

ECOLOGICAL THOUGHT: PAST TO PRESENT

BIO 602, Spring 2011
Stuart R. Borrett

Course Descriptions and Goals

Participants in this course will encounter questions central to current ecological science and investigate their intellectual roots. An overarching goal of the class is to raise the level of scholarship in our work. Specifically, through your experiences in this course you will have the opportunity to achieve the following **learning goals**:

- Discover the breadth and depth of ecological science by reading the primary literature;
- Construct an understanding of how scientific ideas, tools, techniques, and communication change through time;
- Place your own research into the broader context of ecology;
- Extend your skills using databases to search for and evaluate primary literature.
- Develop your critical thinking, analytical, and quantitative skills; and
- Become more effective, self-assessing, and self-directed learners.

In many ways, this course will be under your direction. What are your goals for the course? How do you plan to achieve them?

My goals for this course are bested stated in the words of Ebert-May and Tsao (2007):

- As a facilitator, I will encourage and create a learning environment in which all students are actively engaged in the process of scientific thought and reasoning.
- I will guide your development toward higher-order thinking and reasoning skills so you can successfully explore and demonstrate achievement of each of the goals above.

General Course Information

Time and Location

Class meets 8 – 9:15 am on Tuesdays and Thursdays in Friday Hall 1014

Contact Information

I can be reached using the following information:

Office Location: Friday Hall 1057
Office Phone: 910.962.2411
Email: borretts@uncw.edu
Website: <http://people.uncw.edu/borretts>
Office Hours: By appointment

Email is often the best way to contact me. To insure a prompt response, please include “bio602” in the subject line followed by an informative subject. For example, if you have a question about the syllabus, your email subject line would read: “bio602 : syllabus question”. Though I will often respond faster, please allow 24 hours for a response.

About the Course

This seminar course will be largely based on reading and discussing primary literature. After an initial discussion about the origins of ecology, we will address a new ecological topic each week. For each topic, we will read a selection of papers that spans the development of the ideas. This will usually include a historical paper or selection of historical excerpts, a more recent influential paper, and a current paper (last 2 years) on the topic.

There are two main elements to the course. First, students will **lead discussion** on the topics on a rotating basis. The discussion leader will be responsible for providing a short (~1 page) summary of the topic with 3-5 open ended questions to initiate our discussion. The topic leader will also be responsible for selecting the “recent” paper for the class to read. Once all students have led discussion we will rotate through again, starting with volunteers. Topics later in the semester will be selected by the class.

The second element of class is a set of 4 **homework exercises**. These exercises generally introduce an analytical tool to facilitate critical thinking that you will then apply to the course readings. The last exercise will be to write a short reflection paper in which you will map your own research into the broader context of ecological thought. Each student will give a short presentation of his or her reflection in the last days of the course.

Texts

There is no required text for the course. Most of the readings will come from the primary literature and a PDF copy or a link to the PDF will be posted on the course website. However, some readings will be drawn from two excellent texts that I would like to bring to your attention. We will just scratch their surface and I recommend you read more when you have a chance. These texts are:

- Kormondy, E. J. 1965. *Readings in Ecology*. Prentice Hall, Englewood Cliffs, NJ. 219 pp.
- Real, L., and J. H. Brown, editors. 1991. *Foundations of Ecology: Classic Papers with Commentaries*. University of Chicago Press, Chicago. 905 pp.

Schedule & Assignments

Month	Date	Day	Topic	Exercises
Jan	13	Th	No Class	
	18	T	Introductions	
	20	Th	Origins of Ecology	
	25	T	Topic 1: Ecological Stoichiometry	Concept Mapping (Due Feb 3)
	27	Th		
Feb	1	T	Topic 2: Biosphere & Gaia Hypothesis	
	3	Th		
	8	T	Topic 3: Population Regulation & Density Dependence	Propositional Logic (Due Feb. 17)
	10	Th		
	15	T	Topic 4: Host-Parasite Interactions & Disease Ecology	
	17	Th		
	22	T	Topic 5: Importance of Biodiversity	
	24	Th		
Mar	1	T	Topic 6: Community Assembly	Kinematic Graphing (Due Mar 8)
	3	Th	(SRB out of town)	
	8	T	Topic 7: Niche vs. Neutral Theory Debate	Position Paper (due Mar. 20)
	10	Th		
	15	T	<i>Spring Break</i>	
	17	Th	<i>Spring Break</i>	
	22	T	Topic 8: Ecosystem Energetics	
	24	Th		
	29	T	Topic 9: TBD by class	
	31	Th		
April	5	T	Topic 10: TBD by class	
	7	Th		
	12	T	Topic 11: TBD by class	
	14	Th		
	19	T	Presentations	Reflection paper due
	21	Th	<i>Easter Break</i>	
	26	T	Presentations	
	28	Th	Presentations	
May	2	M	<i>Last Day of Classes</i>	
	5	T	Scheduled Final Exam (no exam)	

