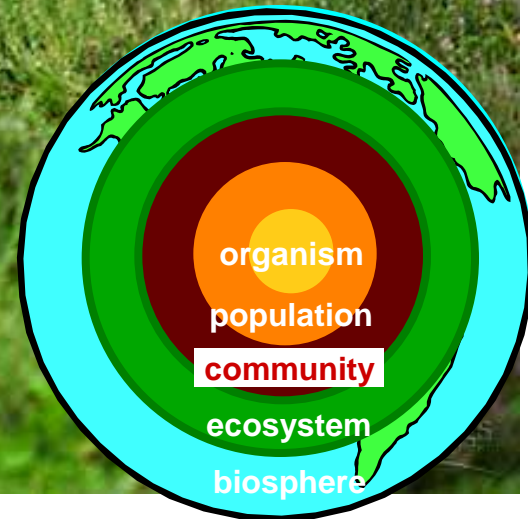


Community Ecology

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?



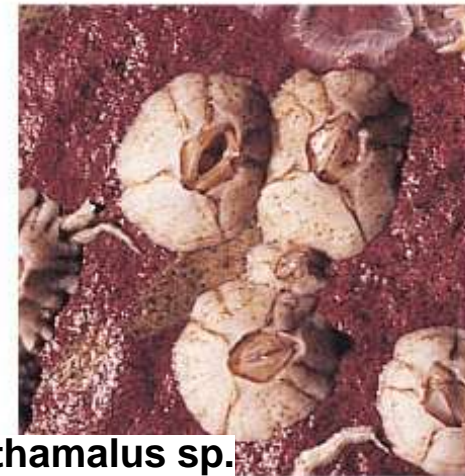
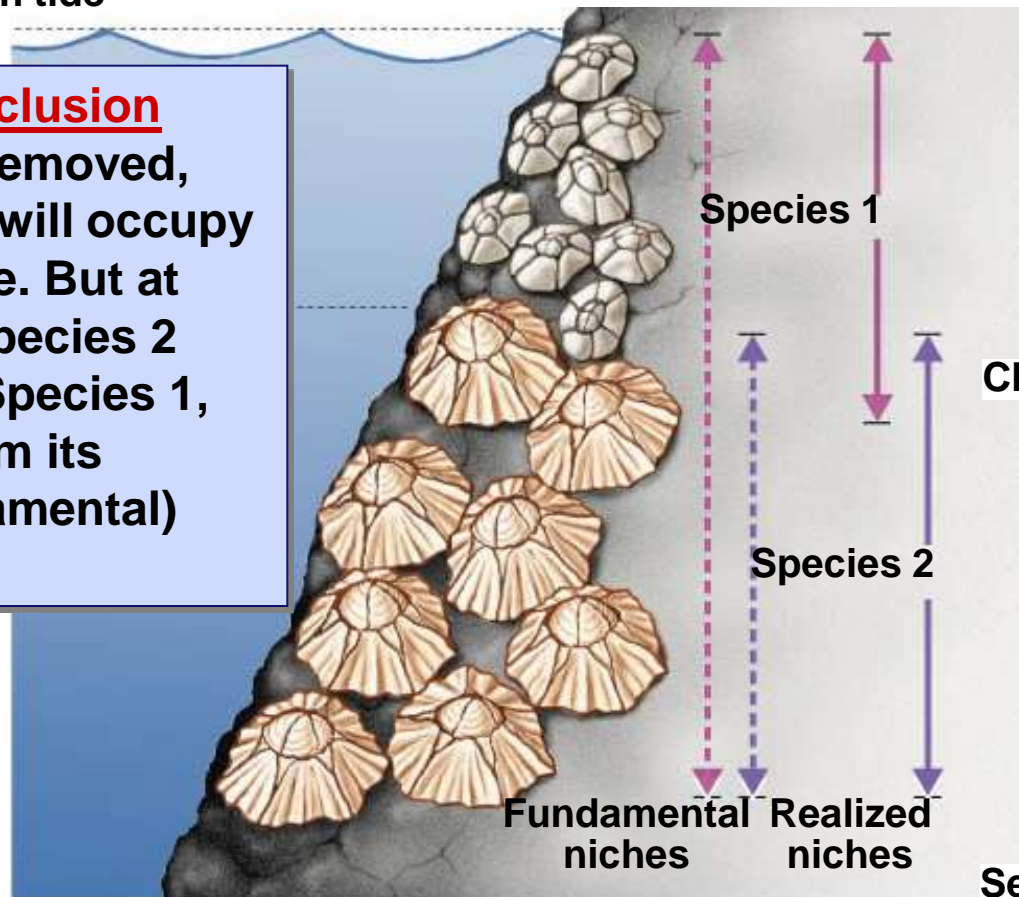
Niche

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

High tide

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.



