

AP Biology



Community Ecology

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The diagram consists of five concentric circles. From the center outwards, they are: a small orange circle labeled 'organism', a red circle labeled 'population', a green circle labeled 'community', a blue circle labeled 'ecosystem', and an outermost light blue circle labeled 'biosphere'. The word 'community' is highlighted in a white box with a red border.

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?**



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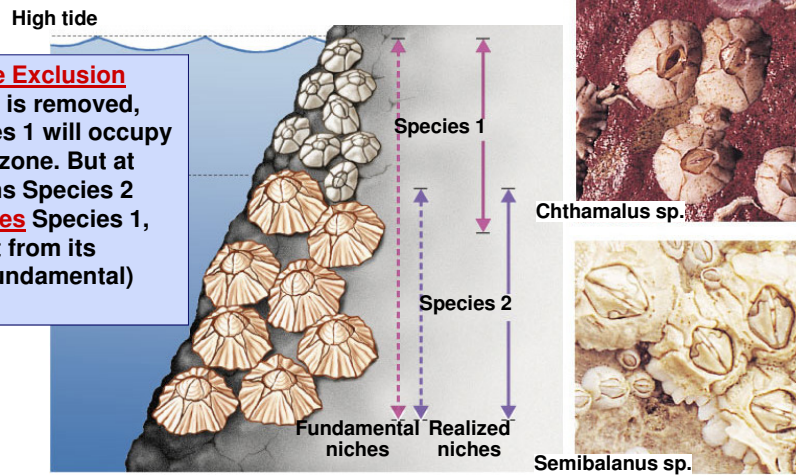
Niche

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

Competitive Exclusion

If Species 2 is removed, then Species 1 will occupy whole tidal zone. But at lower depths Species 2 **out-competes** Species 1, excluding it from its potential (fundamental) niche.

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Niche & competition

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



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Resource partitioning

Reduce competition through **microhabitats**

“the ghost of competition past”

A. ricardii

A. insolitus

A. christophei

A. cybotes

A. etheridgei

A. aliniger

A. distichus

Interspecific interactions

- **Symbiotic interactions**
 - ◆ **competition (-/-)**
 - compete for limited resource
 - competitive exclusion!
 - ◆ **predation / parasitism (-/+)**
 - ◆ **mutualism (+/+)**
 - lichens (algae & fungus)
 - ◆ **commensalism (+/0)**
 - barnacles attached to whale

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Symbiosis

commensalism $+/0$

mutualism $+/+$

predation $+/-$

competition $-/-$

...not very funny for a clown fish

What relationship is this?

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Predation drives evolution

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



Predation provides a strong selection pressure on both prey & predator

horns, speed, coloration



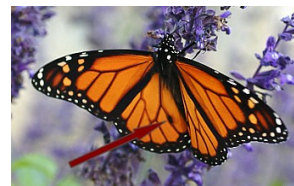
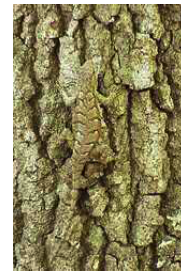
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spines, thorns, toxins



