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

Mt. Rainier NP, Nat. Geo.

What’s a community?

- ??
- vs. assemblage?
- vs. guild?
- vs. ecosystem?

Characterizing communities

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

“the x-axis”

Physical vs. biological structure

Fig. 16.9

Yellow-rumped warbler

Fig. 16.10

Biological/Community structure

- Species abundances
- Species dominance
- Species diversity
Species abundance
- The lognormal distribution (Preston 1948)

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

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

Species diversity example

A diversity index
- **Shannon-Wiener Index:**
  - $H' = -\sum p_i \log_2 p_i$
  - Increases as $p_i$ and $-\log_2 p_i$ increase
  - Derived from information theory

Issues with diversity indices
- $H' = 1$ here, = 3 there...celebrate or not?
- $H' = 3$ now, = 2 later...why?
- Also:
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?

Disturbances
- What are disturbances?
- Characterized by
  - Intensity
  - Spatial scale
  - Frequency
  - Duration

Intermediate disturbance hypothesis
- Connell (1978)

A test case for disturbance

Any supporting evidence?
A human disturbance example

Active valley fill

Just how much earth is being moved?

Implications for aquatic life downstream

Implications for residents


Melissa M. Abreu, Michael Hendryx, Jamison Conley, Evan Fedorak, Alan Ducatman, Keith J. Zallie

Impact of mountaintop mining on aquatic life downstream of coal mining activities in central Appalachia

Palmer et al. (2010) Science

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

Michael Hendryx, PhD, West Virginia University

Abstract: Poverty living in an area experiencing previously elevated poverty and mortality rates, higher mortality is independently associated with birth defects only in areas that were affected by mountaintop mining. This suggests that the synergistic effects of socioeconomic and environmental components from mining activities contribute to worse health outcomes in Appalachian residents in those areas where disparities are concentrated.