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”

A. ricordii



A. insolitus

A. christophei

A. aliniger

A. distichus

A. cybotes

A. etheridgei



Interspecific interactions

■ Symbiotic interactions

◆ competition (-/-)

- compete for limited resource
- competitive exclusion!

◆ predation / parasitism (-/+)

◆ mutualism (+/+)

- lichens (algae & fungus)

◆ commensalism (+/0)

- barnacles attached to whale



Symbiosis



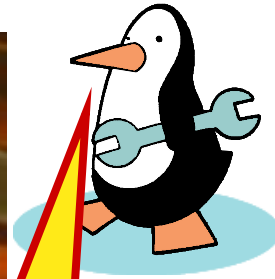
commensalism

+ / 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



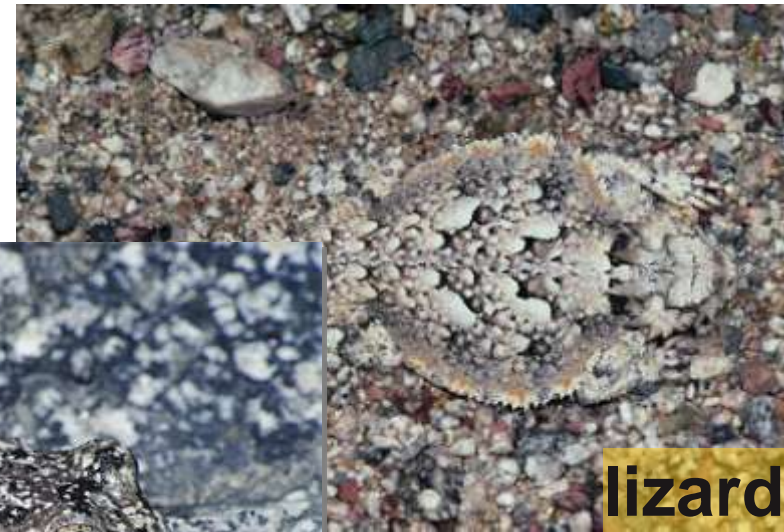
Anti-predator adaptations

- 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**

