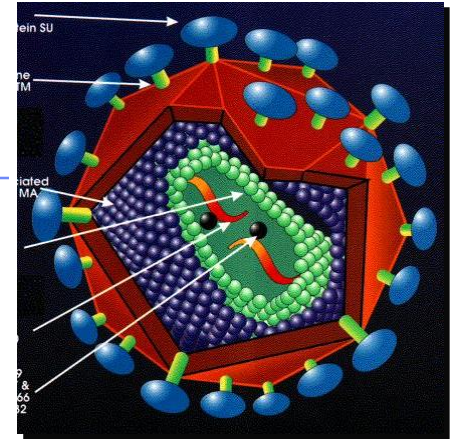


King snake is not

**Red on yellow, poison fellow;
red on black, safe from attack**

Coevolution in Community

- Predator-prey relationships
- Parasite-host relationships
- Flowers & pollinators



Long term evolutionary adjustments between species

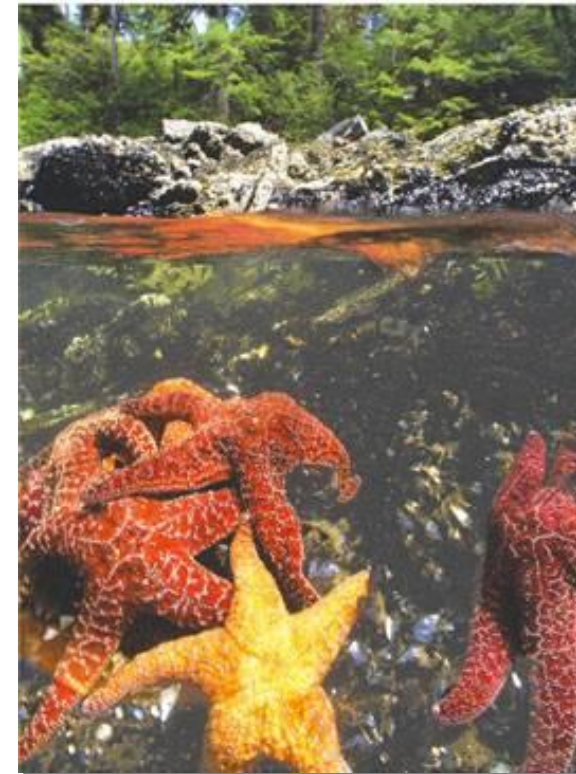
A decorative graphic consisting of a horizontal blue line extending from the left edge, a vertical blue line extending from the top edge, and another horizontal blue line extending from the right edge. Small white circles with blue outlines are positioned at the intersections of these lines: one at the top-left, one at the bottom-right, and one at the bottom-right end of the horizontal line.

Properties of a Community

Species Diversity

Characterizing a community

- **Community structure**
 - ◆ **species diversity**
 - how many different species
 - ◆ **composition**
 - dominant species
 - most abundant species or highest **biomass** (total weight)
 - **keystone species**
 - changes over time
 - ◆ **succession**

