GRANDE PRAIRIE REGIONAL COLLEGE
DEPARTMENT OF SCIENCE
BIOLOGY INSTRUCTIONAL GROUP

ZOOLOGY 2310 T. Shewchuk
GENERAL ECOLOGY
SPRING SESSION 1995
COURSE OUTLINE

1. Ecology as a science
   - Ecology defined
   - History of Ecology
   - Ecology today
2. Ecology of individual organisms: principles
   - Relationships to the abiotic environment
     - Tolerance range
     - Range of the optimum
     - When conditions change
     - Limiting factors and the environmental complex
     - Ecological indicators
   - Energy balance
     - Energy and work
     - Energy in organisms
       - Autotrophs, heterotrophs, and chemotrophs
       - Variations
       - Energy flow through an individual organism
     - Energy subsidies
   - Animal behavior
   - Evolutionary considerations
     - Proximate and ultimate factors
     - Adaptation
     - Ecotypes
   - Habitat Selection
   - The spread of organisms
     - Dispersal
     - Range expansion
3. Ecology of individual organisms: abiotic factors
   - Temperature
     - Thermal relations of organisms
     - Homeotherms and poikilotherms
     - Interactions of temperature and wind
     - Life forms of plants
   - Moisture
     - Humidity
     - Vapor pressure
     - Water balance in plants
     - Water balance in animals
   - Light
     - Shade tolerance
     - Photoperiodism

- Soil
    - Soil formation
    - Soil texture and fertility
    - Soil water
    - Loams and humus
    - Soil names
- Fire
    - Types of fire
    - Effects of fire
    - Fire frequency
    - Fire as a management tool

4. Population ecology: growth and density
    - Birth and death
        - Birth rate and death rate
        - Life tables and longevity
            - Types of life tables
            - Survivorship curves
    - Population growth
        - Exponential population growth
        - Biotic potential
        - Logistic population growth
        - The logistic curve as a model
        - Mathematical treatments of population growth
            - Exponential growth
            - Logistic growth
            - Adding time lags
            - Intrinsic rate of natural increase
            - Net reproductive rate
    - Population density and population regulation
        - Carrying capacity
        - Population regulation
        - Intraspecific competition
        - Nonequilibrium populations
        - The Allee effect
5. Population ecology: organization and evolution
    - Organization
        - Spacing
        - Sociality
            - Predator protection
            - Increased foraging efficiency
            - Modifying environment
            - Other benefits
        - Social organizations
        - Mating systems
        - Age structure
            - Animals
            - Plants

- Evolution
    - Natural Selection
    - The Hardy-Weinberg Law
    - Genetic fitness
    - The evolution of life history traits
        - r and K selection
        - Beyond the r/K model
    - Sociobiology
        - Altruism
    - Group selection
    - Extinction

6. Population-community interface: herbivory and predation
    - Types of species interactions
    - Trophic interactions
    - Optimal foraging
        - Where to look
        - Whether to pursue
        - Energy and fitness
        - Optimization
    - Herbivory
        - Types
        - Plant defenses
        - Effects on plant distribution and abundance
    - Frugivory
        - Seed predation
    - Predation
        - The Lotka-Volterra predator-prey model
        - The Rosenzweig-MacArthur model
        - Fluctuations in population size
        - Cyclic populations
        - Functional and numerical responses
        - Control of prey numbers by predators
    - Biological control
    - Mimicry and other kinds of advantageous resemblances
7. Population-community interface: parasitism, commensalism, and saprobism
    - Parasitism
        - Types of parasites
        - Parasitic organisms
        - Ecology of parasites
        - Parasite-host interactions
            - Epidemics
            - Effects on host numbers and distribution
            - Evolution within the parasite-host system
    - Commensalism
        - Phoresy

- Saprohism
    - Carrion
        - Vertebrates
        - Insects
    - Dung
        - Tumblebugs and other buriers
    - Dead trees
    - Litter
    - Aquatic habitats

