Chan's ENVS200 Review

Chapter 10 - Patterns in Species Richness

QUANTIFYING SPECIES RICHNESS AND DIVERSITY

- Species richness - number of species in a community
- Diversity index
  - = - sum of (proportion of community * ln(proportion of community)), iterating over each species in the community
  - The more equal the distribution, the higher the value
- Rank abundance
  - plot proportion of community for a specific species vs. rank
  - rank is based on abundance (most abundant is rank 1)
  - steeper the plot slope, the greater the dominance of common species
- niche breadth
  - given all resources as a one-dimensional line, niche breadth is how the amount of resources that niche uses
  - <———————[niche]———————> resources
  - can calculate average niche breadth, and niches can overlap, giving us average niche overlap
  - if R (resources) is larger, it can usually contain more species
  - more species if average niche breadth is smaller
  - greater average overlap means more coexistence

SPATIALLY VARYING FACTORS INFLUENCING SPECIES RICHNESS

- alpha-diversity - diversity within a community
  - declines or is hump-shaped with productivity
- beta-diversity - diversity between communities
  - increases with productivity
- gamma-diversity - diversity in collections of communities
  - increases with productivity
- energy seems to have more effect on diversity on a large scale, and productivity seems to have more effect on diversity on a smaller scale
  - usually positively correlated with diversity
- heterogenous/patchy environments can support more species than homogenous ones
- "harsh" environments like very low or very high pH, or extreme amounts of salt also decrease diversity
  - but there's a big issue in determining what a "harsh" environment is, because it leads to a circular argument if you say "it's harsh if it's hard to live in"

TEMPORALLY VARYING FACTORS INFLUENCING SPECIES RICHNESS

- Species richness increases as climactic variation decreases
  - why adapt when you can just do the same thing all the time?
- Species richness near highest at intermediate amounts of disturbance (just like how it is with intermediate amounts of predation)
- Environmental age doesn't have much to do with richness

HABITAT AREA AND REMOTENESS: ISLAND BIOGEOGRAPHY

- Species-area relationship - species diversity decreases as island size decreases
  - island refers to anything where the surrounding area is essentially uninhabitable for the island species (a lake is an island surrounded by land)
- Isolation also plays a part - if the island is very far from the "mainland", immigration by other species to it is impossible
  - So allowing immigration means for possibly higher species diversity
- MacArthur and Wilson's predictions
  - number of species on an island is roughly constant with time
  - this is a result of continuous turnover (locals becoming extinct, immigration)
  - large islands support more species than small islands
  - species numbers goes down the more isolated it is

GRADIENTS OF SPECIES RICHNESS

- Being near the tropics = more species richness, probably because higher energy input
  - also fewer "seasons"
- Species richness highest near ocean level, lowers as you go deeper or higher
  - There is a peak of diversity near the very bottom of the ocean though, as the sea floor is a very different environment than the middle of the ocean
- Usually, something that "kick starts" a higher species diversity will in turn, produce more of it
  - ex. good competitor plants fills an open gap, drains nutrients from surrounding soil
  - this creates a new "patch" that's different from the rest of the environment, allowing for other plants that can live with few resources to thrive