ENTMLGY 6701: Biodiversity and Ecosystem Services Assessment
2 semester credits (two 80-minute labs per week)

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Course Description:
Biodiversity, through its links to ecosystem services production, is crucial for human well-being, economic development and poverty alleviation. Biodiversity also constitutes an important component of ecosystem resilience, i.e. the capacity of a system to deal with change and withstand shocks without shifting into a qualitatively different state. Resilience has increasingly been acknowledged as an important factor in determining ecosystems' capacity to continue generating ecosystem services in a world increasingly influenced by global environmental change. Interest in this subject has grown immensely since the 2005 UN Millennium Ecosystem Assessment concluded that degradation of ecosystem services presents a significant threat to achieving the UN's Millennium Development Goals, worsening poverty and causing social conflicts. The escalation of this interest is reflected by the recent publication of several books, governmental reports and international conferences on the subject, and the establishment, in 2009, of the peer-reviewed *Journal of Biodiversity Science, Ecosystem Services, and Resilience*. This interest has also created increased demand for knowledge about biodiversity assessment methods and understanding of the relationship between biodiversity and ecosystems services and resilience. Therefore, the need for scientists with knowledge of the theory and practice of biodiversity science, ecosystem services and resilience has risen and will likely increase in coming decades, especially as awareness about the subject increases in public policy. Thus, this course will fill a critical need for training future scientists in this important topic and preparing them for future leadership for solving society's most complex problems.

Through a hands-on team research project(s), students will learn how to assess invertebrate species diversity and its ecosystem services. Students will learn how to make sampling decisions to assess species diversity of multiple taxa including insects, collembolans, spiders, mites, nematodes, and earthworms. Students will identify various taxa to family and genus levels and will quantify their ecosystem services including pollination, biocontrol, nutrient cycling, and soil formation. Research project(s) will be designed to reveal subtle human impact on biodiversity and the ecosystem services it provides through comparisons between different habitats or urban to rural gradients. Students will analyze the data collected, interpret results by integrating

discussion of ecological principles, biodiversity, environmental bioindicators, ecosystem services and resilience, and will communicate their findings in a well-written scientific paper. Thus, the course would be attractive to a wide range of graduate students in entomology, EEOB, ESGP, Horticulture and Crop Science, Natural Resources, Soil Science, Landscape Architecture, engineering, and others.

Credit Hours: 2 semester credits (two 80-minute labs per week)

Course grading:

Mid-term exam (understanding of concepts):	20%
Research project (data collection and analysis):	60%
Research paper (interpretation of results):	20%

Course Grading Scale: Standard percent scale, no curve. (e.g., 91-100% = A; 89-90 = A-; 87-88 = B+; 81-86 = B; 79-80 = B-; 77-78 = C+; 71-76 = C; 69-70 = C-; etc.)

Prerequisites: ENTMLGY 3000 (ENTOMOL 500) or 4000 (500), and 5130 (621); or permission of instructor.

Learning Objectives:

- Students will be able to express their understanding of biodiversity and its contributions to ecosystem services and resilience
- Students will be able to examine the myriad effects of human activities on biodiversity patterns and discuss the need for assessing these effects and their many consequences
- Learn and use basic sampling and identification techniques of all major groups of invertebrates including insects, collembolans, spiders, mites, nematodes, centipedes, and earthworms
- Learn and use methods of quantifying major ecosystem services of invertebrate biodiversity including pollination, biocontrol, nutrient cycling, and soil improvement
- Students will be able to express thoughts on integrated perspectives about biodiversity, environmental bioindicators, ecosystem services, and ecosystem resilience
- Produce a cognitive advancement in the form of a new understanding and communicate the finding effectively in a research paper

Course Syllabus

1 Introduction to biodiversity and its relation to ecosystem services
2 Designing a research project to assess biodiversity and ecosystem services
3 Aquatic insect biodiversity: sampling, preservation, identification, and enumeration
4 Aerial insect biodiversity: sampling, preservation, identification, and enumeration
5 Plant insect biodiversity: sampling, preservation, identification, and enumeration
6 Terrestrial surface insect and macroarthropod diversity: sampling, preservation, identification, and enumeration

7 Soil macroarthropod and microarthropods: sampling, extraction, preservation, and identification and enumeration
8 Soil nematode biodiversity: sampling, extraction, fixing, and identification
9 Data management, data analyses, and generation of tables and graphs
10 Interpretation of results
11 Research Paper writing

Possible guest lecturers and laboratory leaders

Dr. Richard Bradley – spiders
Dr. Clive Edwards – earthworms
Dr. Mary Gardener – above-ground biocontrol and pollination services
Dr. Susan Jones – household/structural pests
Dr. Hans Klompen – mites
Dr. Richard Moore – stream quality bioindicators
Dr. Robin Taylor – statistical analysis of biodiversity data
Dr. Casey Hoy – principle components analysis

Relevant texts for consideration as course readings (or parts thereof):

Kovacs, ed. 1992. Biological Indicators in Environmental Protection. (book)
Pankhurst et al. (eds) 1997. Biological Indicators of Soil Health (book)
Adams (ed) 2002. Biological Indicators of Aquatic Ecosystem Stress (book)
Jeffrey and Madden 1991. Bioindicators and Environmental Management (book)
Markert et al. 2003. Bioindicators and Biomonitors: Principles, Concepts and Applications (book)
Markert et al. 2003. Bioindicators and Biomonitors: Principles, Concepts and Applications (book)
Paoletti, ed. 1999. Invertebrate Biodiversity as Bioindicators of Sustainable Landscapes (book)
Porrini et al. 2003. The death of honey bees and environmental pollution by pesticides: the honey bees as biological indicators. Bulletin of Insectology 56:147-152.
Burger, J. 2006. Bioindicators: Types, development and use in ecological assessment and research. Environmental Bioindicators 1:22-39.
Rohr et al. 2006. Community ecology theory as a framework for predicting contaminant effects. Trends in Ecology and Evolution 21: 606-613.
Nahmani et al. 2006. Does changing the taxonomical resolution alter the value of soil macroinvertebrates as bioindicators of metal pollution? Soil Biol Biochem 38: 385-396.
Pearce and Venier 2005. Small mammals as bioindicators of sustainable forest boreal management. Forest Ecology and Management 208: 153-175.
Ponge et al. 2003. Collembolan communities as bioindicators of land use intensification. Soil Biol Biochem 35: 813-826.

Hill et al. 2002. Hemeroby, urbanity and ruderality: bioindicators of disturbance and human impact. J App Ecology 39: 708-720.
McGeoch et al. 2002. The verification and application of bioindicators: a case study of dung beetles in a savanna ecosystem. J. App Ecology 39: 661-672.

Course Policies

Academic Integrity:
Please note that the university policy will serve as the basis for dealing with any such issues in this course. http://studentaffairs.osu.edu/pdfs/csc_12-31-07.pdf

Special Needs and Accommodations:
Any student who feels she/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 (Fax: 614-292-4190; TDD: 614-292-0901) in room 150 Pomerene Hall, 1760 Neil Ave, Columbus, Ohio 43210 to coordinate reasonable accommodations for students with documented disabilities.
http://www.ods.ohio-state.edu/

Incomplete Grade Policy:
Incomplete grades will be given only in special circumstances as outlined in university policy.
http://trustees.osu.edu/rules8/ru8-21.php

General Information:
Additional information on general Ohio State University Policies can be found at:
http://trustees.osu.edu/ChapIndex/index.php

Late Policy:
A report that is handed in late will be reduced in value 10 percent per day that it is late.