Community Ecology

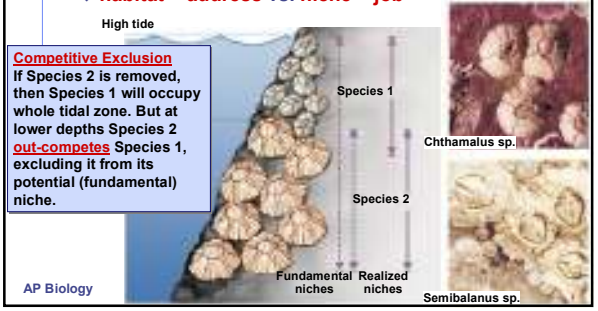
- Community
  - all the organisms that live together in a place
    - interactions
- Community Ecology
  - study of interactions among all populations in a common environment

To answer:
In what way do the populations interact?

AP Biology

Niche

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



Niche & competition

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

AP B

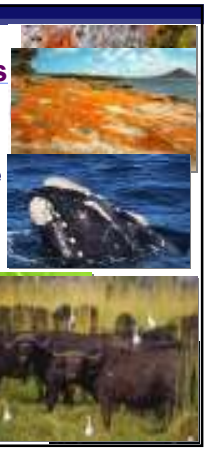
Resource partitioning

Reduce competition through microhabitats

"the ghost of competition past"

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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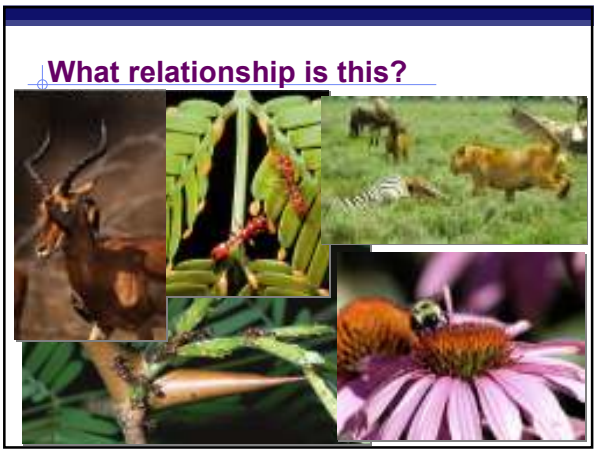
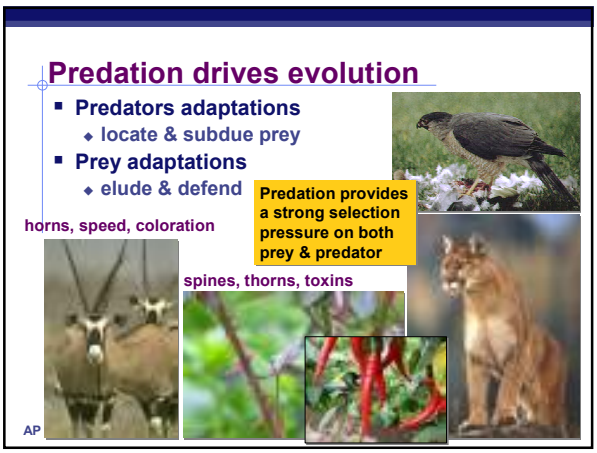
Symbiosis
mutualism +/+
…not very funny for a clown fish
commensalism +/0
predation +/-
competition -/-


What relationship is this?


Predation drives evolution
Predators adaptations
locate & subdue prey
Prey adaptations
elude & defend
horns, speed, coloration
Predation provides a strong selection pressure on both prey & predator
spines, thorns, toxins
AP

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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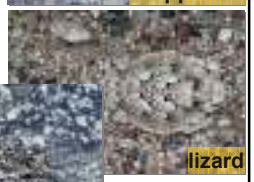
Defense mechanisms

- Camouflage
  - cryptic coloration



Mimicry

Convergent evolution

Batesian mimicry

palatable or harmless species mimics a harmful model

Hawkmoth larva puffs up to look like poisonous snake

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Batesian mimicry

Convergent evolution

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

What kind of mimicry?

