

## BioE 107 2<sup>nd</sup> mid term

### Lecture 1--Food webs and food chains

- Matrix of direct species interactions
- Trophic levels
- Autotrophs, herbivores and omnivores
- Direct vs. indirect linkages
- Complexity—calculating direct vs. indirect interactions
- The importance of perturbations in observing the links between species
- Food chain theory—Oksanen and Fretwell
- Trophic cascades
- Examples

### Lecture 2—Biological Communities

- Definition
- Ways of defining communities
- Not all species are equal—interaction strength
- Species importance—numerical dominants, keystone species, ecosystem engineers
- Context dependency
- Community assembly
- Species filters—biotic interchange and invasive species
- Disturbance—scale and intensity
- Ecological succession
  - Early views
  - Modern view—facilitation, tolerance, inhibition

### Lecture 3—Ecosystem ecology

- Primary production
  - Units
  - Net vs. gross primary production
  - Measurements
  - Global patterns
  - Patterns with succession
  - Controls on NPP
- Chemosynthesis
- Secondary production
  - NSP—trophic efficiency and energy loss
  - Patterns
  - Trophic pyramids—energy and biomass
- Material flux
  - Carbon
  - Water
  - Nitrogen

- Phosphorous

#### Lecture 4—Diversity

- Form and function
- How many species
- Species diversity through time
- Spatial patterns in species diversity
  - Biogeographic regions
  - Continental drift
  - Vicariance
  - Latitudinal patterns of species diversity
  - Hypotheses for diversity patterns
  - Alpha, beta and gamma diversity
- Measures of diversity—richness and evenness
- Estimating species diversity
  - Rarefaction techniques
  - Asymptotic techniques
- Species-area relationships
- Island Biogeography
- Ecological control of species diversity
- Consequences of diversity
- Diversity and stability

#### Lecture 5—Stability

- Definitions of stability
- Global stability vs. alternate stable states
- Conditions for alternate stable states
- Models for alternate stable states
- Phase shifts and hysteresis
- Examples—mechanisms of persistence and change

#### Lecture 6—Linkage and connectivity

- Stable isotopes
- Linkages with and between ecosystems
- Within ecosystems—ecological chain reactions
- Between ecosystems
  - Physical transport
  - Biological transport
- Examples
- Observing and understanding linkages

#### Lecture 7—Evolutionary Ecology

- The importance of history
- Interactions in evolutionary ecology

- Effects of the physical environment
- Effects of direct one-way interactions
- Effects of reciprocal one-way interactions
- Effects of indirect interactions
- Coevolution
- Geographical mosaic of coevolution
- Examples
  - Human effects on evolution
  - New synthesis—eco-evo coupling

#### Lecture 8—Paleoecology

- The importance of time
- Dimensions of time
- Understanding process on historical time scales
- Time scales of interest
- Methods of historical analysis and kinds of data
- Time variation in the physical environment
- Materials
  - Modern archives
  - Aboriginal peoples
  - Fossil record
  - Geological record and geochemistry
  - DNA—coalescence techniques
- Examples—inferring process from pattern

#### Lecture 9—Management and conservation

- Dimensions to resource management and conservation biology
- Population viability analysis
- Living resource exploitation
- Invasive species
- Rewilding
- Resource economics

