Species abundance & diversity
Now it gets interesting...

Lecture outline
- Community characteristics
  - Physical structure
  - Biological structure
- Biological structure
  - Species abundances
  - Species dominance
  - Species diversity
- Disturbance
  - Characteristics
  - Intermediate Disturbance Hypothesis
  - A human-caused example

What's a community?
- ??
- vs. assemblage?
- vs. guild?
- vs. ecosystem?

Characterizing communities
- Physical structure
  - Both biotic and abiotic
- Biological structure (=community structure)

Physical vs. biological structure

Biological/Community structure
- Species abundances
- Species dominance
- Species diversity
Species abundances
- The lognormal distribution (Preston 1948)

![Fig. 16.3](image)

Species dominance
- How do you tell?
- Relative abundance
- Relative dominance
- Importance value

![Species dominance](image)

Species diversity
- Two components:
  - __________ and __________
- Many formulas to calculate diversity based on these two components, each with varying degrees of success

![Species diversity](image)

A diversity index
- Shannon-Wiener Index:
  - $H' = -\sum p_i \log p_i$
  - Increases as $? and ?$ increase
  - Derived from information theory

![A diversity index](image)

Shannon-Wiener Index example

<table>
<thead>
<tr>
<th>Community</th>
<th>Species</th>
<th>Number</th>
<th>Proportion ($p_i$)</th>
<th>$\log p_i$</th>
<th>$-p_i \log p_i$</th>
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</thead>
<tbody>
<tr>
<td>a</td>
<td>1</td>
<td>25</td>
<td>0.94</td>
<td>-0.114</td>
<td>0.114</td>
</tr>
<tr>
<td></td>
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<td>1</td>
<td>0.04</td>
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<td>0.0129</td>
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<tr>
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<tr>
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<td></td>
<td>25</td>
<td>1.00</td>
<td>0.00</td>
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</tr>
</tbody>
</table>

$H' = -\sum p_i \log p_i = 0.062$

Issues with diversity indices
- $H' = 1$ here, $= 3$ there…celebrate or not?
- $H' = 3$ now, $= 2$ later…why?
- Also:
A picture of species diversity
- Rank-abundance curves

Fig. 16.6

What controls species diversity?
- Resources?
- Competition?
- Predation?
- Many ecological models assume stable environmental conditions—an equilibrium—in order to answer this question
- Is this realistic?

Intermediate disturbance hypothesis
- Connell (1978)

Disturbances
- = ?
- Characterized by
  - Intensity
  - Spatial scale
  - Frequency
  - Duration

A test case for disturbance

Any supporting evidence?
A human disturbance example

Active valley fill

Just how much earth is being moved?

Hooke (1999)

Implications for aquatic life downstream

Implications for residents


Melissa M. Abreu, Michael Hendrys, Janisson Conley, Evan Fedoros, Alan Ductman, Keith J. Zullig

Poverty and Mortality Disparities in Central Appalachian Mountaintop Mining and Environmental Justice

Michael Hendrys, PhD, West Virginia University

Conclusions: Poverty living in MTH areas experience preciously elevated poverty and mortality rates. Higher mortality is independently associated with birth poverty and MTH, the total effect is greater, poor environmental conditions from mining activities. Effects to entire socioeconomic health disparity in Appalachia manifests in these areas where disparities are concentrated, the Appalachian coalfields.