

# BIOL 599d – Seminar in Ecosystem Services

W 12-2 p.m., Biology Rm. 415

Winter 2003

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**Text:** Daily, G.C. (ed.) 1997 Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Washington D.C.

## NATURE OF THE COURSE:

Ecosystem services include those properties of ecosystems that either directly or indirectly benefit human endeavors, such as maintaining hydrologic cycles, regulating climate, cleansing air and water, maintaining atmospheric composition, pollination, soil genesis, and storing and cycling of nutrients. We will use the volume edited by Gretchen Daily as the starting point for discussions on the biological mechanisms, magnitudes, tradeoffs, and valuation of ecosystem services. Readings from the book will be supplemented by recent articles in the primary scientific literature. The goals of this course are to

- 1) gain an understanding of the **scope and mechanisms of ecosystem services** at a biological level;
- 2) gain an understanding of the **tradeoffs and choices** involved in attempting to maximize and/or preserve certain services;
- 3) **introduce you to the primary literature** and some of the current "hot topics" being studied and debated in the field.

## COURSE GRADE:

1. The course will be graded S/U and your performance evaluated in terms of the following criteria:

**a. Lead one discussion.** 100 points. You will be the discussion leader for one class. You will need to prepare a set of questions to help focus the discussion (to be handed out at class time) and do additional background reading in the primary literature (supply a bibliography) necessary to prepare yourself as an effective class leader.

**b. Discussion attendance and participation.** 100 points. Discussion attendance and participation are mandatory and constitute an important component of this class. Each class missed (without a pre-approved excuse) will result in loss of 10 points. Missing more than 5 discussions results in loss of all 100 points. However, being a warm body in the room is not sufficient to get all 10 points per class. Informed contribution to the discussion, reflecting an understanding of the reading material, is also required.

**c.** You will need to get a minimum of 140 points (the equivalent of a C) to get a grade of "satisfactory".

**CLASS SCHEDULE:** Readings listed are chapters from the Daily volume, plus additional papers.

Week	Date	Topic	Reading
1	W, 1/8	Course introduction, background	
2	W, 1/15	What are ecosystem services?	Chaps. 1, 2 (Daily et al. 1997, Hughes et al. 1997, Lawler et al. 2002)
3	F, 1/24 <i>Note date change</i>	Economic issues of valuation <i>Same time, same room</i>	Chaps. 3, 4 (Costanza et al. 1997, Balmford et al. 2002); Costanza critique
4	W, 1/29	Linking processes and services I: soils and atmosphere	Chaps. 5, 6, 7 (Naeem et al. 1999, Wardle et al. 2000, Loreau et al. 2001)
5	W, 2/5	Linking processes and services II: trophic dynamics	Chaps. 8, 9 (Brown and Ewel 1987)
6	W, 2/12	Services by biome I: aquatic systems	Chaps. 10, 11 (Carpenter 2002)
7	W, 2/19	Services by biome II: terrestrial systems	Chaps. 12, 13 (Costanza et al. 2002)

8	W, 2/26	Case studies I: genes and extraction	Chaps. 14, 15 (Naylor et al. 2000)
9	W, 3/5	Case studies II: subsistence and modern economies	Chaps. 16, 17 (Browder 1992, Butler and Batmanian 1992) (Harte and Shaw 1995)(next time)
10	W, 3/12	Case studies III: wetlands and fynbos; wrap-up	Chaps. 18, 19, 20 (Beck et al. 1999, Isaacs 2000, Zedler 2003)

