

**LANDSCAPE ECOLOGY WORKSHOP
J. A. BISSONETTE
USGS UTAH COOPERATIVE FISH AND WILDLIFE
RESEARCH UNIT
COLLEGE OF NATURAL RESOURCES
UTAH STATE UNIVERSITY
LOGAN UT, USA
john.bissonette@cnr.usu.edu**

**June 16-20,23-27, 2003
UNIVERSITY OF LISBON**

This two-week short course will address both the conceptual and applied aspects of landscape ecology. The student will note that this short course is directed primarily at the bio-physical aspects of landscape ecology and will not address landscape planning except peripherally.

The workshop will be conducted in an informal interactive manner to encourage student participation. Generally, each day will be divided as follows; presentation of ideas, break for refreshments, computer-based student exercises, lunch, completion of computer-based student exercises, and an extended discussion period. Although the computer-based exercises are intended to be primarily self-explanatory, the instructor will be available to provide assistance when required.

We will use this syllabus as a guide, however we will remain flexible with the organization and timing of subject matter to try to address student interests related to landscape ecology and to proceed so that every student is able to understand the concepts and ideas, and to complete the exercises.

After the first day, the instructor will start each day with a brief review of the previous days work and a question and answer session. Each day the instructor will introduce the subject matter and provide needed background information for the day's work. Presentations will vary in length and questions are encouraged at any time. After each presentation, a discussion period will allow a dialog on important concepts to enhance understanding. The students will then participate in structured computer-based exercises.

Each day, students will work through 1 or 2 exercises in the book *LEARNING LANDSCAPE ECOLOGY: A PRACTICAL GUIDE TO CONCEPTS AND TECHNIQUES* by S. E. Gergel and M. G. Turner (eds), Springer-Verlag (New York, Berlin, Heidelberg) ISBN 0-387-95354-3. We will discuss the results of each exercise after completion. The work for each day is expected to take 7-8 hours of time.

Supplementary material, in the form of handouts and Background Readings in pdf format will be provided to cover background material that may be relevant to understanding each day's subject. Short, informal 5 minute written exercises, as well as in-class student participation exercises will be used to help solidify important concepts

Day 1 Monday 16th June

1) Why Landscape Ecology?

During this first morning, students will be asked to introduce themselves and give a brief description of their interests and what they expect to get from the class. The discussion will help the Instructor to understand the background of each student and to focus the workshop to address particular student interests. The objectives for this first segment are for students and instructor alike to understand the interests and capabilities of the class.

After a morning break, the instructor will then provide a context for understanding what landscape ecology is, and will establish a conceptual basis for understanding 'causality' in larger-scale ecology.

PowerPoint presentations:

- 1) Context for Landscape Ecology
- 2) Causality in Ecology

We will then discuss definitions of commonly used terms in landscape ecology and will discuss briefly how landscape ecology has been defined and used in recent times.

After lunch, the instructor will ask the class to participate in a short exercise that demonstrates the common tendencies for misinterpretation of observations that humans make in everyday life. We will extend the idea to how science and landscape ecology is conducted. The instructor will then address the idea of how 'rigor' is achieved in science and show why the

widely accepted classical definition of 'rigor' does not always equate with data reliability in landscape ecology. We will finish the day by redefining how we think about science and how ecological understanding is achieved.

PowerPoint Presentations:

- 3) Things are not always what they seem
- 4) Observation set and rigor in ecology

Background Readings:

- 1) Wright, B. E. 1979. Causality in biological systems. Trends in Biochemical Sciences. May: N 110-111.
- 2) Williams, B. K. 1997. Logic and science in wildlife biology. Journal of Wildlife Management 61(4):1007-1015.
- 3) Chamberlin, T. C. 1897. The method of multiple working hypotheses. Reprinted in Science 1965 148:754-759
- 4) Platt, J. R. 1964. Strong inference. Science 146(3642): 347-352.

DAY 2 & 3 Tuesday 17th & Wednesday 18th June

2) **Scaling Concepts & Hierarchy Theory: the Organization of Nature**
Objectives are to explain the critical concept of scale, present pertinent definitions and terminology, illustrate scale problems, and relate to hierarchy theory, the underlying basis for ecological organization.

PowerPoint Presentation:

- 1) Why are the doomsday predictions wrong?
- 2) Transmutation
- 3) Number Systems in Ecology
- 4) Critical Concept of Scale/Scale considerations

Student Exercises:

- 1) Learning Landscape Ecology Chapter 1: Scale and Hierarchy Theory, R. V. O'Neill and M. A. Smith ;
- 2) Chapter 5: Simulating changes in Landscape Pattern, E. J. Gustafson.

Background Readings:

- 1) King, A. W. 1997. Hierarchy theory: a guide to system structure for wildlife biologists. Pages 185-212 in J. A. Bissonette, (ed), Wildlife and Landscape Ecology: Effects of pattern and Scale. Springer-Verlag, New York, N. Y.
- 2) Urban, D. L., R. V. O'Neill, and H. H. Shugart, Jr. Landscape Ecology. Bioscience 37:119-127
- 3) Bissonette, J. A. 1997. Scale sensitive ecological properties: historical context, current meaning. Pages 3-30 in J. A. Bissonette (ed.), Wildlife and

Landscape Ecology: Effects of Pattern and Scale, Springer-Verlag, New York, N.Y.