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

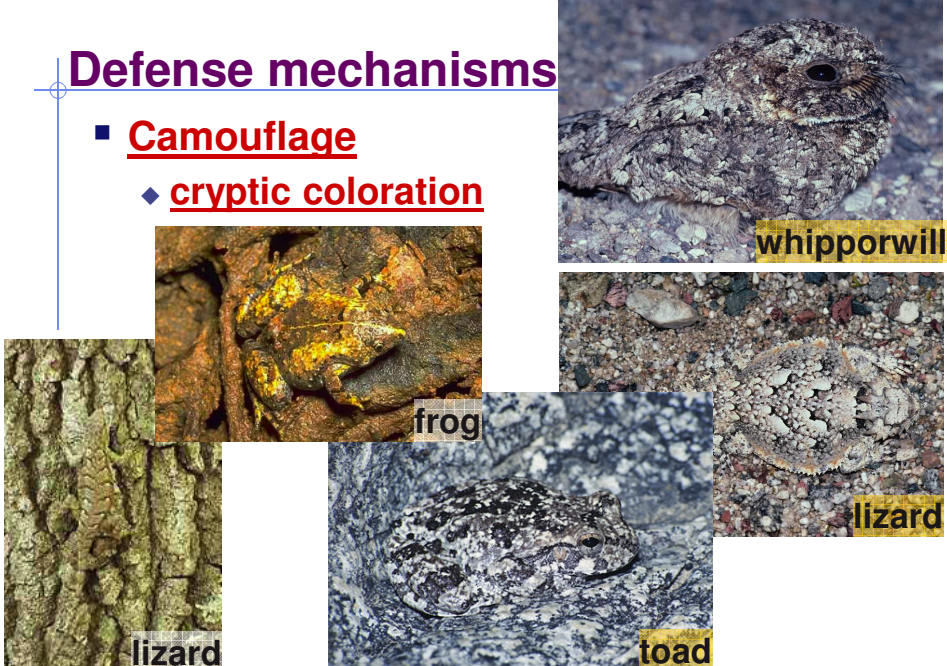


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Defense mechanisms

- **Camouflage**
 - ◆ **cryptic coloration**



whipperwill

frog

lizard


lizard

toad

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

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Batesian mimicry


Convergent evolution




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Mullerian mimicry


two or more protected species look like each other



cuckoo bee



yellow jacket



Mullerian mimicry

sense?
may evolve innate avoidance

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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



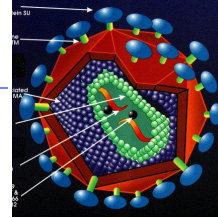
King snake is not

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

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Coevolution in Community

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



Long term evolutionary adjustments between species

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

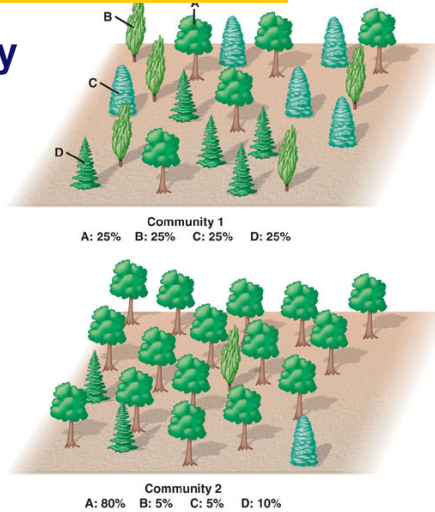


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Species diversity

greater diversity = greater stability

- Greater biodiversity offers:
 - ◆ more food resources
 - ◆ more habitats
 - ◆ more resilience in face of environmental change



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The impact of reduced biodiversity

compare these communities



agricultural
"monoculture"



"old field"

- Irish potato famine
- 1970 US corn crop failure

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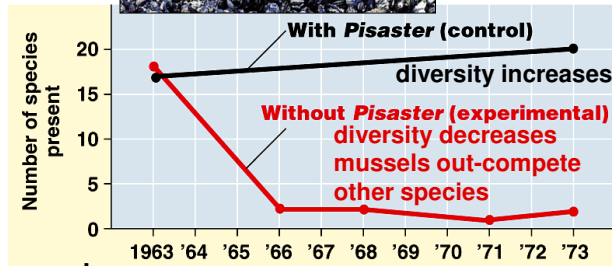
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Keystone species

Influential ecological role

- ◆ exert important regulating effect on other species in community
- ◆ keystone species increases diversity in habitat