### Additional readings

- Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. Jenkins, P. Jefferiss, V. Jessamy, J. Madden, K. Munro, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, and R. K. Turner. 2002. Economic Reasons for Conserving Wild Nature. *Science* **297**:950-953.
- Beck, R. J., S. E. Kraft, and J. H. Burde. 1999. Is the conversion of land from agricultural production to a bioreserve boon or bane for economic development. *Journal of Soil and Water Conservation* **54**:394-401.
- Browder, J. O. 1992. The limits of extractivism. *BioScience* **42**:174-182.
- Brown, B. J., and J. J. Ewel. 1987. Herbivory in complex and simple tropical successional ecosystems. *Ecology* **68**:108-116.
- Butler, J., and G. Batmanian. 1992. The opportunities of extractivism. *BioScience* **42**:740-741.
- Carpenter, S. R. 2002. Ecological futures: Building an ecology of the long now. *Ecology* **83**:2069-2083.
- Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Sutton, and M. van den Belt. 1997. The value of the world's ecosystem services and natural capital. *Nature* **387**:253-260.
- Costanza, R., A. Voinov, R. Boumans, T. Maxwell, F. Villa, L. Wainger, and H. Voinov. 2002. Integrated ecological economic modeling of the Patuxent River Watershed. *Ecological Monographs* **72**:203-231.
- Daily, G. C., S. Alexander, P. R. Ehrlich, L. Goulder, J. Lubchenco, P. A. Matson, H. A. Mooney, S. Postel, S. H. Schneider, D. Tilman, and G. M. Woodwell. 1997. Ecosystem services: benefits supplied to human societies by natural ecosystems. *Issues in Ecology* **1**:1-16.
- Harte, J., and R. Shaw. 1995. Shifting dominance within a montane vegetation community: results of a climate-warming experiment. *Science* **267**:876-880.
- Hughes, J. B., G. C. Daily, and P. R. Ehrlich. 1997. Population diversity: its extent and extinction. *Science* **278**:689-692.
- Isaacs, J. C. 2000. The limited potential of ecotourism to contribute to wildlife conservation. *Wildlife Society Bulletin* **28**:61-69.
- Lawler, S., J. J. Armesto, and P. Kareiva. 2002. How relevant are studies of biodiversity and ecosystem functioning to conservation? Pages 294-313 *in* A. Kinzig, D. Tilman, and S. Pacala, editors. *Functional Consequences of Biodiversity: Experimental Progress and Theoretical Extensions*. Princeton University Press, Princeton.
- Loreau, M., S. Naeem, P. Inchausti, J. Bengtsson, J. P. Grime, A. Hector, D. U. Hooper, M. A. Huston, D. Raffaelli, B. Schmid, D. Tilman, and D. A. Wardle. 2001. Biodiversity and ecosystem functioning: current knowledge and future challenges. *Science* **294**:804-808.
- Naeem, S., F. S. Chapin, III, R. Costanza, P. R. Ehrlich, F. B. Golley, D. U. Hooper, J. H. Lawton, R. V. O'Neill, H. A. Mooney, O. E. Sala, A. J. Symstad, and D. Tilman. 1999. *Biodiversity and Ecosystem Functioning: Maintaining Natural Life Support Processes*. Ecological Society of America, Washington, D.C.
- Naylor, R. L., R. J. Goldberg, J. Primavera, N. Kautsky, M. Beveridge, J. Clay, C. Folke, J. Lubchenco, H. Mooney, and M. Troell. 2000. Effects of aquaculture on world fish supplies. *Nature* **405**:1017-1024.
- Wardle, D. A., M. A. Huston, J. P. Grime, F. Berendse, E. Garnier, W. K. Laurenroth, H. Setälä, and S. D. Wilson. 2000. Biodiversity and ecosystem function: an issue in ecology. *Bulletin of the Ecological Society of America* **81**:235-239.
- Zedler, J. B. 2003. Wetlands at your service: reducing impacts of agriculture at the watershed scale. *Frontiers in Ecology and the Environment* **1**:65-72.

## Instructions for discussion leaders

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#### To Prepare

You should prepare for leading your discussion section as if you were doing a research paper. Read the assigned articles, but DO NOT STOP THERE. To be an effective discussion leader, you will need to be informed on your topic. You will need to read at least **six** additional references that deal with aspects of the topics covered. Some topics for focusing your reading include: What main points from the chapters were unclear to you? What are the background papers for important points that are made? What has been done since this book came out in 1997? Is there scientific evidence that contradicts anything that is said? (Some of the assigned readings try to bring out the latter issues).

You will need to prepare

1. A bibliography citing all additional references you used
2. A list of at least six discussion questions
3. A 15 minute summary of the assigned chapters and additional readings (see below).

Please make copies of your bibliography and discussion questions for everyone in the class. In preparing your questions, look for controversy, inconsistencies, and points that struck you as particularly novel or unusual. In short, use critical thinking to evaluate the chapters and assigned papers. Part of your grade depends on the depth and rigor of the questions you pose.

#### In your discussion

1. Summarize the articles. What are the main points of the chapters and the linkages among them? This should take no more than 15 minutes (and no less than 10). Rather than trying to say everything about all the chapters and articles, your summary should lead up to the main questions that you intend to pose. That is, you should make key points that help raise the questions that most interest you. At the same time, you should not allow your focus to be too narrow. All the assigned readings should be at least partially addressed, particularly where conflicting evidence or different perspectives are presented.
  - If you want to use figures, overheads, or PowerPoint to illustrate your summary, that's fine. If you decide to use PowerPoint, please let me know in advance so we can arrange for a projector.
2. To help get things rolling after your summary, pose some of the questions you have outlined. As mentioned in #1, your questions should follow naturally from the summary you have provided.
  - Everyone in class should receive a copy of your questions and your bibliography.
3. It is up to you, the discussion leader, to keep the discussion on track. It's fine if the discussion wanders into some uncharted areas, but don't let things swerve too far out.
4. Your grade will be based on the depth of your background research, the extent to which your summary adequately paves the way for your questions (without being too long), the critical thinking and degree of insight displayed by the questions you prepare, and your ability to keep the discussion focused on the relevant issues.

#### Some tips for running and participating in a discussion

1. **READ ALL THE ASSIGNED CHAPTERS AND PAPERS.** Part of your grade depends on discussion participation, and you will only be able to participate effectively if you have prepared for class.
2. Don't direct your questions to me. I will try to be as unobtrusive as possible, and prefer to interrupt the student's discussion only if I think things are getting really off-track or if a point of clarification is needed.
3. After asking a question, allow some time for people to answer. Don't be afraid to wait in silence for a while.
4. Don't feel that it is necessary to agree with everything people say. Use your critical thinking to evaluate the strength of their argument based on the scientific evidence.
5. When disagreeing, be courteous. This is a scientific discussion, not reality TV.
6. Think carefully and critically about your own biases. Many of us may feel a particular urgency about ecological and environmental issues, but that doesn't mean we should automatically agree with everything that seems "green". Part of the point of this class is to evaluate just how the ecological science informs real world solutions to environmental problems.