NRM/BIOL 694
Ecological Background in Resilience and Adaptation
Fall Semester, 2006

Meeting Time:  Fridays  2:00 PM -5:00 PM

Classroom: O’Neill Room 309 on the UAF Fairbanks campus,

Instructor  Dr. Glenn Patrick Juday, Professor of Forest Ecology, School of Agriculture and Land Resources Management, Forest Sciences Department

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Office Hours - (arrange in advance to confirm) Tuesday & Thursday 1:00-3:00 pm

Prerequisites:  Graduate student enrollment or permission of instructor.

Grading Policy:  Letter grades determined from one exam at the end of the course.

Readings:  To be provided - posted to course Blackboard website
Powerpoint Lectures – posted to course Blackboard website


Outline of Lectures

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Synopsis for Ecological Background in Resilience  BIOL/NRM 694
G. Juday 12/07/2006

Assigned readings in Principles of Terrestrial Ecosystem Ecology
Chapter 2. Earth’s Climate System

Chapter 3. Geology and Soils

Chapter 6. Terrestrial Production Processes

Chapter 8. Terrestrial Plant Nutrient Use

Chapter 9. Terrestrial Nutrient Cycling

Chapter 13. Temporal Dynamics

Optional, enrichment readings in Principles of Terrestrial Ecosystem Ecology
Chapter 10. Aquatic Carbon and Nutrient Cycling

Chapter 14. Landscape Heterogeneity and Ecosystem Dynamics

Learning Objectives
1. What distinguishes the field or subject of natural resource management from the field of ecology? (EM01 slides 2-5)

2. Name more than one integrative level (the scope of subject matter) of biology proper to the subject of ecology? (EM01 slide 5)

3. What features of the Earth’s climate system causes the Sahara, Southwestern US/Mexican, and Arabian Deserts to be located within the same latitude limits? (Fig. 2.6, EM03 slides 36, 38, 39)

4. About what percentage of incoming solar shortwave, high energy radiation is scattered back to space directly (before absorption and re-radiation) by the Earth’s surface, clouds, and the air itself? (Fig. 2.2)
5. About what percentage of incoming solar shortwave, high energy radiation is emitted back to space by all sources (surface, clouds, greenhouse gases) as outgoing, low-energy longwave radiation? (Fig. 2.2)

6. Why (what process accounts for) are the tropics warm and the polar regions cold? (Fig. 2.5, EM01 slide 34)

7. Which of the Earth’s climate/ecosystem regions has the least variable climate, which has the most variable climate, and why? (Fig. 2.6, EM01 slide 37)

8. What regions of the Earth have the highest Net Primary Productivity (NPP)? (Plate 3, EM02 slide 5)

9. Why is boreal Alaska warmer than other parts of boreal North America and warmer than Far East Russia that is at the same latitude as Alaska? (Plate 2 top, EM02 slide 50)

10. Why are the equatorial regions of Africa, Asia, and South America wet and humid? (Plate 2 bottom, EM02 slides 37-39)

11. How (in what direction) and why do storm systems spin in the northern and southern hemispheres? (Page 26 top, EM02 slide 41)

12. Name and define the 3 widely recognized levels of biological diversity (EM01 slide 9)

13. Name one organism group for which the US has a disproportionate share of all species (EM01 slide 18)

14. The basic unit of conservation and the basic unit that allows organisms to survive is the gene. What is a gene? (EM01 slide 42)

15. What is an allele? What is a dominant allele? What is a recessive allele? (EM01 slide 42)

16. Minimum Viable Population (MVP) is not a single number. What two attributes have to be explicitly stated in order to specify a given MVP? (EM01 slide 46)

17. Contrast the disturbance systems and species richness characteristics of tropical moist forests with those of temperate/boreal forests. (EM01 slide 53)

18. Why do tropical moist forests have so many species? (EM01 slide 42)

19. The balance of nutrients required to support maximal growth is similar for most plants (Page 177). What are the major plant nutrient elements? (EM01 slide 54, Table 8.2)
20. What are the nutrients absorbed by plants used for primarily? (Page 189)

21. The Earth’s crust is 99% made up of what 8 elements? (EM02 slide 20)

22. What is Nutrient Use Efficiency and in what kind of environments do plants maximize it? (page 190)

23. When a population of organisms falls to very low numbers a number of challenges to survival appear or become acute. Name two such challenges to survival? (EM01 slide 26)

24. What are the three main rock types, and how can each be converted into the other? (Figure 3.1, EM02 slide 26)

25. Explain why/how island dwarfism occurs? (EM01 slide 49)

26. Ecological Management Regimes are based on the trade-off relationship between what two characteristics or requirements as the size of a management area changes? (EM01 slide 71)

27. Soils formed under moist tropical forests are strongly leached (subject to element removal from warm acidic solution flow. After long periods of this leaching, what minerals primarily are left in the soils of moist tropical forests? (EM01 slide 58)

28. What is the major factor that explains the differences of Net Primary Productivity among the world’s biomes? (page 138) Why?

