**Title**:  Understanding ecological systems through geographical comparison

http://www.montana.edu/hansen/newpages/coursestaught.htm

**Instructor**:  Andrew Hansen

**Rubric and Venue**:  BIOE 494 (1 cr) or BIOE 594 (1 cr), Mondays 3-4 pm, Lewis 407

**Overview:** This readings and discussion course is aimed at helping to develop a 3-5 credit 400-level ecology course that would be offered annually starting in 2013.  Advanced undergraduates and graduates are invited to enroll.

The class will examine forested biomes as integrated ecological systems, compare similarities and differences among biomes in order to better understand general ecological principles, and consider implications for place-based management. The class will build on the sub-disciplines of population, community, and ecosystem ecology to study “ecological systems”. Ecological systems encompass all levels of organizations and integration of all or many sub-disciplines in ecology is necessary to understand and manage them. The use of sub-disciplines in ecology has helped us simplify ecological systems and improve understanding of components of the systems. An important step in ecology is “putting the pieces back together” to understand and manage integrated ecological systems.

           We will approach the study of ecological systems by examining how they differ across the globe and identify the overarching principles that govern these differences.  Traditionally, ecologists have studied one or a few ecological systems in depth and their understanding of physiology, population dynamics, community interactions, ecosystem processes and human land use was heavily influenced by those particular systems.  New technology now allows us to know the in-depth functioning of many types of ecological systems.  Through comparison across biomes, we can better understand the factors that govern ecological systems in particular locations.  The role of grazing in driving biodiversity, for example, varies with soil fertility and ecosystem productivity.  Grazing can reduce diversity in low productivity systems and increase it in productive systems.  Hence, the management of cattle or wildlife stocking density should differ among ecosystems to achieve biodiversity objectives

**Goals**:

1.  Integrate subdisciplines in ecology to understand “ecological systems”.

2. Better understand general ecological principles through comparison among biomes.

3. Draw on these principles to better tailor conservation and management strategies to local places.

**Prerequisite:**  **BIOB 370** Principles of Ecology or equivalent.

**Course Structure**:

* 1-credit reading/discussion course with readings draw from text books and peer-reviewed journal articles.
* A brief lecture will be followed by class discussion.
* Students will work in teams of two to develop a 10-minute presentation contrasting an ecological issue of interest between two biomes.

**Grading:** Pass/Fail. Based on participation in class, evidence of completion of readings, and final presentation.

**Textbook:**

Chapin, III, F. Stuart, Matson, Pamela A., Vitousek, Peter M. 2011. Principles of Terrestrial Ecosystem Ecology. Springer (http://www.springerlink.com/content/978-1-4419-9503-2/contents/)

**Schedule**

Date Topic and Tentative Reading

Jan 16 Martin Luther King Day (No Class)

Jan 23 Conceptual models of ecological systems, Class orientation

Pickett, S.T.A., J. Kolasa, C.G. Jones. 2007. Ecological Understanding: The Nature of Theory and the Theory of Nature. Elsevier, Boston. Chapter 1 Integration in Ecology, pgs 3-17, 27-32).

Jan 30 Terrestrial forest biomes of the world

Chapin, III, F. Stuart, Matson, Pamela A., Vitousek, Peter M. 2011. Principles of Terrestrial Ecosystem Ecology. Springer, New York. Chapter 2. Earth’s climate system, pgs 23-26, 30-62.

Feb 6 Primary productivity: controls, patterns, consequences

Chapin, III, F. Stuart, Matson, Pamela A., Vitousek, Peter M. 2011. Principles of Terrestrial Ecosystem Ecology. Springer, New York. Chapter 5. Carbon inputs to ecosystems, pgs 123-128, 134-156 (Omit C4 and CAM photosynthesis).

Feb 13 Primary productivity: comparison among biomes

Running, S. W., R. R. Nemani, F. A. Heinsch, Z. Zhao, M. Reeves, and H. Hashimoto. 2004. A continuous satellite derived measure of global terrestrial primary production. BioScience 54:547–560. Read pgs: 547-548 (omit Relating NDVI, APAR…), 550-559.

Huston, M. A., and S. Wolverton. 2009. The global distribution of net primary production: resolving the paradox. Ecological Monographs. 79(3), 2009, pp. 343–377. Read pgs: 343-343 (Introduction); 346 (Patterns of Terrestrial NPP and Nutrients – 350 (Omit Addressing the Paradox); 351 (Direct Measurements of NPP in Forest Ecosystems) – 353; 368-369.

Chapin et al. 2011. Chapter 6. Plant Carbon Budgets. Pgs. 157, 169 (Environmental and Species Controls) – 172, 178 (Biome Differences in NPP) – 180.

Feb 20 President’s Day (No Class)

Feb 27 Home range size and body size

Harestad, A. S., and F. L. Bunnell. 1979. Home range and body weight-A reevaluation. Ecology 60:389-402. Read all pages.

Huston, M. A., and S. Wolverton. 2011. Regulation of animal body size by eNPP, Bergmann’s rule, and related phenomena. Ecological Monographs 81:349-405. Read pgs 349-365 (down to “Non-latitudinal Variation in Body Size”), 388-393.

Mar 5 Herbivore abundance and richness

Oiff, H., M. E. Richie, and H. H. T. Prins. 2002. Global environmental controls of diversity in large herbivores. Nature 415:901-904.

Mar 12 Spring Break (No Class)

Mar 19 Habitat complexity: controls, patterns, consequences

Chapin, III, F. Stuart, Matson, Pamela A., Vitousek, Peter M. 2011. Principles of Terrestrial Ecosystem Ecology. Springer, New York. Chapter 13. Landscape heterogeneity and ecosystem dynamics, pgs 369-397.

Mar 26 Habitat complexity: Comparison among biomes – Student lead discussion.

Verschuyl, J.P., A.J. Hansen, D.B. McWethy, R. Sallabanks, R.L. Hutto. 2008. Is the effect of forest structure on bird diversity modified by forest productivity? Ecological Applications 18(5), 1155-1170.

Hansen, A. J., L. Baril, J. Watts, F. Kasmer, T. Ipolyi, R. Winton. In Prep. Towards generality in fragmentation theory: Does ecosystem biomass predict edge effects? Forest Ecology and Management.

Virtual Field Trip – Eastern Deciduous Forest

Apr 2 Community diversity: controls, patterns, consequences

Gaston, K. J. 2000. Global patterns in biodiversity. Nature 405:220–227.

Virtual Field Trip – Wet Tropical Forest

Apr 9 Human land use

Luck, G. W., L. Smallbone, S. McDonald, and D. Duffy. 2010. What drives the positive correlation between human population density and bird species richness in Australia? Global Ecology and Biogeography 19:673–683.

Apr 16 Synthesis: Grouping Biomes based on ecological properties

Hansen A.J. In Review. Ecosystem energy as a framework for prioritizing conservation vulnerabilities and management strategies. Unpublished manuscript. Pgs 1-36.

Apr 23 Student presentations

Apr 30 Suggestions for building 3-credit class