Lecture Summary Points
Lectures 9/1-9/27/05
Plant Ecology EBIO 4140 – Fall 2005

Abiotic Environment I: Climate Dynamics and Plants (1 Sept 05)

- Geography of climate controlled by global, regional, and local processes
  - Solar energy and the earth's heat balance – human alteration
  - Continental physiography
  - Geomorphology and vegetation cover – human alteration
- A feature of climate is variability at seasonal, interannual, and longer-scales. – human alteration
- Climate geography and temporal variability a prime determinant of vegetation structure and function (i.e. plant ecological processes)
  → *next lecture*

Biogeography: Continental Survey of Vegetation Types (6 & 8 Sept 05)

- Biomes described in terms of vegetation physiognomy
  - Ecosystem structure & function implicit
- Distribution primarily determined by climate
  - By thermal & moisture regimes
  - Wind and solar radiation regimes additionally important
  - Temporal variability key roles at seasonal & interannual+ scales
- In some instances, biome distribution & dynamics strongly set by:
  - Disturbance: fire, grazing
  - Soil (edaphic factors) → *Coming in 2 weeks*
- Repeated pattern of biome distribution from continent-to-continent
  - So strong ecological similarities
  - But important distinctions
- All biomes significantly impacted by human activities
  - Directly or indirectly

Functional Ecology I: Photosynthesis (13 Sept 05)

- Multiple pathways for CO_2 fixation:
  - C_3, C_4, CAM – each with ecological advantages
  - Morphological and biochemical features enable pathways
  - Advantages reflected in distribution of plant functional types
- In addition to biotic (structural and biochemical) constraints, photosynthesis limited by abiotic factors:
  - CO_2
  - Light
  - Temperature
  - Moisture → *Next lecture*
  - Nutrient availability → *Next week*

Functional Ecology II: Plant Water Relations (15 Sept 05)

- Water flows from soil through plant to atmosphere following negative water potential (gradient
  - Powered by solar heating – drying atmosphere creates negative gradient
  - Plant controls over internal 's maintain negative gradient through plant
  - Supplies plant with needed water (for tissues, leaf thermal regulation, and psn) and nutrients
- Enabled by intricate plant morphology/anatomy & physiology
  - Transpiration affected by morphology and tight regulation of stomatal resistance
  - Xylem – morphology balances resistance and cavitation risk
  - Coping with water shortages: Wide range of plant morphological and physiological strategies evident in all environments, especially arid & semi-arid
- Soils and climate exert abiotic controls over water availability
  - Soil water holding capacity
  - PET *vs* precipitation – seasonality of water stress

Abiotic Environment II: Soils (20 Sept 2005)

- Soil formation is a function of
  - Parent material
  - Climate
  - Organisms – plants, microbes, fauna
  - Topography
  - Time
- Soil profiles reflect these controls over
  - Weathering rates
  - Movement (translocation) of salts (including Fe, Al), clays, humus
    →eluvial – illuvial zones
  - Organic inputs and decomposition rates
  - Rooting zone
- Plant growth (and community succession) controlled by soil processes:
  - Soil water availability
  - Soil nutrients – parent material weathering, organic matter mineralization, & ion exchange (binding)
  - Soil pH

Functional Ecology III: Nutrients (22 & 27 Sept 05)

- Nutrients play significant roles in a wide range of plant functions
  - Some required in only small amounts – micro vs. macronutrients
- Sources include weathering, atmospheric dep., decomposition, N-fixation
  - Some of these significantly altered by human activities (dust, N deposition,…)
  - N deposition consequences at plant, community, and ecosystem levels
- Nutrient limitation
  - N & P usually limiting – Different constraints on availability
  - Some environments micronutrients limiting
  - Liebig's Law of the Minimum?
    - Physiological compensation
    - Species specific responses
    - Species interaction
- Range of plant adaptations
  - e.g., Roots – allocation, morphology and physiology