Chan's ENVS200 Review

Chapter 9 - From Populations to Communities

MULTIPLE DETERMINANTS OF THE DYNAMICS OF POPULATIONS

- Raw numbers of individuals are not enough to determine the health of a population
  - Are all the members old and beyond reproduction age? Are they all diseased?
- Correlations help in determining possible relationships
- Stability over years may hide large fluctuations, and large fluctuations may be misleading in the overall picture
- Regulation - tendency for a population to decrease when it is above a certain level, and increase when it's below that level
  - However, it's rare in nature that density of a population is the one and only determinant of future trends
- Can use k-value analysis to distinguish between what regulates and what determines the abundance of a population
  - Compile data each year, list each stage in an organism's life cycle, and the number of them at some given time
  - First, we calculate log10(total number of organisms)
  - k_somephase is calculated as the difference of the current row vs. the next row in the table
  - e.g. 11799 organisms at step 1, 9268 organisms at step 2. K_step1 = log10(11799)-log10(9268) = 0.105
  - Then, you find the mean k for each phase for a certain number of years
  - Higher mean k -> more losses occurred
  - Can also calculate the coefficient of regression for each phase -> higher means that that particular phase is more important to the overall population of the given species
  - Plotting k values against population usually shows greater population density leads to higher loss

DISPERSAL, PATCHES, AND METAPOPULATION DYNAMICS

- Dispersal is more important when populations are fragmented or patchy
  - Abundance is dependent on the size of and distance between habitats, and how far species are typically dispersed
- Metapopulations are aggregations of subpopulations, where each individual subpopulation can go extinct and recolonize
  - A subpopulation may not be stable, but as a whole, the metapopulation could be
  - Metapopulation can only be considered as a concept if there is dispersal between subpopulations - segregated subpopulations would be considered as their own distinct entities

    - Plants may be part of subpopulations, but only if specific conditions are met - since metapopulations require the ability for complete extinction of a subpopulation, a plant and its seeds must be able to truly go extinct for some subpopulation

TEMPORAL PATTERNS IN COMMUNITY COMPOSITION

- A gap is created when many members of a subpopulation go extinct
- Founder-controlled community - a large number of species are equivalent in their ability to colonize a gap
    - Priority effect - species that arrives first is able to hold it against competing invaders, whereas they may have to coexist if both species arrived at the same time
- Dominance-controlled community - some species are competitively superior than others, and can oust other species, even if they arrive first
    - When the dominant species kicks out the less competitive ones, it is the “climax stage”
- Early species of a gap are usually good colonizers and fast growers, whereas later species can tolerate lower resource levels and mature slower (see: succession)
- As such, a gap’s population is 0 -> growing (early colonizers) -> climax (peak population) -> decreasing (as competition increases)
    - There may not necessarily be a climax stage for every ecosystem
- Primary succession - the first sequence of species after a disturbance
- Secondary succession - sequence of species that come in after previous species are mostly removed, but seeds and spores remain

FOOD WEBS

- Trophic cascade - interactions of the food web where effects of top predators on their prey affects things lower in the trophic level
- Top-down control - where predators control the rest of the food web by interactions with their prey
- Bottom-up control - organisms are subject to bottom-up control when their predators are removed
- These often both act on an ecosystem at the same time, though top-down control may have more impact than bottom-up control, as found my meta-analysis
- Resilient community - returns rapidly to stable state after disturbance
- Resistant community - relatively unaffected by disturbances
- Dynamically robust - stays roughly the same in the face of larger disturbances
- Keystone species - species whose removal would greatly alter a community, and whose impact is disproportionately large compared to its relative population
- Communities with more species richness are generally more stable than homogenous communities