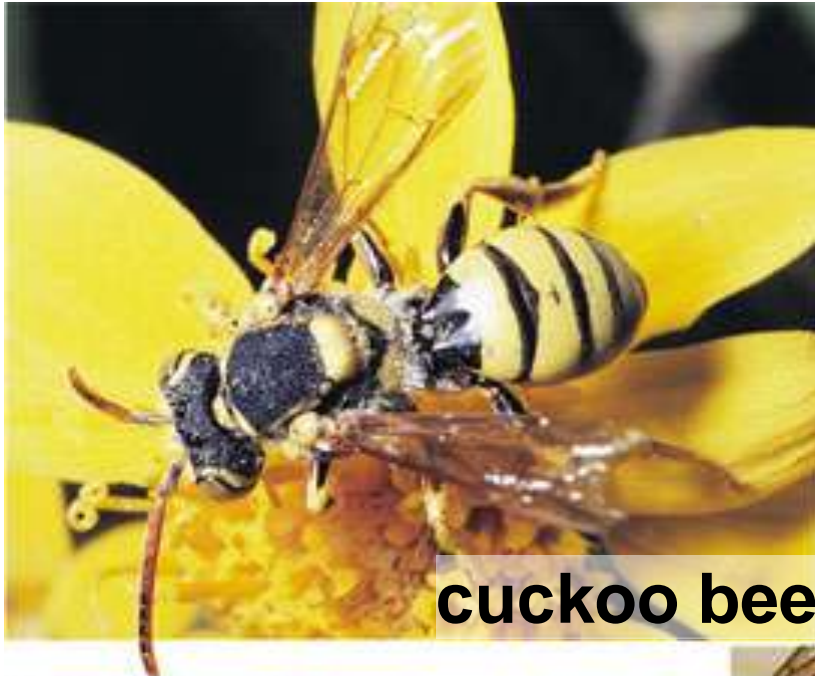
Convergent evolution

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**

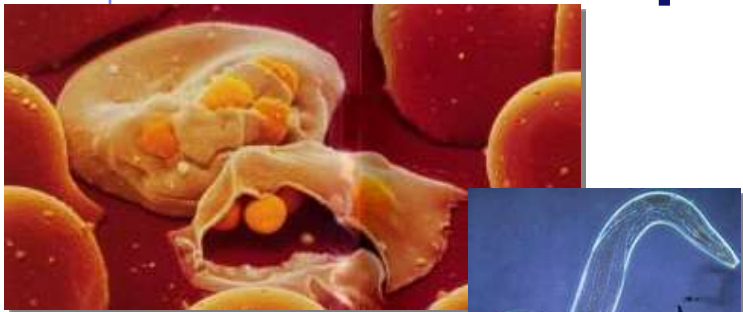
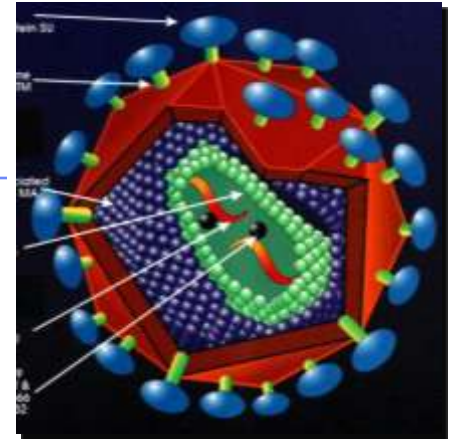


King snake is not

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

Coevolution in Community

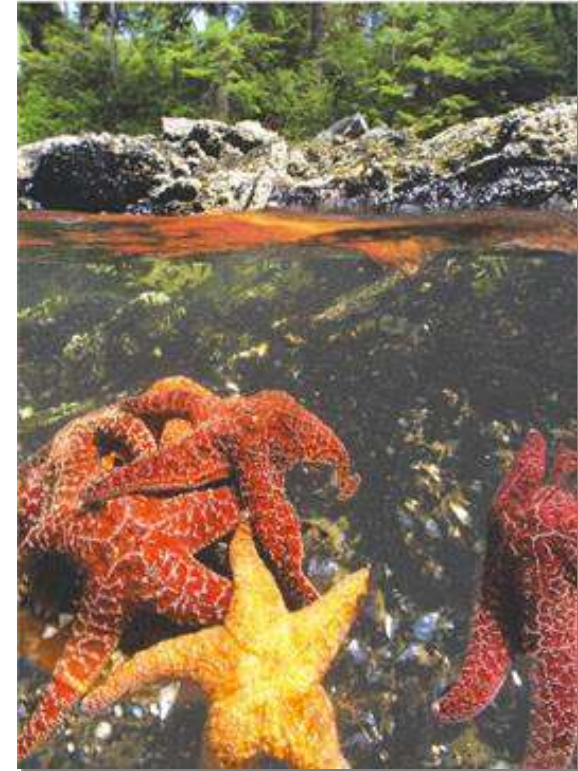
- Predator-prey relationships
- Parasite-host relationships
- Flowers & pollinators



Long term evolutionary adjustments between species

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

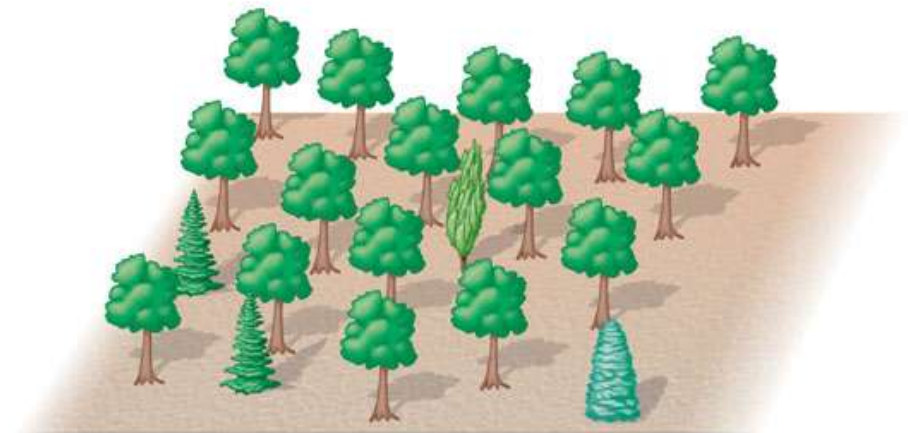
greater diversity = greater stability

■ 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**”

