# Ecological Complexity

## Seminar 380, Spring 2004
## Wednesdays, 3:30 – 4:20, Bailey 128
## Dr. Gregg Hartvigsen

**Purpose**. To investigate recent findings regarding complexity in ecological systems. Complexity in ecological systems will generally be seen as patterns that arise from relatively simple, underlying processes that generate interesting, but not easily predicted, outcomes. The papers we read will be recent contributions to this new field.

Primary literature, our main readings, comprises papers whose authors have actually done the research and are reporting it for the first time (check for a "methods" section). Your work (presentations and/or papers) should rely on primary research. In general the rule is the more work you base your paper or presentation on the better. A good minimum is five papers and 10-20 would be considered sufficient to build a strong argument. You should not use a paper which you do not have on hand. Therefore, a rule to follow is that you should be able to hand in the cited papers along with your paper. If Jones (1998) says that Smith (1990) laid the foundation for one of your ideas it is not proper for you to cite Smith (1990) unless you have read that paper yourself.

Finally, I think doing science is really the most fun thing to do. Therefore, we will devote two meetings to short presentations that introduce an original research topic and plan of attack (method) to the group. That project should entail some aspect of "ecological complexity."

**Learning Objectives**. After completing this course you should be

- familiar with recent advances in ecology,
- able to discuss arguments and results found in scientific papers,
- able to discuss the contribution of a scientific paper to the field of ecology,
- able to write a review paper and a research paper that rely on the primary literature,
- able to develop and lay the foundation to the solution of a problem in ecological complexity.

**Papers**. There will be two papers that you'll get to write. The first is a short review of a topic of your choice related to ecological complexity (<= 5 pages). The second paper is a research proposal paper (<= 5 pages) that discusses in depth a topic and proposes research (hypotheses and approach) that is aimed at solving a problem in ecological complexity. Both papers will have one preliminary draft (three copies!) and a final draft (just one copy).

**Citations in your work (and in science).** Citing prior research in science is critical. As stated by Henri Poincare, "Science is built up with facts, much as a house is built with stones. But a collection of facts is no more a science than a pile of stones is a house." But we need to cite this research in a way that is consistent so our readers can find these sources. Here are two examples of how to refer to research in your written work.

1. "The method of analyzing canopy structure, later expanded by MacArthur and Horn (1969), involves…."

2. "…found in structures such as leaves and branching patterns (Wu 1994, Borkowski and Smith 1999, West et al. 1999, Monteiro et al. 2000, Byrne et al. 2001), as well as…."

Note the "et al." is use when there are three or more authors in the cited work. The complete citations to these references must be placed in a "Literature Cited" section at the back of your paper. The format I recommend you follow is this:

Literature Cited


Gower, S. T., C. J. Kucharik, and J. M. Norman. 1999. Direct and indirect estimation of leaf area index, fAPAR, and net primary production of terrestrial ecosystems. Remote Sensing of Environment 70:29-51.

Hartvigsen, G. 2000. The analysis of leaf shape using fractal geometry. The American Biology Teacher 62:664-669.

Hastings, H. M., and G. Sugihara. 1993. Fractals: a user's guide for the natural sciences. Oxford University Press, New York.

MacArthur, R. H., and H. S. Horn. 1969. Foliage profile by vertical measurements. Ecology 50:802-804.

Wu, H. P. 1994. Allometrical growth of the quantitative characters of plants. 1. Measurement of leaf size and shape. Botanical Bulletin:35(32): 115-124.


The hanging indent is achieved in Word by placing the cursor in the paragraph (or highlighting all your citations) and pressing "<ctrl> t." The citations should be alphabetical by first author's last name.

**Using figures**. I highly recommend you include figures whenever possible. Those drafted by you to clarify a point are best. Those redrawn from an original source are good. Copying a figure directly from a source without permission from the publisher is frowned upon.