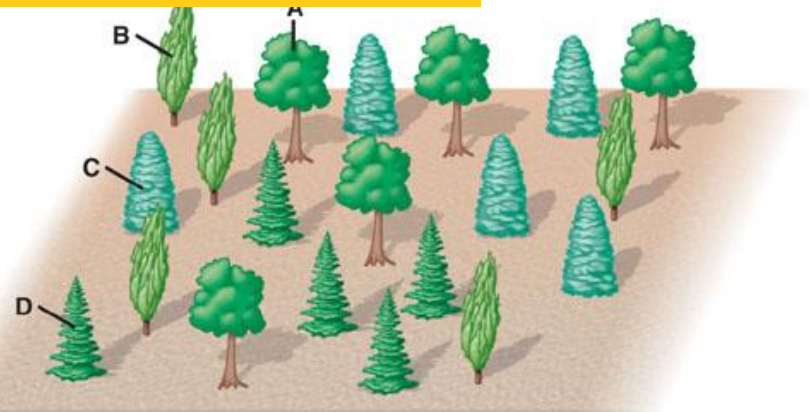


Species diversity

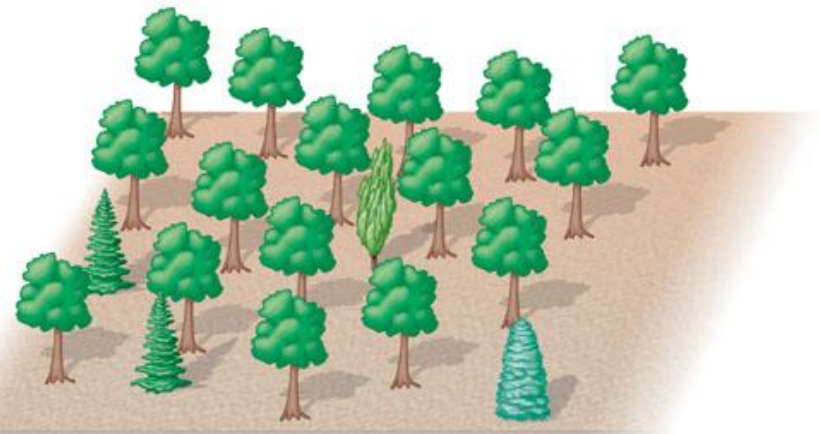
greater diversity = greater stability

Greater biodiversity offers:

- ◆ more food resources
- ◆ more habitats
- ◆ more resilience in face of environmental change



Community 1
A: 25% B: 25% C: 25% D: 25%



Community 2
A: 80% B: 5% C: 5% D: 10%

The impact of reduced biodiversity

compare these communities



agricultural
“**monoculture**”



“old field”

- Irish potato famine
- 1970 US corn crop failure

Keystone species

- **Influential ecological role**
 - ◆ exert important regulating effect on other species in community
 - ◆ keystone species increases diversity in habitat



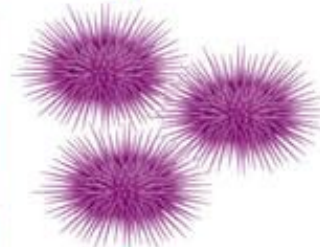
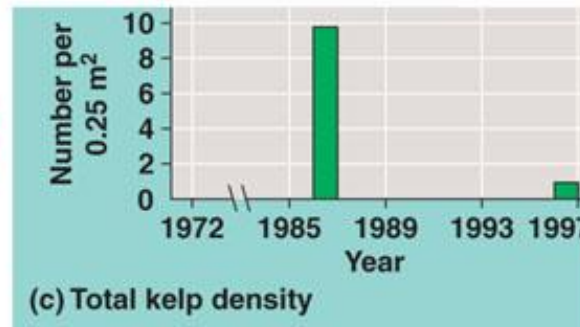
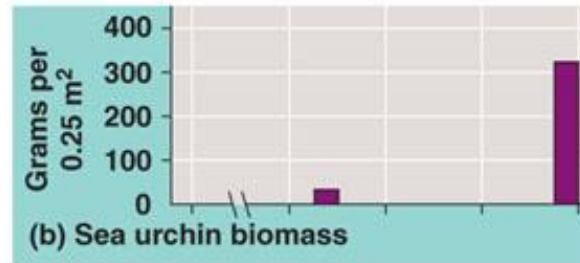
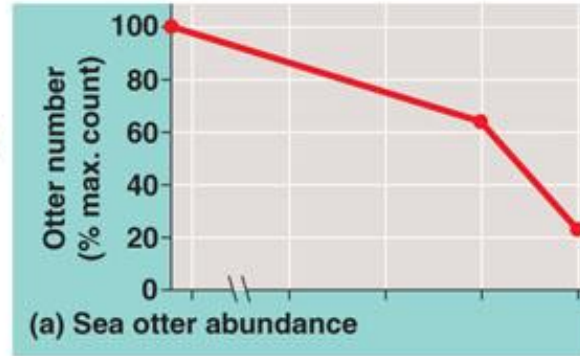
Keystone species

Sea otter is a keystone predator in North Pacific

What is the impact of the Orca whale?



Food chain before killer whale involvement in chain



Food chain after killer whales started preying on otters

The slide features a decorative layout with thin blue lines. A horizontal line spans the width of the slide, starting from a small circle at the top-left corner. A vertical line descends from this circle. Another horizontal line spans the width of the slide, ending at a small circle at the bottom-right corner. A vertical line ascends from this circle. The word "Succession" is centered in the upper-left quadrant of the slide.

Succession

Ecological succession

- **Sequence of community changes**
 - ◆ **transition in species composition over time**
 - years or decades
 - ◆ usually after a disturbance



Primary succession

- Begins with virtually lifeless area without soil, then...

