Community Ecology

AP Biology

Community Ecology

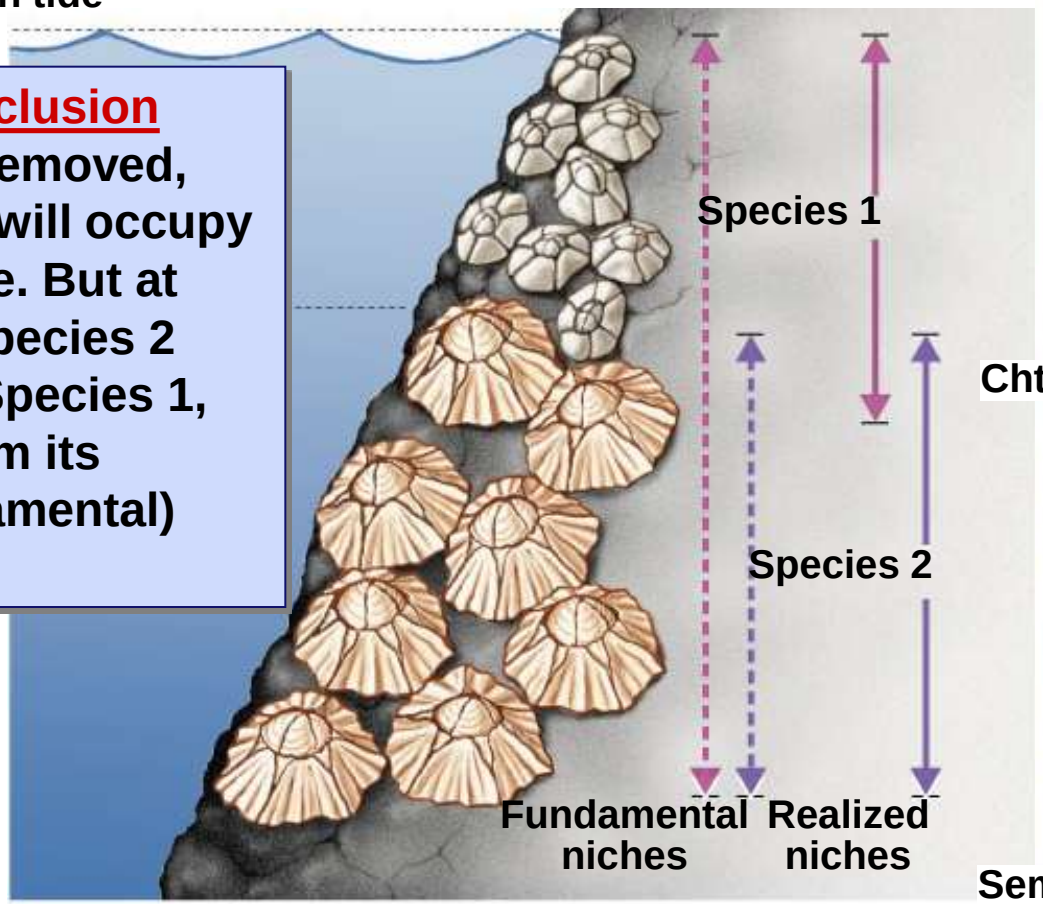
- **Community**
  - all the organisms that live together in a place
    - interactions
- **Community Ecology**
  - study of interactions among all populations in a common environment

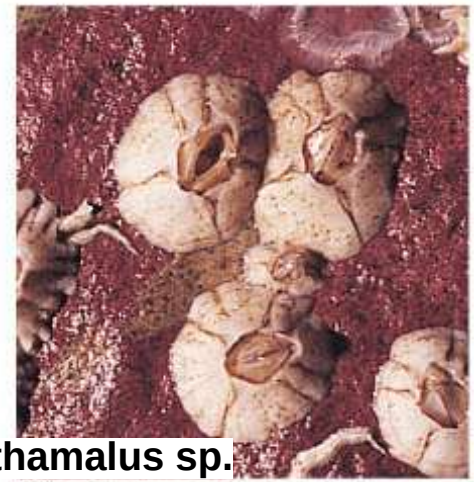
To answer:
In what way do the populations interact?

Niche

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

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.




Chthamalus sp.


Semibalanus sp.

