

Landscape and Spatial Ecology

ENVS 385/IBS 510

Emory University, Fall 2010

Syllabus: 7 August 2010

Instructor: Dr. Berry J. Brosi

Department of Environmental Studies

INTRODUCTORY PARAGRAPH FOR THE PIEDMONT PROJECT:

Landscape Ecology addresses large-scale spatial pattern and process in biology, a topic with deep linkages to sustainability, primarily through its connection to conservation biology. This course will be taught for the first time in fall 2010, and originally, I had planned to teach it with a more or less exclusive focus on ecological theory. Participating in the Piedmont Project helped me realize that the real-world application of these theoretical topics would not necessarily be obvious to the students in the class, and as a result of the Piedmont Project I have substituted some of the planned lectures and heavily changed others to include a much more applied emphasis, and for some, discussions of the social and political context of scientific decisions. I believe that the updated syllabus will give students a strong grasp of the conceptual foundations of spatial and landscape ecology, the ways in which these concepts are currently applied to the conservation of biological diversity, and an introduction to the social and political implications of science-based conservation biology interventions. Much of the structure and content of this course was inspired by David Skelly's Landscape Ecology course at Yale University.

LECTURE TOPICS:

Course Introduction

Landscape Patterns

Spatial Effects in Ecology

Class Projects (including Meta-Analysis)

Species-Area Relationships

Island Biogeography I

Island Biogeography II

Metapopulations I
Metapopulations II
Metapopulations III
Macroecology & Biogeography I
Macroecology & Biogeography II
Corridors, Dispersal and Invasion

Midterm Examination

Landscape Mosaics: Conservation in Agroecosystems I
Landscape Mosaics: Conservation in Agroecosystems II
Paleoecology
Individual-based Models I
Individual-based Models II
Individual-based Models III
Biodiversity Models I
Biodiversity Models II
Reserves in Fragmented Landscapes
Meta-analysis in Ecology
Course Overview

Final Examination

Course readings will be drawn from the scientific literature, including both classic papers and contemporary manuscripts. We will not use a textbook. Course readings are required and will be discussed in class.

Grade will be based on Midterm and Final examinations, three quantitative (calculation-based) problem sets, class participation, and, for graduate students, a final paper. The final paper will be written as a manuscript following the guidelines for submission to the journal *Ecology*, including page limits (maximum of 30 pages of double-spaced 12-point type), formatting, etc.

COURSE READINGS

Landscape Patterns

Levin, S. 1992. The problem of pattern and scale in ecology. *Ecology* 73:1943-1967.

Spatial Effects in Ecology

Hoehn M, Sarre SD, Henle K 2007. The tales of two geckos: does dispersal prevent extinction in

recently fragmented populations? *Molecular Ecology* 16:3299-3312.

Urban, M. C., D. K. Skelly, D. Burchsted, W. Price, and S. Lowry. 2006. Stream communities across a rural-urban landscape gradient. *Diversity & Distributions* 12:337-350.

Class Projects/Meta-analysis

Gurevitch, J., L. L. Morrow, A. Wallace, and J. S. Walsh. 1992. A meta-analysis of competition in field experiments. *American Naturalist* 140:539-572.

Gurevitch, J., and L. V. Hedges. 1993. Meta-analysis: combining the results of independent experiments. Pages 378-398 *in* Scheiner, S. M. and J. Gurevitch (Editors), *Design and analysis of ecological experiments*. Chapman and Hall, New York.

Cadotte, M. W. 2006. Dispersal and species diversity: a meta-analysis. *American Naturalist* 167:913-924.

Ecological Society of America. Instructions for Authors (website link).

Species-Area Relationships

Connor, E. F., and E. D. McCoy. 1979. The statistics and biology of the species area curve. *American Naturalist* 113:791-833.

Tittensor DP, Micheli F, Nyström M, Worm B. 2007. Human impacts on the species-area relationship in reef fish assemblages. *Ecology Letters* 10:760-772.

Island Biogeography I

Gotelli, N. J. 2001. *Island biogeography in A primer for ecology*. Sinauer, Sunderland, MA.

Simberloff, D. S., and E. O. Wilson. 1969. *Experimental Zoogeography of islands: the*

colonization of empty islands. *Ecology* 50:278-296.

Island Biogeography II

Simberloff, D. S., and L. G. Abele. 1976a. Island biogeography theory and conservation practice. *Science* 191:285-286.

Diamond, J. 1976. Island biogeography and conservation: strategy and limitations. *Science* 193:1027-1029.

Terborgh, J. 1976. Island biogeography and conservation: strategy and limitations. *Science* 193:1029-1030.

Whitcomb, R. F. et al. 1976. Island biogeography and conservation: strategy and limitations. *Science* 193:1030-1032.

