

TOX/NTRES 406

Ecological Risk Assessment

3 credits

11:15-12:05 M W F

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This course strives to develop a thorough understanding of the different types of ecological (i.e., non-human health) risk assessments and the methods employed with respect to chemical, physical and biological stressors. Particular attention will be paid to how these assessments might be employed for risk management and other decision making. This course is presented in the general context of integrated environmental management for seniors and graduate students. For some Environmental Toxicology Ph.D. students it may also offer an appropriate opportunity to meet the field requirement for "demonstrated competence in risk assessment." The particular objectives of this course include the following:

- Develop a working familiarity with the structure of ecological risk assessments and their use in ecological risk management as presently put forth by the U.S. EPA and employed by resource management agencies;
- Develop and exercise skills with regard to information and data acquisition, evaluation and management, including both prospective and retrospective assessments (simulation modeling) for terrestrial and aquatic ecosystems and their interfaces;
- Acquire and exercise skills in working with diverse technical authorities (persons and agencies) under a variety of policies [Superfund (CERCLA, SARA); Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); Endangered Species Act (ESA) and other environmental regulations], including Life-Cycle Analysis and other efforts at toxicity reduction, and waste minimization and elimination; and
- Provide an opportunity for undergraduates and graduate students anticipating work in regulatory and resource agencies, consulting firms or elsewhere in the private sector, or advanced study in an applied environmental discipline, to explore the types of work and work product involved therein.

Lectures, readings, guest speakers, and special assignments -- and discussions about the foregoing in relation to a series of representative case studies -- will be used to explicate issues, their evaluation, and the application of assessment principles.

PRE-REQUISITES: BIOSCI 261 or equivalent; permission of instructor if not an advanced student in the natural sciences or engineering, as evidenced by at least two 300-level courses in relevant subjects. [The principal question is how to cover the course material for undergraduates (who are increasingly likely to work for consulting firms or agencies performing these assessments) when $\geq 50\%$ of the case studies require a higher degree of technical expertise (both generally and specifically) in areas such as statistics, biochemistry, biogeochemistry, organic and physical chemistry, civil engineering, systems ecology,

operations research, mathematical modeling, toxicology, and organismic physiology and pathology. When in a work environment, the participant in an ecological risk assessment will be expected to bring a disciplinary background contributing to the competence of the group of colleagues from other fields.] Grading: Two mid-term take-home exams (200 pts each), a final exam (200 pts), eight classroom assignments (problem sets and oral or written reports; 25 pts each), and a term project (200 pts) provide the basis for the grade, which can be letter or S/U.

CLASSROOM ACTIVITIES:

<u>Week No.</u>	<u>Subject</u>
1	Introduction; scope and definitions; general paradigm - ecosystem health; problem definition
2	Case Study #1. <i>Carbofuran -- Review of Impact of Granular Formulation on Birds</i> . Exposure assessment; species level lethal effect; quotient method of risk assessment
3	Problem formulation; Case Study #2. <i>The Guamian Avifauna Losses -- a retrospective assessment; indirect effects</i>
4	Case Study #3. <i>Land Application of Paper & Pulp Wastewater Sludge Compost -- a potential reproductive impact; QA/QC, test methodologies, and data acquisition and management</i>
5	<u>Mid-term Examination</u> [focus on organismic and population-level effects]
6	Case Study #4. <i>PCBs, Mink, and Fish Stocks</i> . Food web and energetics models; predictive assessments for non-testable species
7	Case Study #5: <i>Northern Spotted Owl, Coho Salmon, and the Timber Harvest</i> ; sustainable fisheries, agriculture, renewable resources & agroforestry
8	Tools - modeling, uncertainty analysis & simulation technology; Case Study # 6: <i>Acidic Deposition on Aquatic Ecosystems</i> ; regional/landscape-level effects and assessments
9	<u>Mid-term Examination</u> ; Database development & EMAP; monitoring, surveillance & RS/GIS in risk assessment and management
10	Case Study #7: <i>Kesterson Reservoir</i> ; point source vs non-point source problems; effects cascades and other multiple exposure/effects scenarios
11	Case Study #8: <i>Assessing Ecological Risk at a Superfund Site (Rocky Mountain Arsenal)</i> ; pre- and post-remediation assessment processes; land/water use and protection implications for assessment procedures
12	Case Study #9: <i>Wetlands Modification -- non-conventional "exposures" and system-wide impacts; regulatory actions and implications for assessment</i>
13	Abstract pollutants; assessment paradigm revisited - theory and practice; <u>Final Examination</u>

READING MATERIALS

TEXT:

Suter, Glenn W. ,II (1993). *Ecological Risk Assessment*. Lewis Publishers, Boca Raton, FL. **QH541.15.R57 1992**

RESERVED BOOKS:

Bartell, S.M., R.H. Gardner, and R.V. O'Neill (1992). *Ecological Risk Estimation*. Lewis Publishers, Boca Raton, FL. **QH541.15.R37x 1992**

- Calabrese, E.J. and L.A. Baldwin (1993). *Performing Ecological Risk Assessments*. Lewis Publishers, Boca Raton, FL.
- Costanza, R., B.G. Norton, and B.D. Haskell (1992). *Ecosystem Health: New Goals for Environmental Management*. Island Press, Washington, DC. **GF21 E19 1992**
- U.S. Environmental Protection Agency (1989). *Risk Assessment Guidance for Superfund. Volume II. Environmental Evaluation Manual*. (Interim Final) EPA/540/1-89/001. Office of Emergency and Remedial Response. Washington, DC.
- U.S. Environmental Protection Agency (1992). *Framework for Ecological Risk Assessment*. EPA/630/R-92/001. Risk Assessment Forum. Washington, DC. 41 pp.
- U.S. Environmental Protection Agency (1992). *Peer Review Workshop Report on a Framework for Ecological Risk Assessment*. EPA/625/3-91/022. Risk Assessment Forum. Washington, DC. 100 pp.
- U.S. Environmental Protection Agency (1993). *A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective*. Vol. I. EPA/630/R-92/005. Risk Assessment Forum. Washington, DC. 408 pp.
- U.S. Environmental Protection Agency (1994). *A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective*. Vol. II. EPA/630/R-94/003. Risk Assessment Forum. Washington, DC. 251 pp.
- U.S. Environmental Protection Agency (1994). *Peer Review Workshop Report on Ecological Risk Assessment Issue Papers*. EPA/630/R-94/008. Risk Assessment Forum. Washington, DC. 273 pp.
- U.S. Environmental Protection Agency (1994). Guidelines for Ecological Risk Assessment; Notice *Fed. Register* **63**(93): 26845-26924. (May 14, 1998).