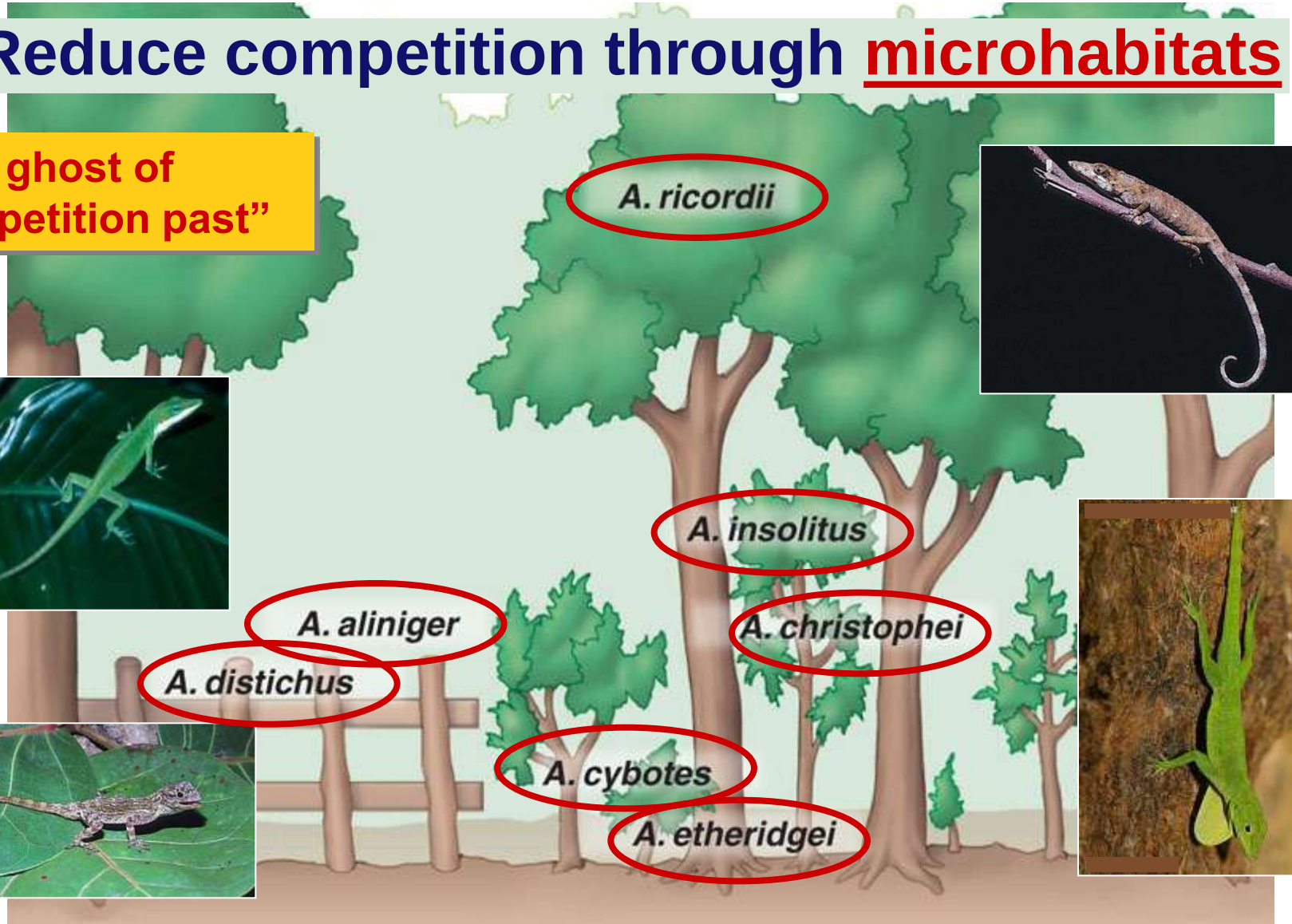
Niche & competition

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

Resource partitioning

Reduce competition through microhabitats

"the ghost of competition past"



