Community Ecology

• Community
  – all the organisms that live together in a place

• Community Ecology
  – study of interactions among all populations in an environment

To answer: In what way do the populations interact?

Niche

• An organism’s niche is its ecological role
  – habitat = address vs. niche = job

Niche & competition

• Competitive Exclusion Principle
  – No two similar species can occupy the same niche at the same time

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.
Resource partitioning

• Reduce competition through **microhabitats**

Interspecific interactions

• **Symbiotic interactions**
  – competition (-/-)
  – predation / parasitism (-/+)
  – mutualism (+/+)
  – commensalism (+/0)

...not very funny for a clown fish
commensalism  +/0
Parasitism  +/−
predation  +/−
competition  −/−
Predation drives evolution

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

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 & *semantic* = sign/meaning

Defense mechanisms

- Camouflage
  - cryptic coloration

Whippoorwill

Lizard

Frog

Lizard

Toad
Mimicry

**Batesian mimicry**
- Palatable or harmless species mimics a harmful one
- Hawkmoth larva puffs up to look like poisonous snake

**Mullerian mimicry**
- Two or more protected species look like each other
- Cuckoo bee, yellow jacket

**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

Genetic diversity in a vole population

Species diversity in a coastal redwood ecosystem

Community and ecosystem diversity across the landscape of an entire region
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

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

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Keystone species

- **Sea otter** is a keystone predator in North Pacific

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Keystone species

- **Beaver** is a keystone species in Northeast & West

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**Pisaster ochraceous**

Sea star

![Graph showing diversity increases with Pisaster](image)

With Pisaster (control)

- Diversity increases

Without Pisaster (experimental)

- Diversity decreases
  - mussels out-compete other species

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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

**Primary succession**

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

**Secondary succession**

- Existing community cleared, but base soil is still intact

**Succession of species**

- Pioneer species
  - compete well in high sunlight
- Lichens & mosses
- Grasses
- More shade tolerant species
- Bushes & small trees
- Climax forest
- Shade tolerant species
- Stable community
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

Disturbances as natural cycle

- Disturbances are often necessary for community development & survival
  - release nutrients
  - increases biodiversity
  - 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!
Review Questions

1. Two barnacles, *Balanus* and *Chthamalus*, can both survive on the lower rocks just above the low tide line on the Scottish coast, but only *Balanus* actually does so, with *Chthamalus* adopting a higher zone. Which of the following best accounts for this niche separation?
   
   A. competitive exclusion  
   B. predation of *Chthamalus* by *Balanus*  
   C. cooperative displacement  
   D. primary succession  
   E. mutualism

2. Dwarf mistletoes are flowering plants that grow on certain forest trees. They obtain nutrients and water from the vascular tissues of the trees. The trees derive no known benefits from the dwarf mistletoes. Which of the following best describes the interactions between dwarf mistletoes and trees?
   
   A. mutualism  
   B. parasitism  
   C. commensalism  
   D. facilitation  
   E. competition
3. In a particular case of secondary succession, three species of wild grass all invaded a field the first growing season after a farmer abandoned the field. By the second season, a single one of the wild grasses dominated the field. A possible factor in this succession was
   A. equilibrium.
   B. facilitation.
   C. immigration.
   D. inhibition.
   E. mutualism.