24.11.11 Biodiversity

Diversity vs. Uniformity

- biological
- cultural
- financial
- language
- food sources
- religious
- ethnic
- farming
- clothing

Biodiversity: small to large

- Genetic Diversity: genetic variation among individuals in a population (e.g. redheads, blondes, black hair)
- Species Diversity: number of species in an ecosystem (moose, wolf, bear)
- Habitat Diversity: number of habitats in an ecosystem (forest, plains, swamp)

Genetic Variation:

- Genetic variation occurs because reproduction is always a combination of factors: genetics, environment, even lifestyle (kinin potentiation: health impacts genetic variation)
- When a population suffers a massive reduction in population (e.g. whales being hunted) the total genetic variation in the remaining population is lower.
- This is called a **Population bottleneck**
- This makes them vulnerable to disease and threats that apply to that limited gene pool.
- A greater genetic variation, like ideas, makes for a richer population, able to survive and thrive in different challenging conditions.
- They are also able to diversify food sources, shelter and the ability to withstand environmental challenges.
- The opposite of this biodiversity has a perfect example: monocropping, where one threat can wipe out an entire group of crops (no diversity)
- Habitat diversity has two categories: specialists and generalists
- Specialists can only live in certain limited conditions, and tend to be located in niches
- Generalists can live in many conditions, and many invasive species tend to be generalists
- **Species richness** means many different species in an ecosystem
- **Species evenness** means no one species takes over

Example
Both of these have 4 species (richness) but community 1 (left side) has more evenness:

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Diversity, local to global:

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Shannon's index:

Imagine a community of 100 individuals that are evenly divided among four species, so that the proportions *(p1)* of the species all equal 0.25. We can calculate Shannon's index as follows:

- H = - ((0.25 X In 0.25) + (0.25 X In 0.25) + (0.25 X In 0.25) + (0.25 X In 0.25))
- H = - [(-0.35) + (- 0.35) + (- 0.35) + (-0.35))
- H = 1.40

Now imagine another community of 100 individuals that also contains four species, but in which one species is represented by 94 individuals and the other three species are each represented by 2 individuals. We can calculate Shannon's index to see how this difference in species evenness affects the value of the index:

- H = - ((0.94 X In 0.94) + (0.02 X In 0.02) + (0.02 X In 0.02) + (0.02 X In 0.02)]
- H = - [(-0.06) + (-0.08) + (- 0.08) + (-0.08)]
- H = 0.30

Because this value of *H* is lower than the value we calculated for the first community, we can conclude that the second community has lower diversity. Note that the total number of individuals does not affect Shannon's index of diversity; only the number of species and the proportion of

individuals within each species matter.

Low diversity looks like H = 1.5, high diversity is around H = 4.5

Try this with your data:

- pick several populations (age in class, home state/country, M&M, goldfish)
- determine percent of total for each population (p1)
- calculate ln (natural log) of each percentage
- multiply ln of each percentage by the percentage
- add these up for each population

Link to Biodiversity lab:

http://10.14.4.85:6875/books/ap-environmental-science/page/biodiversity-lab

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