AP Biology



“old field”

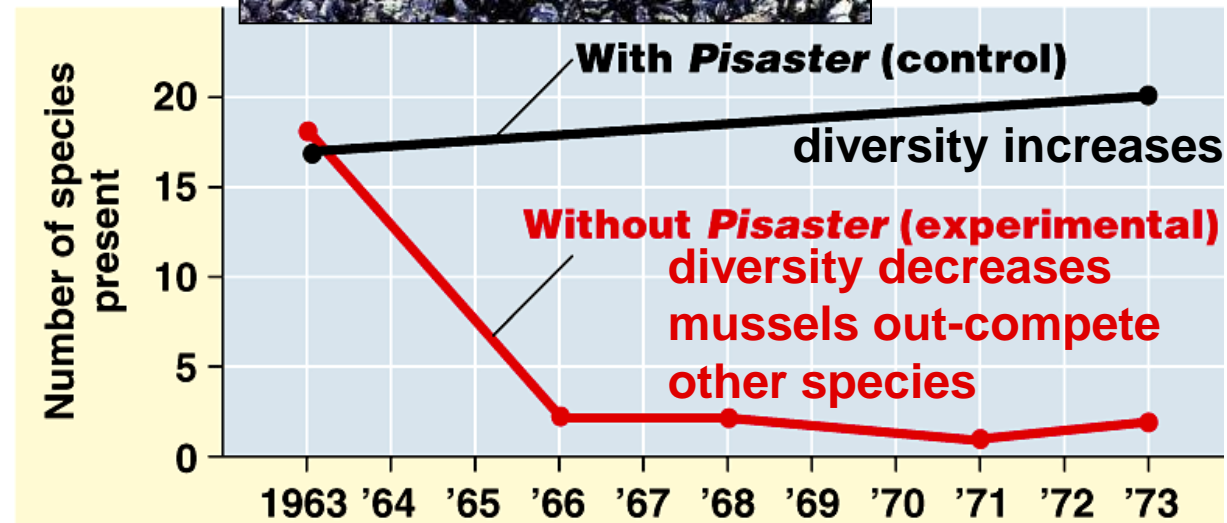
- Irish potato famine
- 1970 US corn crop failure

Keystone species

■ Influential ecological role

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

Pisaster ochraceus



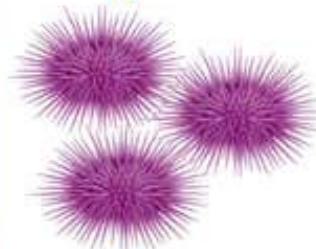
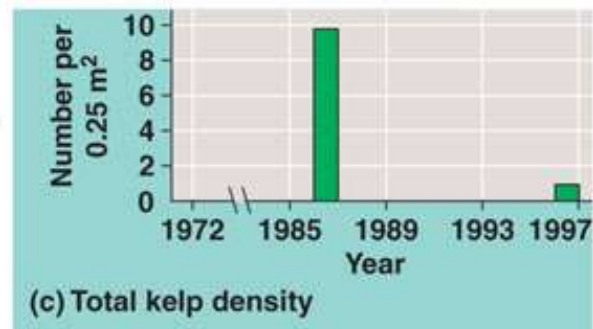
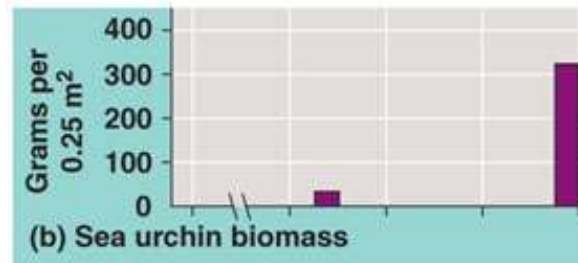
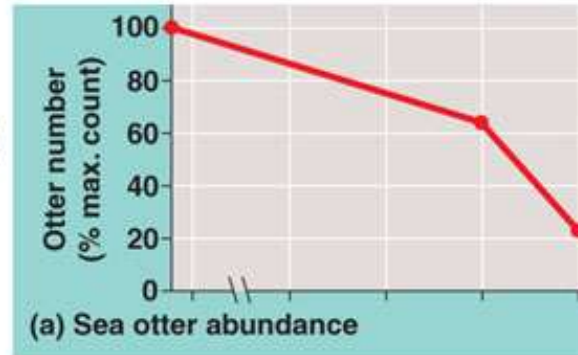
Keystone species