8. Population-community interface: competiton and mutualism
    - Interspecific competition
        - Outcomes of competition
        - Competitive exclusion
            - Competitive replacement
            - Competition as a factor in geographical and habitat distribution
            - Competitive exclusion in the laboratory
        - Coexistence of competing species
        - Mathematical models of competition
            - The Lotka-Volterra model
            - Adding species to the model
            - Can two species live on one resource?
    - Amensalism and allelopathy
    - Neutralism
    - Mutualism
        - Symbiotic mutualism
        - Nonsymbiotic mutualism
        - Mycorrhizae
        - Pollination
        - Evolution of mutualism

9. Communities and ecosystems: structure and diversity
    - Community structure
        - Dominance
        - Chemical ecology
        - Spatial structure
        - Synusia and guild
        - Temporal structure
            - Day-night change
            - Seasonal change
            - Phenology
    - The ecological niche
        - Hutchinson's niche as hypervolume
    - Hutchinson's ecological theatre and evolutionary play
        - Ant-acacia system
        - Bat-moth coevolution
    - What produces community organization?

- Importance of competition
    - Are there regularities in species composition based on competitive exclusion?
        - The species/genus ratio
        - Assembly rules
    - Is there evidence that current competition affects the structure of communities?
    - Is there evidence that evolution based on reduction of competition has been widespread?
- Integrated vs. individualistic community
- Ecological diversity
    - Ways of being diverse
    - Factors affecting diversity
        - Unique history
        - Time
        - Extreme habitats
        - Resource diversity
        - Productivity
        - Climatic stability
        - Predation
        - Disturbance
    - Diversity indices
    - What determines the number of species on islands?
        - Habitat islands
        - Park theory

10. Communities and ecosystems: reactions
    - Reactions on land
        - Soil formation
        - Topography
        - Soil moisture
    - Reactions on air
        - Solar radiation
        - Temperature, humidity, rainfall, and wind
    - Reactions in fresh water
    - Reactions in the ocean
11. Communities and ecosystems: energy
    - Trophic structure and the food chain
        - Producers
        - Consumers
        - Decomposers
        - Pyramids of numbers and biomass
    - Energy flow
        - Solar energy input
        - Energy flow within the ecosytem
    - Grazing food chains
    - Detritus food chains
    - Biomass

- Productivity
    - Primary and secondary production
    - Energetic steady states
    - Net primary production in the biosphere
    - Relationships between productivity and biomass
- Ecological efficiencies
    - Producer level efficiencies
        - GPP/sunlight
        - NPP/GPP
    - Harvesting efficiencies of herbivores
    - Consumer efficiencies
        - Within tropic levels
        - Between trophic levels
- Difficulties with trophic levels
- Chemolithoautotrophs
    - Lakes and coastal marine ecosystems
    - Hydrothermal vents
- Regulatory processes and energy quality
- Energy in agriculture
    - Basic patterns
    - Energy flow in food sytems

12. Communities and ecosystems: biogeochemistry
    - Nutrient cycling
        - Carbon cycle
        - Nitrogen cycle
        - Phosphorus cycle
        - Sulphur cycle
    - Hydrological cycle
    - Watershed studies
    - Biological control of the composition of the atmosphere and oceans
        - Early Earth
        - The world's greatest reaction
        - Biological controls
            - The Gaia Hypothesis
13. Communities and ecosystems: community change
    - Types of community change
    - Replacement changes
        - Canopy replacement in forests
    - Fluctuation
        - The great drought
    - Succession
        - Types
        - Microseres
        - Causes
            - Role of reactions
            - An evolutionary view of succession
            - Role of coactions

- Examples of succession
    - Sand dune succession
    - Old-field succession
- Climax community
    - Monoclimax and polyclimax
- Stability
- Paleoecology
    - Uniformitarianism
    - The paleocommunity
    - Autecology
    - Population ecology
    - Community ecology
        - Early Tertiary
        - Later Tertiary
        - Pleistocene