Topic 1: Defining Ecology

A. Kormondy Readings

Introduction (Early definitions) xiii-xiv

Reiter (1865)

Haeckel (1866)

St. Hilaire (1859)

Mivart (ca. 1859's)

Early Natural History (1-10)

Theophrastus (300 B.C.)

Linnaeus (1750)

De Reaumur (ca. 1742)

B. Kingsland, S.E. 1991. Definition as a science. In: Real, L., and J. H. Brown, editors. Foundations of Ecology: Classic Papers with Commentaries. University of Chicago Press, Chicago. pp. 1-10.

(may not read) C. Ford, E.D. 2000. Chapter 16. Criticisms and improvements for the scientific method in ecology. In: Scientific method for ecological research. Cambridge University Press, Cambridge; New York

Ecological Stoichiometry

A. Kormondy Readings: Physical and Chemical Environment

J. Liebig (1840) Organic Chemistry in its application to vegetable physiology and agriculture.

F. F. Blackman (1905) Optima and limiting factors.

Victor E. Shelford (1911) Physiological animal geography.

B. Reiners, W.A., 1986. Complementary models for ecosystems. American Naturalist, 127:59-73. (14 pgs)

C. Elser, JJ; Fagan, WF; Denno, RF; et al. 2000. Nutritional constraints in terrestrial and freshwater food webs. Nature 408: 578—580. (2 pgs) <http://0-www.nature.com.uncclc.coast.uncwil.edu/nature/journal/v408/n6812/full/408578a0.html>

Exercise 1: Concept Mapping

Biosphere and the Gaia Hypothesis

A. Lovelock, J.E. and Margulis, L. 1974. Atmospheric homeostasis by and for the biosphere- The Gaia hypothesis. Tellus Series B-Chemical and Physical Meteorology, 26:2-10.

B. Charlson, R.J., Lovelock, J.E., Andreae, M.O. and Warren, S.G., 1987. Oceanic phytoplankton, atmospheric sulfur, cloud albedo and climate. Nature, 326:655-661.

Population Regulation and Density Dependence

A. Kormondy Readings: Populations

- T.R. Malthus (1798) An essay on the principle of population as it affects the future improvement of society. Pp 62-64
- P.F. Verhulst (1838) Notice sur la loi que la populationsuit dans son accroissement. Pp 64-66
- L. C. Birch (1957) the role of weather in determining the distribution and abundance of animals. Pp. 106-109
- A. J. Nicholson (1957) The self adjustment of populations to change. Pp 109-113.
- N. G. Hairston, F. E. Smith & L. B. Slobodkin (1960) Community structure, population control, and competition. Pp113-116

B. Choose One:

Caley, M.J., Carr, M.H., Hixon, M.A., Hughes, T.P., Jones, G.P. and Menge, B.A., 1996. Recruitment and the local dynamics of open marine populations. Annual Review of Ecology and Systematics, 27:477-500.
<http://arjournals.annualreviews.org/doi/pdf/10.1146/annurev.ecolsys.27.1.477>

Murdoch, W.W., 1994. Population regulation in theory and practice - The Robert-H-MacArthur-Award-Lecture presented August 1991 In San-Antonio, Texas, USA. Ecology, 75:271-287. <http://www.jstor.org/stable/1939533?origin=crossref>

Exercise 2: Propositional Logic

Host-Parasite Interactions / Disease Ecology

A. Kormondy Readings: Populations

Burkholder, Gause, Connell, Wheeler

B. May, R.M. 1983. Parasitic infections as regulators of animal populations. American Scientist 71:36-45.

Biodiversity and Ecosystem Function (a.k.a. diversity—stability debate)