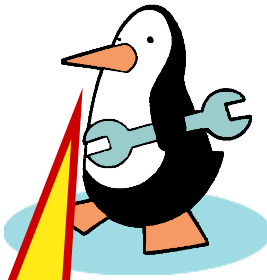
Interspecific interactions

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

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

Predation provides a strong selection pressure on both prey & predator

horns, speed, coloration

spines, thorns, toxins

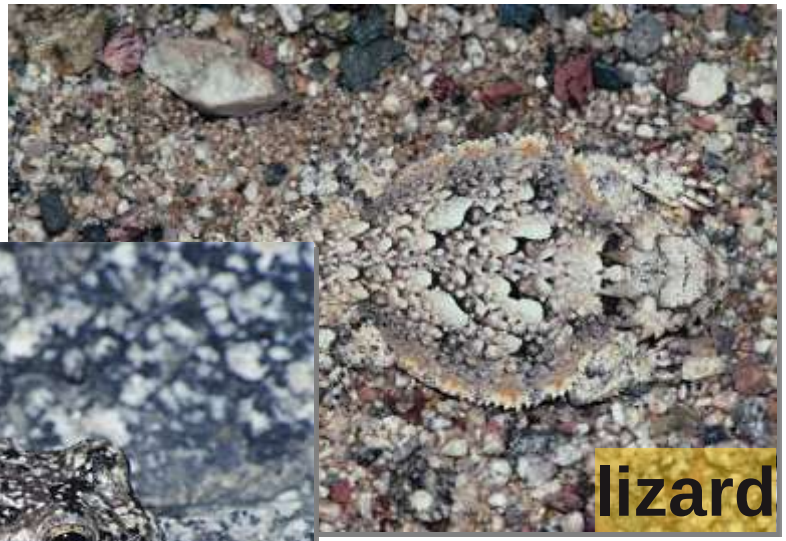
AP

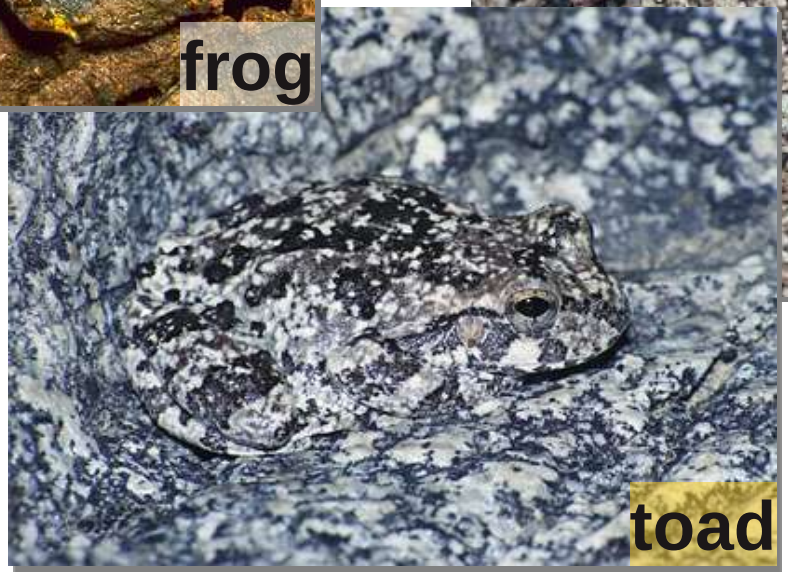
Anti-predator adaptations

- **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**

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

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?

