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- Behavioral
  - How does behavior influence survival and reproduction?
  - Genetics
    - Mutation
    - Genetic Variation
    - Inbreeding
    - Genetic Drift
    - Neighborhoods
    - Effective population size
  - Extinction
    - Sixth mass extinction
    - Patterns of extinction
    - Endangered species
    - Characteristics of extinction
  - Selection
    - Individual selection

        * Group selection (Self-regultation)
        * Altruism
        * Coefficient of relatedness
        * Inclusive fitness
        * Kin selection
        * Reciprocal altruism
        * Haplo-diploidy and eusociality
        * Group living
            · Many eyes
            · selfish herd
    - Life History
        * reproductive strategies
        * age structure
        * mating systems
            · monogamy
            · polygamy
            · polygyny
            · polyandry
        * strategies (r vs K)

- Population
    - What determines the size of populations?
    - Population Dynamics

    * life tables
    * reproductive rates
    * deterministic models
    * stochastic models
- Physical Environment
    * phyisical variables
        · temperature
        · fire
        · wind
        · salt
        · pH
        · water
    * Influences on:
        · species abundance
        · species richness
- Interactions
    * Competition
        · Tribolium (Park 1954)
        · Lotka-Volterra
        · $dN = rN\frac{K-N}{K}$
        · $\frac{dN_1}{dt} = r_1 N_1 \frac{K_1 - N_1 - \alpha N_2}{K_1}$
        · $\frac{dN_2}{dt} = r_2 N_2 \frac{K_2 - N_2 - \alpha N_1}{K_2}$
        · Yeast, flies

            - R star = growth rate at resource levels at which lead to extinction
        * Coexistence
            - allopatry
            - sympatry
        * Mutualism
        * Predation
        * Herbivory
            - qauntitiative
            - qualitative
            - constituative
            - induced
            - mechanical
            - repellnets
            - reproduction inhibition
            - associative defense
            - mutualism
            - beneficial berbivory
        * Parasitism

- Community
    - What determines the numbers and composition of species?
    - Organization
        * Clements = superorganism
        * Gleason (+ Whitaker) = individualistic

    - Climate
    - Polar - Ferrell - Hadley Cells
    - Adiabatic cooling 1C for 100m
    - Life Zones
    - Eutrophication = aging and dying
- Species Richness
    - Latitudinal
        - Spatial Heterogeneity
        - Competition
        - Predation
        - Pollinators
        - Time
        - Area
        - Productivity
        - Evolutionary Speed
- Diversity
    - Indices (alpha)
        - Dominance weighted (Simpson's)
        - Infromation (Shannon's, Brillouin, Evenness)
    - Similarity (beta)
        - Jaccard
        - Sorenson-BC = $\frac{2a}{2a+b+c}$
- Dynamics (equilibrium vs. non-equilibrium)

        * Resistance (change) vs. Resilience (recovery)
        * Diversity-Stability (Elton, MacArthur, May, Pimm)
        * May's equation $\beta * (SC)^{\frac{1}{2}} < 1$
        * Intermediate disturbance
        * Succession = Celemnts
    - Island Biogeography
        * Area
        * Distance
        * Immigration
        * Extinction
        * Target Effect = area + immigration
        * Rescue effect = Distance + extinction

- Ecosystem
    - What determines the influences the flux of nutrients?
    - Trophic Structure
        * Food web complexity
            · Chain length = avg links between trophic levels
            · Connectance = actual links / potential links
            · Linkage density = number of links per species
        * Patterns
            · Pyramids (Elton, Cohen)
        * Guilds

    * Keystones et al.
        · Dominants = large effect, large abundance/biomass
        · Keystone = large effect, small
        · Ecosystem engineers = modify
- Energy
    * Gross = all productivity
    * Net = Gross - loss to respiration
    * Limits = resources and temperature
    * Efficiency
    * Global Distribution
    * Secondary Production (limited by primary)
    * ClORPT
- Nutrients
    * soils
    * SPONCH
- Light