A. Hutchinson, G.E., 1959. Homage to Santa Rosalia; or, Why are there so many kinds of animals? American Naturalist, 93:145-159. (pp 14)

B. Hooper, D.U., Chapin, F.S., Ewel, J.J., Hector, A., Inchausti, P., Lavorel, S., Lawton, J.H., Lodge, D.M., Loreau, M., Naeem, S., Schmid, B., Setälä, H., Symstad, A.J., Vandermeer, J. and Wardle, D.A., 2005. Effects of biodiversity on ecosystem functioning: A consensus of current knowledge. Ecological Monographs, 75:3-35. (33 pgs)
<http://www.esajournals.org/doi/abs/10.1890/04-0922>

Community Assembly

A. Kormondy Group: Community

F. E. Clements (1916) Plant succession, an analysis of the development of vegetation.

J. Braun-Blanquet and E. Furrer (1913) Remarques sru l'étude des groupments de plantes.

L.G. Ramensky (1226) Die Grundgesetzmässigkeiten im Aufbau der Vegetationsdecke

H.A. Gleason (1926) The individualistic concept of the plant association.

B. Leibold, M.A., Holyoak, M., Mouquet, N., Amarasekare, P., Chase, J.M., Hoopes, M.F., Holt, R.D., Shurin, J.B., Law, R., Tilman, D., Loreau, M. and Gonzalez, A., 2004. The metacommunity concept: a framework for multi-scale community ecology. *Ecology Letters*, 7:601-613.

Exercise 3: Kinematic Graphing Exercise

Niche vs. Neutral Theory Debate

A. Hutchinson, G.E., 1957. Concluding Remarks. *Cold Springs Harbor Symposia on Quantitative Biology*, 22:415-427.

B. Hubbell, S.P., 2005. Neutral theory in community ecology and the hypothesis of functional equivalence. *Functional Ecology*, 19:166-172. (8 pgs)

C. Leibold, M.A. and McPeck, M.A., 2006. Coexistence of the niche and neutral perspectives in community ecology. *Ecology*, 87:1399-1410. (11 pgs)

Exercise 4: Position Paper

Ecosystem Energetics

A. Kormondy Group: Ecosystems

F.C. Evans (1956) Ecosystem as the basic unit in ecology.

E.N. Transeau (1926) The accumulation of energy by plants.

C. Juday (1940) The annual energy budget of an inland lake.

R.L. Lindeman (1942) The trophic dynamic aspect of ecology

G.L. Clarke (1946) Dynamics of production in a marine area

H.T. Odum (1957) Trophic structure and productivity of silver springs, FL.

B. Polis, G.A. and Hurd, S.D., 1996. Linking marine and terrestrial food webs: Allochthonous input from the ocean supports high secondary productivity on small islands and coastal land communities. *American Naturalist* 147:396—423. Article Stable URL: <http://0-www.jstor.org.unccl.coast.uncwil.edu/stable/2463215> (29 pages)

Additional Topics Possible Include

- Ecological Genetics
- Intraguld predation

- Landscape Ecology
- Metabolic Scaling
- Microbial ecology
- Mutualisms
- Network ecology
- Paleoecology
- Stream Ecology (River Continuum Concept)
- Trophic Cascades / Food Webs
- Parasites in food webs
- Systems Ecology/Ecological Modelling

Assessment

Your grade will be assessed as follows. Each of the 4 exercises and your final presentation will be worth 10 points for a total of 50. The remaining 50 points will be based on your preparation and participation in class discussions.

University Policies of Concern

Disabilities

If you are a person with a disability and anticipate needing accommodations of any type for this course, you must first notify Disability Services (Westside Hall \#1033, 962.7555), provide the necessary documentation of the disability, and arrange for the appropriate authorized accommodations. Once these accommodations are approved, please identify yourself to me in order that we can implement these accommodations.

Violence and Harassment

UNCW practices a zero-tolerance policy for violence and harassment of any kind. For emergencies, contact UNCW CARE at 910.962.2273, Campus Police at 910.962.3184, or the Wilmington Police at 911. For University or community resources visit <http://www.uncw.edu/wrc/crisis.html>.

Academic Honor Code

The Department of Biology and Marine Biology and I strongly support the Academic Honor Code as stated in the "Student Handbook and Code of Student Life," and we will not tolerate academic dishonesty of any type. Plagiarism is a form of academic dishonesty.