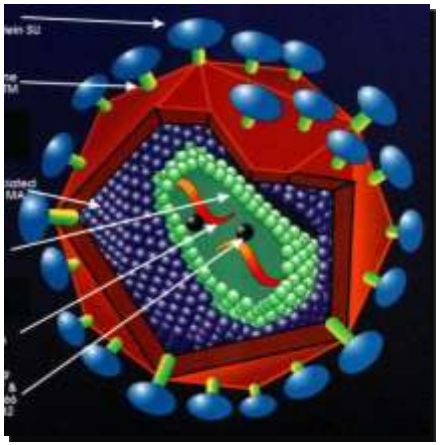
Coral snake
is poisonous

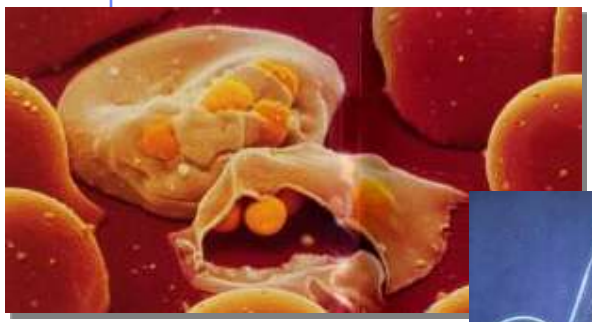
King snake is not

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

Coevolution in Community

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

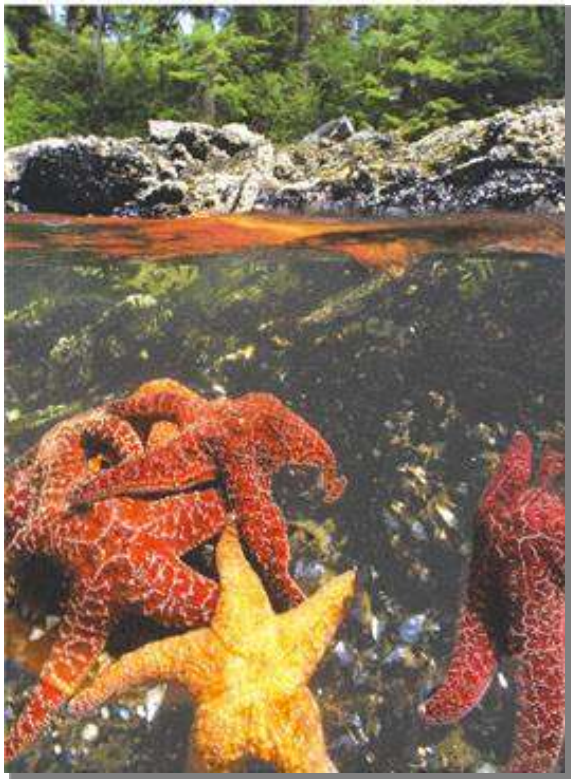




Long term evolutionary adjustments between species

Characterizing a community

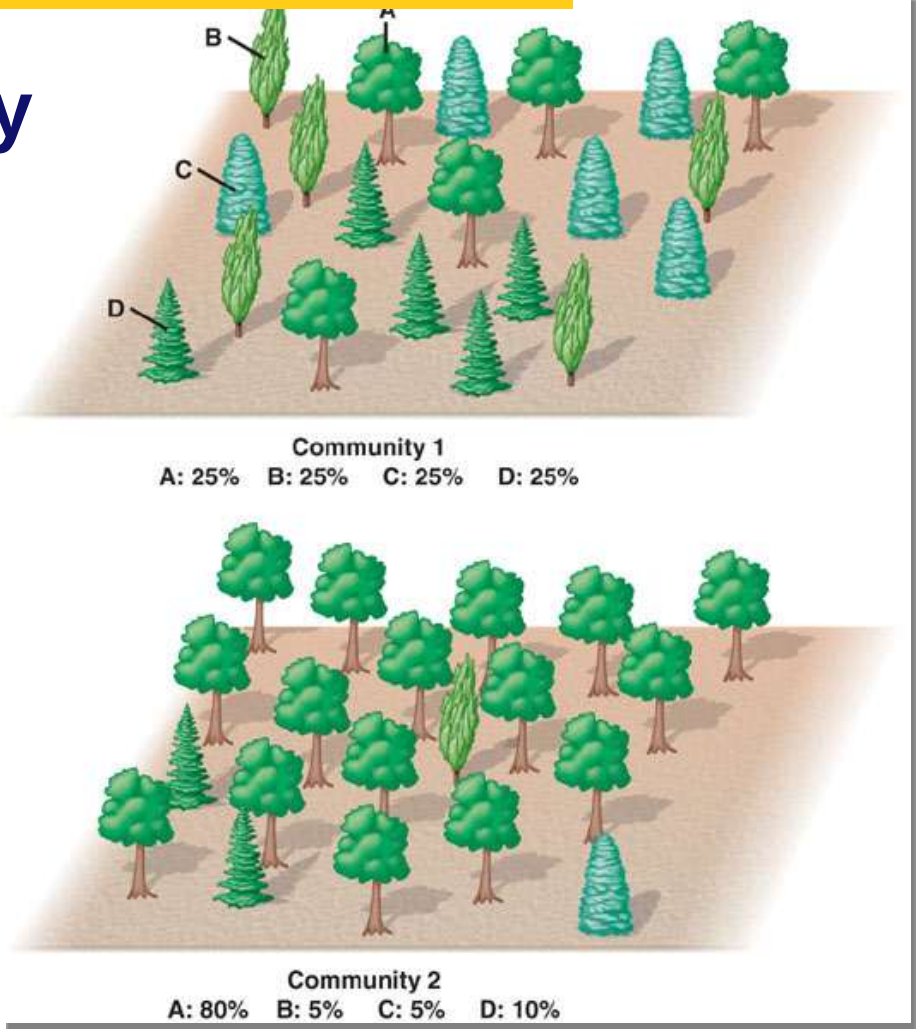
- Community structure
  - species diversity
    - how many different species
  - composition
    - dominant species
    - most abundant species or highest biomass (total weight)
    - keystone species
    - changes over time
      - succession