**Primary Activities**:

1. **Editorial work.** You will help your peers produce more polished work, and at the same time find out what they're doing. You will review two first drafts for each of the two papers.
2. **Discussions**. You will be in charge of leading four discussions and participating in all discussions. Each discussion usually involves two related papers. You will be responsible for leading the discussion on one of these papers. You will, unfortunately, not know which paper. The papers are available on the website (see address in footer).
3. **Papers**. There are two papers for you to write. Each has one draft. The first is a review of a topic of your choice related to this class. The second is a more interesting proposal of research. You also will serve as a reviewer for two papers for each of these assignments. Your comments should be as helpful as possible to the author.
3. **Presentation.** Provide an informal, 15-20 minute presentation on your research proposal using only the white board. In this presentation you should provide a thorough discussion of one paper that you believe forms the corner stone on which your research is based. This must be a paper that we have **not** discussed in class. Before you make this presentation you should have had a chance to see the reviewers comments on your written proposal. This will help you with your presentation.

**Grading**. The goal of these seminars is to become familiar and facile in dealing with primary literature in science. Therefore, your grading will be based on your ability to convey the meaning and importance of science. The distribution of grades, therefore, reflects these goals.

| Activity | % of grade |
|---|---|
| Participation in discussions | 25 |
| Discussion leadership | 10 |
| Review of other papers | 10 |
| Review paper (1 draft, 1 final) | 20 |
| Research paper (1 draft, 1 final) | 20 |
| Presentation | 15 |

---

# Schedule
# CHECK YOUR BOXES UNDER "DISCUSSANT"

| Week | Happenings | Papers | Discussant #1 | Discussant #2 | Due |
|---|---|---|---|---|---|
| | | | | | |
| 1/14/2004 | Overview, expectations, life goals, and ecological complexity defined | | | | |
| 1/21/2004 | Field Trip | | | | |
| 1/28/2004 | Intro to complexity | 1-2 | Russ | Elissa | |
| 2/4/2004 | Individual-level complexity | 3-4 | Ted | Allison | |
| 2/11/2004 | Individual-level complexity | 5-6 | Russ | Reed | Draft of Review Paper |
| 2/18/2004 | Quantifying complexity | 7-8 | Elissa | Michael | |
| 2/25/2004 | Population-level complexity | 9-10 | Reed | Ted | Final Review Paper |
| 3/3/2004 | Complexity of ecological networks | 11-12 | Russ | Elissa | |
| 3/10/2004 | Spring Break | | | | |
| 3/17/2004 | Community-level complexity | 13-14 | Russ | Michael | |
| 3/24/2004 | Complexity in food webs | 15-16 | Ted | Allison | |
| 3/31/2004 | Complexity influences extinctions | 17-19 | Reed | Allison | Draft of Final Paper |
| 4/7/2004 | Overview of ecological complexity | 20-21 | Reed | Michael | |
| 4/14/2004 | Presentations | | TBA | TBA | |
| 4/21/2004 | Presentations | | TBA | TBA | |
| 4/26/2004 | Final Paper Due | | | | |
| 4/30/2004 | Final Exam; Time = 3:30 | | | | |

The papers in the preceding table are indicated below with the exact filename found on the website.

1. long-term effects of valdez - Science 12-03.pdf
2. stability complexity - Polis Nature 1998.pdf
3. Biology of digital organisms - TREE 2002.pdf
4. Ind honeybees measure massive volumes - Proc- Biol Sci 2003.pdf
5. Changing sex at same relative body size - Nature 2003.pdf
6. fractal geom predicts mammal and bird home ranges - Nature 2002.pdf
7. Transients - key to ecol understanding - Hastings TREE 2004.pdf
8. coping with uncertainty in ecol - lessons from fisheries - TREE 2003.pdf
9. Lemmings prey or predators - Turchin 2000.pdf
10. complex sp interactions - Science 2001.pdf
11. Emerg properties of dolphin social network - Proc R. Soc. 2003.pdf
12. two degrees of sep in food webs - PNAS 2002.pdf
13. Coastal Oceanography rocky intertidal dynamics - PNAS 2003.pdf
14. Self-organization and complexity in hist landscape patterns - Oikos 2003.pdf
15. Simple rules - complex food webs - Nature 2000.pdf
16. biodiv, productivity, and stability in real food webs - TREE 2003.pdf
17. Expiry dates - Pimm Science 2003.pdf
18. Sequential megafaunal collapse in N Pacific following whaling - PNAS 2003.pdf
19. Dodo extinction approximation - Science 2003.pdf
20. Complexity and fragility in ecol networks - Sole + Montoya 2003.pdf
21. Conserv trop nature - challenges for ecologist - TREE 2004.pdf