- make soil {
- ◆ bacteria
 - ◆ lichens & mosses
 - ◆ grasses
 - ◆ shrubs
 - ◆ trees

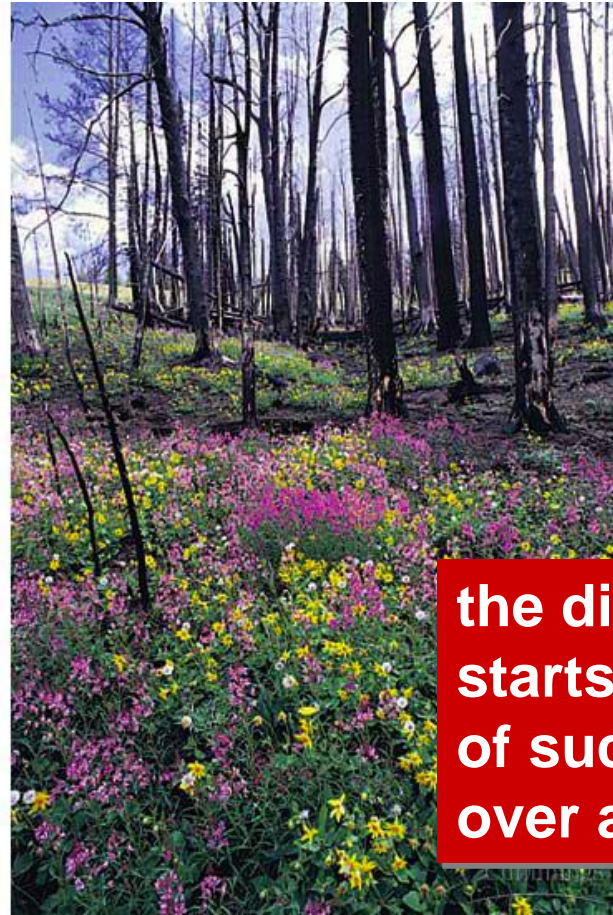


McBride glacier retreating

Secondary succession

- Existing community cleared, but base soil is still intact

burning releases nutrients formerly locked up in the tissues of tree



the disturbance starts the process of succession over again

Succession of species

pioneer species



lichens & mosses

compete well in high sunlight



grasses

more shade tolerant species



bushes & small trees

climax forest

shade tolerant species

stable community



trees

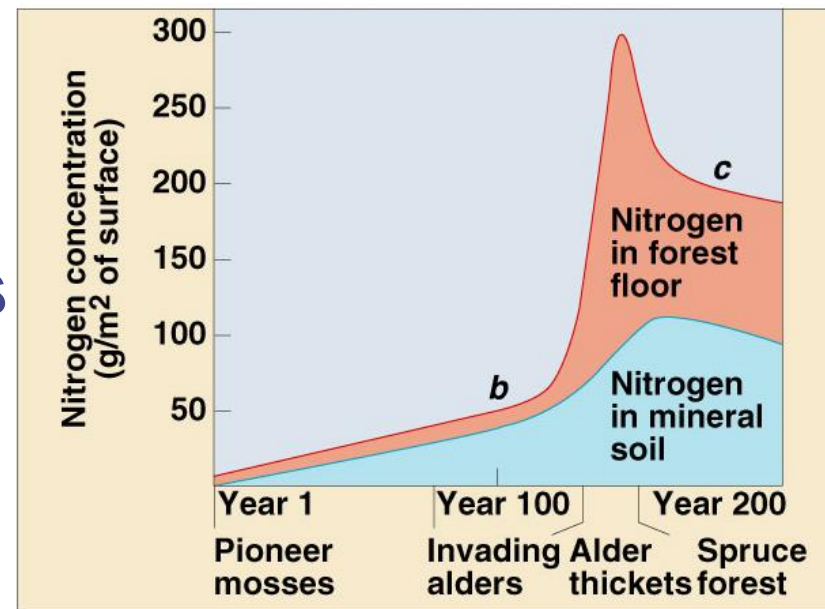
What causes succession?

■ Tolerance

- ◆ early species are weedy **r-selected**
- ◆ tolerant of harsh conditions

■ Facilitation & Inhibition

- ◆ early species facilitate habitat changes
 - change soil pH
 - change soil fertility
 - change light levels
- ◆ allows other species to out-compete



Climax Community

- **Final stage of natural succession for specific location**
 - ◆ stable plant community
 - ◆ remains essentially unchanged in species composition as long as site remains undisturbed
 - birch, beech, maple, hemlock
 - oak, hickory, pine



Disturbances as natural cycle

- Disturbances are often necessary for community development & survival

- release nutrients
- increases biodiversity



fire climax forests



- increases habitats
- rejuvenates community



Fire climax species

adaptations to survive and reproduce in areas than experience frequent fires



When people don't learn ecology!

Building homes in fire climax zones



preventing fires
makes next year's
fire much worse!



© Robert Winslow





**Don't blow
your top!
Ask
Questions!**