Species diversity

greater diversity = greater stability

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



The impact of reduced biodiversity

compare these communities

agricultural
“monoculture”

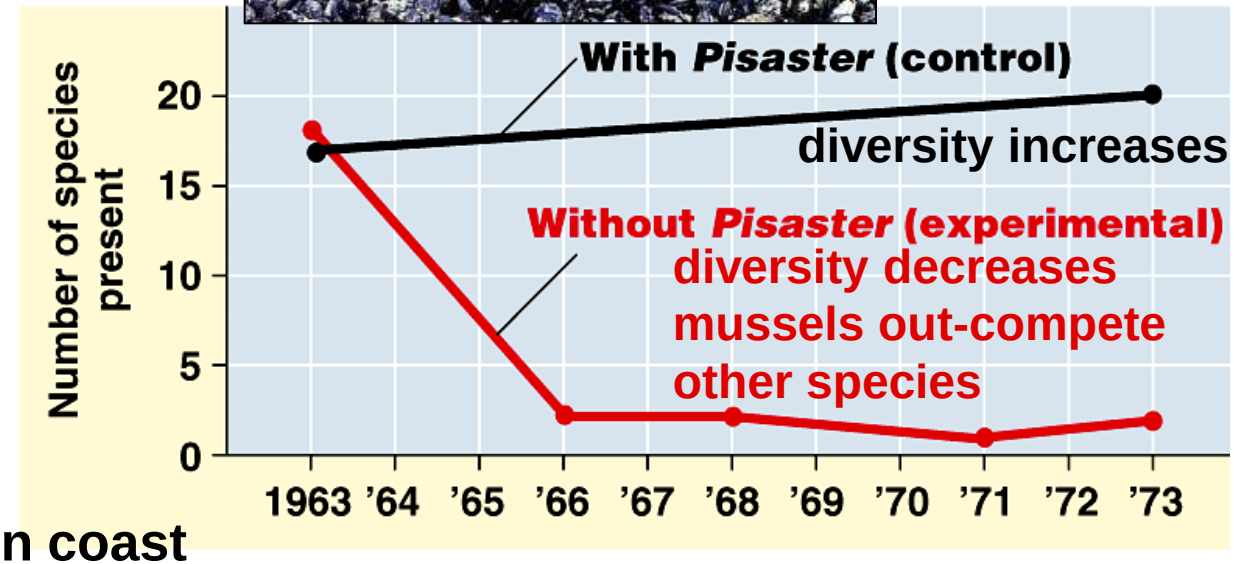
“old field”