29. Population fluctuation of most organisms through time has elements of a stochastic distribution. In a statistical sense, what characterizes a stochastic distribution? (EM01 slide 48)

30. Name two resource management practices that can be used to sustain genetic diversity. (EM01 slide 50)

31. What specifically is the equator to poleward species richness gradient? (EM01 slide 11)

32. Ancient events interacting with evolution can lead to what kinds of patterns of species diversity? (EM01 slide 13)

33. How do unique, rare, or stressful events affect species diversity? (EM01 slide 15)

34. What does it mean to have a homozygous recessive allele “fixed” in a population, and how can it happen? (EM01 slide 43)
35. What is the optimum texture of soil to support plant productivity, and why? (Page 62-64)

36. What is the pattern of the age of Earth crustal material (rocks) – especially where it emerges and where it goes? (EM02 slide21)

37. What geologic process in what context is associated with the production of granitic rocks that produce silicon-rich soils made up of quartz and feldspars? (EM02 slide24)

38. What geologic process in what context is associated with the production of basaltic rocks that produce soils rich in ferromagnesian (iron and magnesium) minerals? (EM02 slide24)

39. What are Gross Primary Production (GPP), Net Primary Production (NPP), and Net Ecosystem Production (NEP), and how do they differ? (Pages 127, 140)

40. Holding constant the growing period, what accounts for much of the biome differences in carbon gain during the growing season? (Page 138 bottom)

41. The carbon dioxide content of the atmosphere at one time was roughly in balance, but now increases annually. What two factors are primarily responsible for adding to the carbon dioxide content of the Earth’s atmosphere? (EM02 slide 17)
42. The plants of both the world ocean and land surfaces take up carbon dioxide from the atmosphere, and then carbon dioxide is released from the plants, animals, and soils of both environments. What is the difference (in gigatons) of carbon between the annual uptake from the atmosphere and annual release to the atmosphere of carbon from both the ocean and land environments? (EM02 slide 17)

43. Name 7 events in the annual cycle of marine ecosystem events that control/reflect primary productivity? (EM02 slide 9)

44. How is the pattern of maximum annual primary productivity distributed differently across the world ocean surface compared to the Earth’s land surfaces? (EM02 slides 10-13)

45. As an animal habitat, and from the ecosystem function perspective, why are riparian zones very important habitats? (EM01 slide 62)

46. Define ecological succession, and what are 3 theories of ecological succession (the force that drives or explains succession? (Pages 285-292, EM01 slide 75)

47. What is a trophic pyramid? (EM01 slide 66-69, also Pages 244, 245)

48. Name the three prey-base jumps made by the California Condor from the end of the Pleistoce Ice Age to today (EM03.A slides 13-16)

49. Name a conservation land management unit with a California Condor reintroduction effort underway, and the 2 most important required habitat features (EM03.A)

50. Name 2 of the 3 important factors that caused the Black-footed Ferret to decline in population from 1,000,000 in the mid 1800s to 18 individuals in the 1990s. (EM03.B slides 9-11)

51. Free-living California Condors have to be periodically captured and treated with for what problem? (EM03.A slide 20-21)

52. The Black-footed Ferret suffers from a major loss of genetic diversity. Name a practical constraint to management of the ferret that involves actions to manage the genetics of the species? (EM03.B slides 21-22)

53. The main free-living population of the Whooping Crane migrates from what conservation unit where they breed to what conservation unit where they overwinter? (EM03.B slides 34-39)

54. The Whooping Crane uses a mid-migration stopover location where? What kind of habitat features is it seeking in stopover habitat? (EM03.B slides 33, 35, 36, 37, 39)
55. Be able to describe 3 kinds of edge effects. (Dec. 11 lecture)

56. Be able to graph the relationship between edge area and interior habitat as the size of square blocks changes. (Dec. 11 lecture)

57. Describe the impact of the brown-headed cowbird and why it is a serious conservation problem, and how it evolved. (Dec. 11 lecture)