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

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

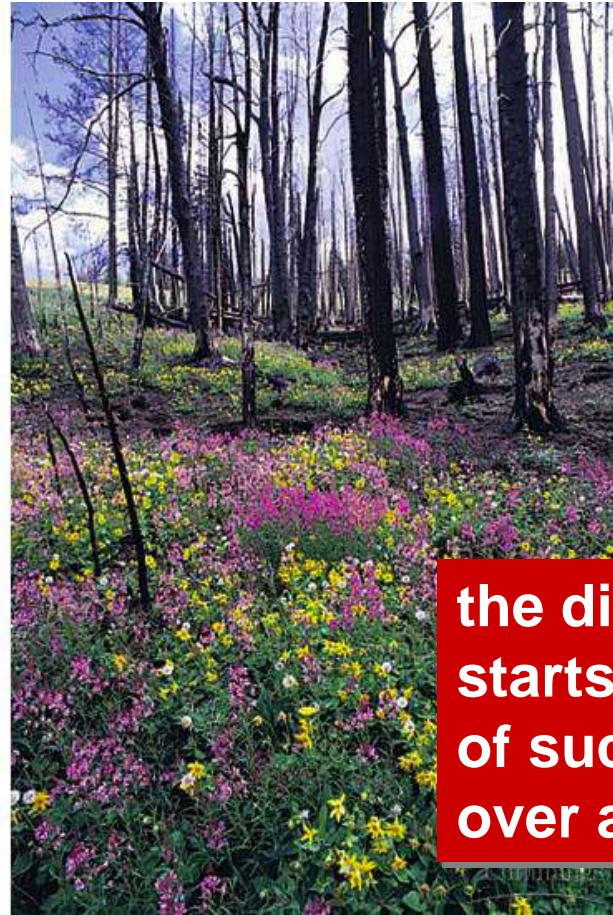


McBride glacier retreating

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

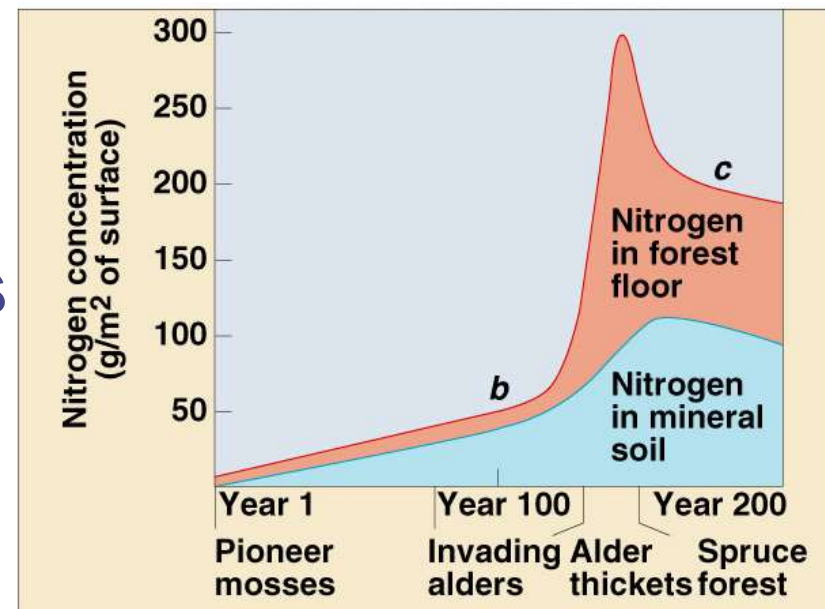
What causes succession?

■ 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

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!**