Simberloff, D. S., and L. G. Abele. 1976b. Island biogeography and conservation: strategy and limitations. *Science* 193:1032.

Schoener, T. W. and D. A. Spiller. 1995. Effect of predators and area on invasion: an experiment with island spiders. *Science* 267:1811-1813.

Metapopulations I

Hanski, I. and D. Simberloff. 1997. The metapopulation approach, its history, conceptual domain, and application to conservation Pages 5-26 *in* Hanski, I., and M. E. Gilpin (Editors). *Metapopulation biology: ecology, genetics, and evolution*. Academic Press, San Diego.

Levins, R. 1969. Some demographic and genetic consequences of environmental heterogeneity for biological control. *Bulletin of the Entomological Society of North America* 15:237-240.

Metapopulations II

Noon, B. R., and K. S. McKelvey. 1996. Management of the Spotted Owl: a case history

in conservation biology. Annual Review of Ecology and Systematics 27:135-162.
Lande, R. 1988. Demographic models of the northern spotted owl (*Strix occidentalis caurina*). Oecologia 75:601-607.

Metapopulations III

Wiegand, T., F. Jeltsch, I. Hanski, and V. Grimm. 2003. Using pattern-oriented modeling for revealing hidden information: a key for reconciling theory and application. Oikos 100:209-222.

Tilman, D., R. M. May, C. L. Lehman, and M. A. Nowak. 1994. Habitat destruction and the extinction debt. Nature 371:65-66.

Macroecology & Biogeography I

Brown, J. H., and B. A. Maurer. 1989.

Macroecology: the division of food and space among species on continents. Science 243:1145-1150.

Lomolino, M. V., and R. Channell. 1995. Splendid isolation: patterns of geographic range collapse in endangered mammals. Journal of Mammalogy 76:335-347.

Macroecology & Biogeography II

Thomas, C. D. et al. 2004. Extinction risk from climate change. Nature 427:145-148.

Corridors, Dispersal & Invasion

Beier, P. and R. F. Noss. 1998. Do habitat corridors provide connectivity? Conservation Biology 12:1241-1252.

Haddad, N. M., D. K. Rosenberg, and B. R. Noon. 2000. On experimentation and the study of corridors: response to Beier and Noss. Conservation Biology 14:1543-1545.

Noss, R. F., and P. Beier. 2000. Arguing over little things: response to Haddad et al. *Conservation Biology* 14:1546-1548.

Landscape Mosaics: Conservation in Agroecosystems I

Daily, G.C. et al. 2001. Countryside biogeography: Use of human-dominated habitats by the avifauna of southern Costa Rica. *Ecological Applications* 11(1): 1-13.

Daily, G.C. 2001. Ecological forecasts. *Nature* 411(6835): 245

Landscape Mosaics: Conservation in Agroecosystems II

Fischer, J., Brosi, B.J., Daily, G.C., Ehrlich, P. R., Goldman, R., Goldstein, J., Manning, A.D., Mooney, H.A., Pejchar, L., Ranganathan, J., and Tallis, H. 2008. Should agricultural policies encourage land sparing or wildlife-friendly farming? *Frontiers in Ecology and the Environment* 6(7): 380–385.

Tallis, H., R. Goldman, M. Uhl, and B.J. Brosi. 2009. Integrating conservation and development in the field: Implementing ecosystem service projects. *Frontiers in Ecology and Environment* 7: 12–20.

Paleoecology

Bush, M. B., M. R. Silman, and D. H. Urrego. 2004. 48,000 years of climate and forest change in a biodiversity hotspot. *Science* 303:827-829.

Individual-based Models I

Pacala, S., and J. Silander. 1990. Field tests of neighborhood population dynamic models of two annual weed species. *Ecological Monographs* 60:113-134.

Individual-based Models II

Pacala, S. W., C. D. Canham, J. Saponara, J. A. Silander, Jr., R. K. Kobe, E. Ribbens. 1996. Forest models defined by field measurements:

estimation, error analysis, and dynamics.
Ecological Monographs 66:1-43.

Individual-based Models III

Casagrandi, R. and M. Gatto. 1999. A mesoscale approach to extinction risk in fragmented habitats. Nature 400:560-562.

Biodiversity Models I

Prendergast, J. R. et al. 1993. Rare species, the coincidence of hotspots and conservation strategies. Nature 365:335-337.

Myers, N. et al. 2000. Biodiversity hotspots for conservation priorities. Nature 403:853-858.

Biodiversity Models II

Richards, S. A., H. P. Possingham, and J. Tizard. 1999. Optimal fire management for maintaining community diversity. Ecological Applications 9:880-892.

Course Overview

Kareiva P, Watts S, McDonald R, Boucher T. 2007. Domesticated nature: shaping landscapes and ecosystems for human welfare. Science 316:1866-1869.