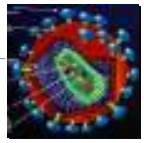
Coral snake
is poisonous

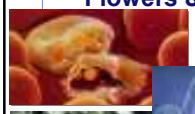
King snake is not

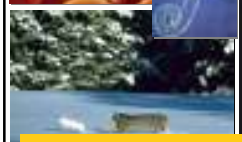
**Red on yellow, poison fellow;
red on black, safe from attack**

Coevolution in Community

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







Long term evolutionary adjustments between species

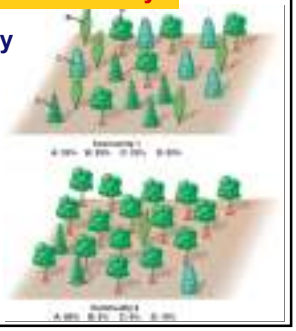
Characterizing a community

- 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



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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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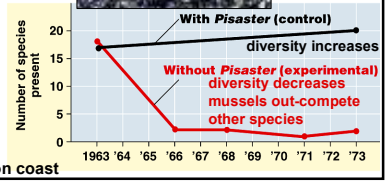
Keystone species

Pisaster ochraceous

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

Sea star



Washington coast

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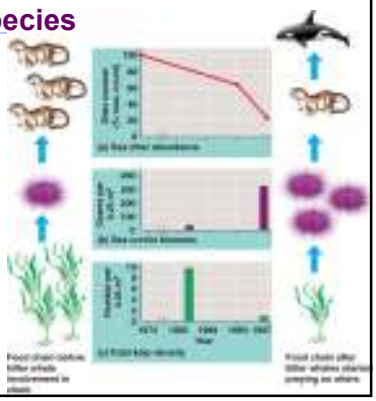
Keystone species

Sea otter is a keystone predator in North Pacific

What is the impact of the Orca whale?



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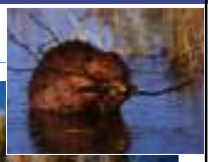
Keystone species

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

Primary succession

- Begins with virtually lifeless area without soil, then…
  - make soil: bacteria, lichens & mosses
  - grasses
  - shrubs
  - trees

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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

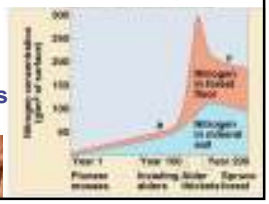
climax forest
shade tolerant species
stable community

trees

AP

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 forest

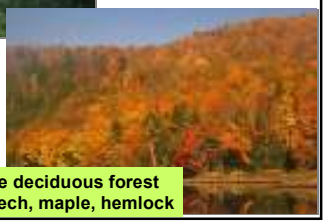
- Plant community dominated by trees
- Representing final stage of natural succession for specific location
  - stable plant community
  - remains essentially unchanged in species composition as long as site remains undisturbed
    - birch, beech, maple, hemlock
    - oak, hickory, pine

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

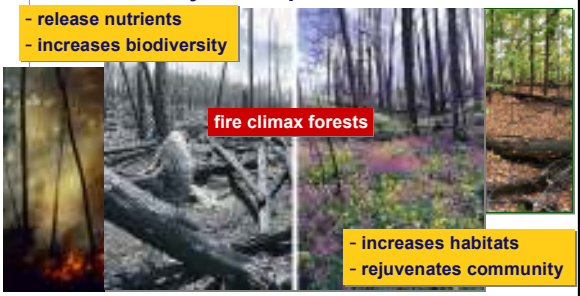


temperate deciduous forest
birch, beech, maple, hemlock

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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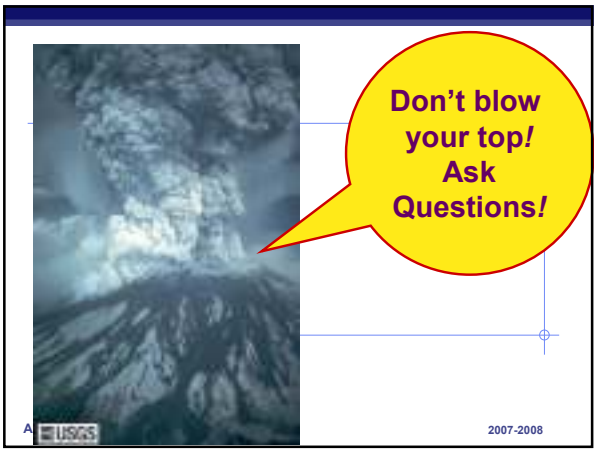
When people don't learn ecology!

Building homes in fire climax zones

preventing fires makes next year's fire much worse!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