Day 4 Thursday 19th June

3) What is a dimension and why is nature fractal?

Objectives are to introduce the idea of dimensions (especially fractal dimensions) as power scaling laws that allow one to understand the concept of scaling organisms to their environment, and as a new way of viewing the natural world.

PowerPoint presentation:

- 1) Dimensions and Fractals

Student Exercise

- 1) Calculating the coastline (fn:coast-prob-set#1-03)

Background Reading:

1) Milne, B. T. 1997. Applications of fractal geometry in wildlife biology, Pages 32-69 in J. A. Bissonette, (ed), Wildlife and Landscape Ecology: Effects of pattern and Scale. Springer-Verlag, New York, N. Y.

Day 5 Friday 20th June

4) Landscape Elements and Pattern

Objectives are to illustrate the fundamental elements in a landscape, to address the idea of landscape pattern, and to encourage students to think about when and whether landscape heterogeneity has effects on animal populations

PowerPoint presentations: 1

- 1) Landscape Elements;
- 2) Are Patterns Real?

Student Exercise:

- 1) Learning Landscape Ecology Chapter 6. Creating Landscape Pattern, H. R. Delcourt

Discussion: How is habitat defined (discuss Mitchell paper)

Discussion: How to link processes with pattern (discuss Dunning et al. paper)

Background Readings:

1) Bissonette, J. A. 2002. Linking landscape patterns to biological reality. Pages 15-34 in J. A. Bissonette and I. Storch (eds.), Landscape Ecology and Resource Management: Linking Theory with Practice. Island Press, Covelo CA, and Washington, D. C.

2) Mitchell, M. S., and R. A. Powell. 2002. Linking fitness landscapes with the behavior and distribution of animals. Pages 93-124 in J. A. Bissonette and I. Storch (eds.), *Landscape Ecology and Resource Management: Linking Theory with Practice*. Island Press, Covelo CA, and Washington, D. C.

2) Dunning, J. B., B. J. Danielson, and H. R. Pulliam. 1992. Ecological processes that affect populations in complex landscapes. *Oikos* 65(1):169-175

DAY 6 & 7 Monday 23rd and Tuesday 24th June

5) Understanding Fragmentation Metrics

"We measure what we consider important". Objectives are to introduce the students to methods of quantifying properties and attributes of fragmented landscapes.

PowerPoint presentations:

- 1) Introduction to Metrics (from FRAGTSTATS)

Discussion: Levels of measurement, aspect, Venn diagrams

Student Exercises:

- a) Learning Landscape Ecology Chapter3: Introduction to GIS, J. D. Greenberg, M. G. Logsdon, and J. F. Franklin. (only for those with no background in GIS)
- b) Learning Landscape Ecology Chapter 7: Understanding Landscape Metrics I, J. A. Cardile, and M. G. Turner
- c) Chapter 8: Understanding Landscape Metrics II, J. D. Greenberg, S. E. Gergel, and M. G. Turner.

Discussion: discuss Gustafson paper

Background Readings:

- 1) Gustafson Quantifying landscape spatial pattern: what is the state of the art (1998) *Ecosystems* (1998) 1:143-156
- 2) Tishendorf, L. 2001. Can landscape indices predict ecological processes consistently? *Landscape ecology* 16:235-254.

DAY 8 Wednesday 25th June

6) Disturbance Regimes: The Rule Rather than the Exception

Objectives are to place into perspective the small and large scale causes that structure populations and influence vital statistics, such as birth and death rates, and survivorship.

PowerPoint presentation:

- 1) Landscape disturbance regimes

Student Exercises:

- a) Learning Landscape Ecology Chapter 11: Landscape disturbance: Location, pattern, and dynamics, Turner, M. F., D. S. E. Gergel, and F. S. Chapin III.

Background Readings:

- 1) Turner, M. G., W. H. Romme, R. J. Gardner, R. V. O'Neill, and T. K. Kratz. 1992. A revised concept of landscape equilibrium: disturbance and stability on scaled landscapes. *Landscape Ecology*.

DAY 9 & 10 Thursday 26th and Friday 27th June**7) Thinking broadly about Landscape Fragmentation**

Objectives are to encourage students to think about fragmentation in a broader sense, to understand whether and when landscape heterogeneity has effects on animal populations, and to put into perspective how patterned landscapes might influence population dynamics

PowerPoint presentation:

- 1) Definition of Fragmentation
- 2) Patterned landscapes and Complicated Population Dynamics

Student Exercise:

- a) Chapter 20 Prioritizing Reserves for Acquisition, Dean L. Urban.

Background Readings for Discussion:

- 1) J. H. Lawton 1999. Are there general rules in ecology? *Oikos* 84:177-192.

27 May 2003 Friday Afternoon

WRAPUP DISCUSSION