Community ecology

Interactions between species

What's a community?
- All of the individuals in a given area
- An assemblage of populations
- Interactions are key
- Has structure determined by the number of species, their identity, their relative abundance, and their interactions

The big questions:
- How many species are present in a community?
- Which species are present?
- Which of those species are most common?
- And….
  - Why?

One Community Level Question
Are abiotic factors or biotic interactions more important in shaping communities?
Individualistic vs. interactive hypotheses.

Interactions between species

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Effects on Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competition (−/−)</td>
<td>The interaction is detrimental to both species.</td>
</tr>
<tr>
<td>Predation (+/−)</td>
<td>The interaction is beneficial to one species and detrimental to the other.</td>
</tr>
<tr>
<td>(includes parasitism)</td>
<td></td>
</tr>
<tr>
<td>Mutualism (+/+</td>
<td>The interaction is beneficial to both species.</td>
</tr>
<tr>
<td>Commensalism (+/0)</td>
<td>One species benefits from the interaction but the other is unaffected.</td>
</tr>
</tbody>
</table>

Competition
- Only occurs when a resource is limiting

![Graph showing competition between Paramecium and P. caudatum](image)
Competitive exclusion in the field
- Gause’s C-E principle: 2 spp cannot occupy the same niche

Ecological niche
- Total amount of a species’ use of the environment
- Odum’s idea:
  - Habitat is an organism’s address
  - Niche is an organism’s habitat and occupation
- Fundamental niche: niche without competition included
- Realized niche: niche with competition included

Resource partitioning
- Besides CE, a species can evolve to use different resources

Character Displacement
- Niches diverge when two species are in contact

Predation
- Consumption of a living organism
  - Includes herbivory and parasitism

Predation and natural selection at work
Batesian and Müllerian mimicry

Figs. 53.7 & 8

Mutualism

Ants and acacias in central and South America

Fig. 53.9

Communities and feeding

- Trophic structure: feeding relationships between organisms
- Trophic levels

Are food chains the whole story?

A more complete story

Antarctic marine food web

Biodiversity

- Species richness and relative abundance
- Which community is more diverse?

The Pacific rocky intertidal zone supports a diverse community – 18-20 species of algae and invertebrates
Robert Paine’s question: does the identity of the species in a food web matter?

- Paine’s experiment: remove all Pisaster

What Paine found:

- Keystone species have an impact greater than their numbers suggest

Communities over time

- Stable equilibrium or non-equilibrium?
- The impacts of disturbance
  - Lots of detritus
  - New growth

Ecological succession (1)

- Primary: species colonize areas devoid of life; no soil
- Secondary: species colonize areas with life previously present; soil
- Examples?

Ecological succession (2)

<table>
<thead>
<tr>
<th>Years after Glaciation</th>
<th>Dominant Plant</th>
<th>Other Common Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–30</td>
<td>Dwarf</td>
<td>Factory, willows,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>chokes,</td>
</tr>
<tr>
<td>30–80</td>
<td>Alder</td>
<td>Willow</td>
</tr>
<tr>
<td>80–200</td>
<td>Sitka spruce</td>
<td>Alder, willows,</td>
</tr>
<tr>
<td>200–350</td>
<td>Sitka spruce,</td>
<td>Mountain hemlock</td>
</tr>
<tr>
<td></td>
<td>western hemlock</td>
<td></td>
</tr>
<tr>
<td>&gt; 350</td>
<td>Sphagnum moss</td>
<td>Bog plants</td>
</tr>
<tr>
<td></td>
<td>(er. musk)</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 53.19
Biodiversity along a gradient

Why?

Fig. 53.23

Biodiversity vs. area

Species-area curve; why?

Fig. 53.25

Island biogeography (1)

MacArthur and Wilson (1967)

Fig. 53.26

Island biogeography (2)

A test in the Galapagos

Fig. 53.27