Pisaster ochraceous



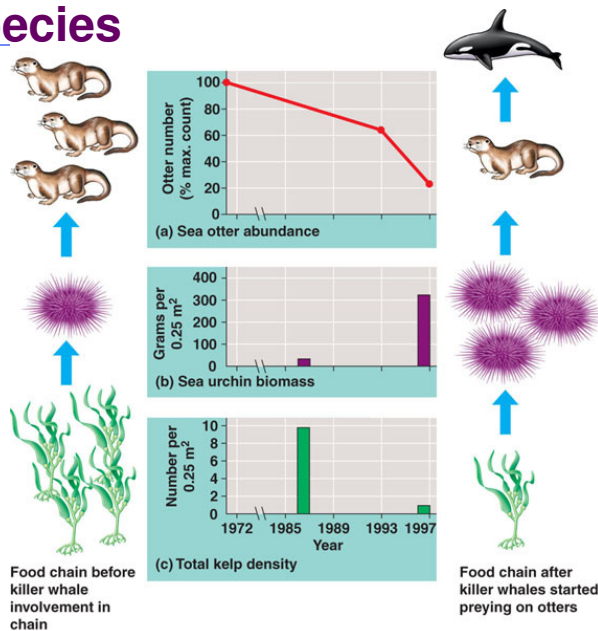
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Washington coast

Keystone species

Sea otter is a keystone predator in North Pacific

What is the impact of the Orca whale?



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Keystone species

Beaver is a keystone species in Northeast & West




dams transform flowing streams into ponds creating new habitat

Ecological succession

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



Mt. St. Helens



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Primary succession

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

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



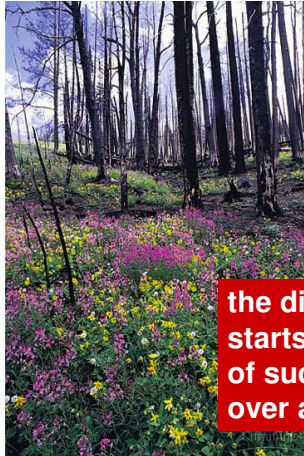
McBride glacier retreating

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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

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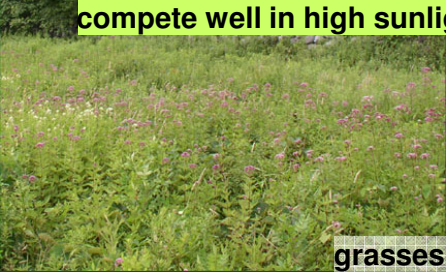
Succession of species

pioneer species




lichens & mosses

compete well in high sunlight



grasses

more shade tolerant species




bushes & small trees

climax forest

shade tolerant species


stable community

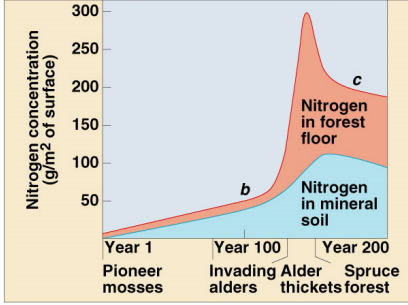


trees

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





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Climax forest

- Plant community dominated by trees
- Representing 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



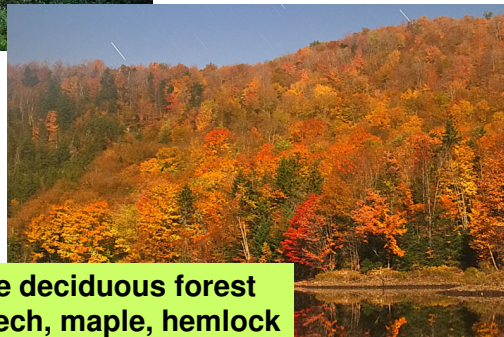
Climax forest

taiga



The species mix of climax forest is dependent on the abiotic factors of the region

- solar energy levels
- temperature
- rainfall
- fertility & depth of soil



temperate deciduous forest
birch, beech, maple, hemlock

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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

Jack Pine

- adaptations to survive and reproduce in areas than experience frequent fires



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When people don't learn ecology!

Building homes in fire climax zones



preventing fires makes next year's fire much worse!



Don't blow your top!
Ask Questions!



2007-2008