- **Irish potato famine**
- **1970 US corn crop failure**

Keystone species

Pisaster ochraceous

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

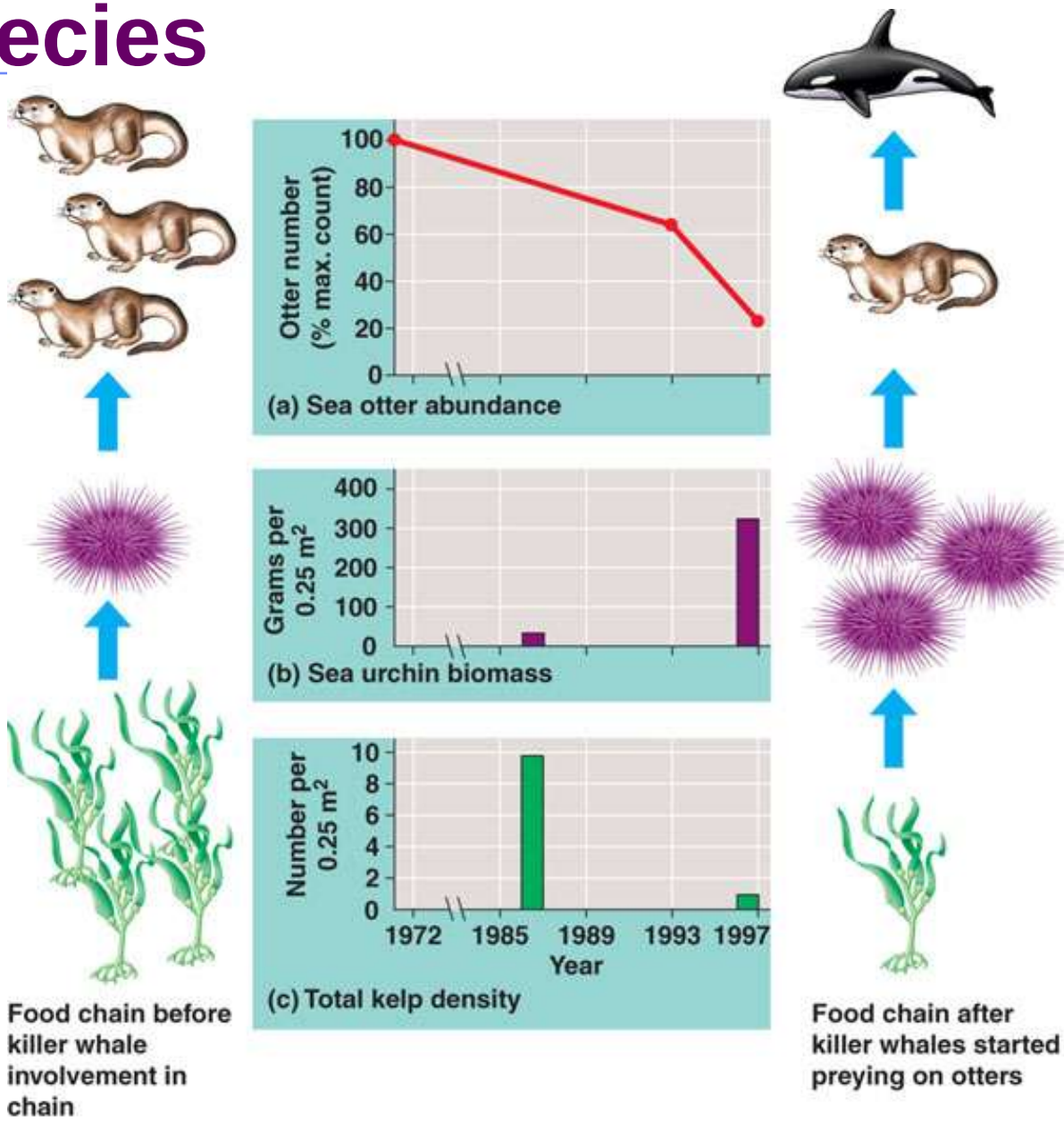


Washington coast

Keystone species

Sea otter is a keystone predator in North Pacific

What is the impact of the Orca whale?



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**

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

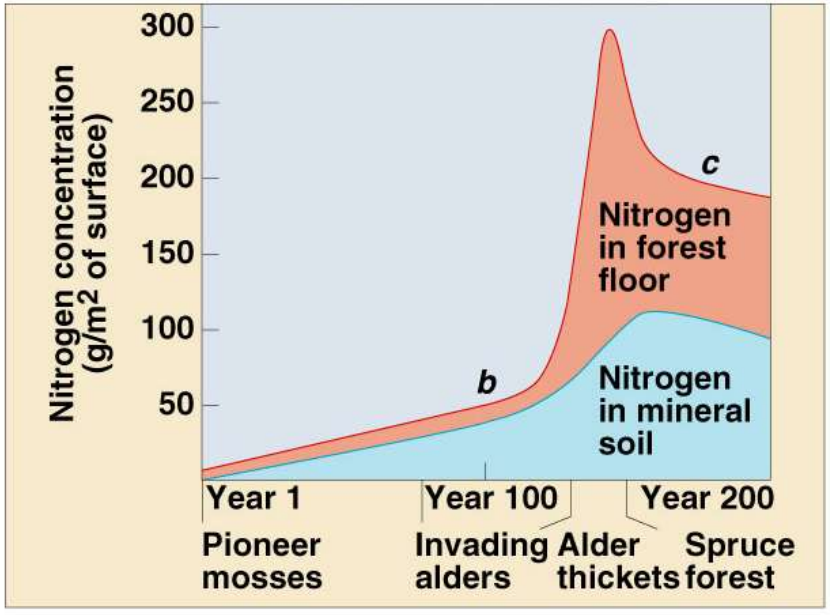
shade tolerant species

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 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

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*!*