Overall objectives
Policy-makers, managers, and stakeholders depend on accurate environmental risk assessments to learn the facts about environmental stressors and their effects on individuals and ecosystems. The field of environmental risk assessment has been rapidly evolving to meet such a demand. This course will introduce students to the basic framework, concepts, and methods of environmental risk assessment with an emphasis on ecological effects on freshwater ecosystems. The topics, ranging from laboratory ecotoxicology to field-based bioassessment to probabilistic risk characterization, will be presented under the US EPA’s Ecological Risk Assessment Framework. The students will be expected to apply the framework by completing an environmental risk assessment project.

Approach
This class emphasizes tremendously on student-based learning. This approach places more responsibility on the student to guide one’s own learning and intellectual development. Therefore, the learning you achieve in this class is largely a product of your participation in all aspects of the course. During lab, the class will be divided into project groups of 4 members, which will work together on a common research question and write a scientific paper using US EPA’s Ecological Risk Assessment Framework.

Prerequisites: ESM 320/323, ESM 321/324.

Recommended reading materials
No textbook is required for the course. Weekly recommended reading materials will be posted as pdf’s in “D2L”.

Software
D2L, an on-line learning system (https://d2l.pdx.edu/). You need to use your ODIN user name and password to log in. Class materials such as syllabus, lectures, reading assignments, and grades will be posted in “D2L”. Please check it on a regular basis for class materials, news, and last-minute announcements. Students are encouraged to use “D2L” to post questions, comments, and suggestions.

Grading
Exams:
- Exam I (25%): Module One
- Exam II (25%): Module Two
- Final Exam (50%): Cover all three modules with an emphasis on Modula Three.

If you have a legitimate reason for missing an exam, please notify the professor prior to the exam date.
Class participation: Attendance is critical to your success in this class and as such is strongly encouraged.

Students are responsible for catching up with all missed course materials.

Grading Scale (percent scores and grade break points for letter grades):
A: "excellent", comprehensive knowledge and understanding of subject matter;
B: "good", moderately broad knowledge and understanding of subject matter;
C: “satisfactory”, reasonable knowledge and understanding of subject matter;
D: “inferior”, minimum knowledge and understanding of subject matter
A 94 - 100 B+ 87 - 89 C+ 77 – 79 D+ 67 - 69
A- 90 - 93 B 83 - 86 C 73 – 76 D 63 - 66
B- 80 - 82 C- 70 – 72 D- 60 - 62

Incompletes: Departmental and university policies dictate that incompletes can be given only for verified medical reasons (through the Office of the Dean of Student Life).

Statement on Academic Honesty
Plagiarism of any form will not be tolerated in this class and will result in failing grades for the assignment and course participation, and a referral to the Office of the Dean of Student Life. For more information, please see the Portland State University's Bulletin and how to avoid plagiarism < http://stage.library.pdx.edu/diy/avoiding-plagiarism>.

Student Resources
PSU Library, http://library.pdx.edu/
PSU Writing Center, http://www.writingcenter.pdx.edu/
Disability Resource Center, http://www.pdx.edu/drc/
Food assistance and other resources, http://www.pdx.edu/studentaffairs/CISFS

Tentative Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course introduction; US EPA Ecological Risk Assessment Framework; Aquatic ecotoxicology testing I: study design and endpoint (NOEC, LOEC) Aquatic ecotoxicology testing II: endpoint (LC50, EC50)</td>
</tr>
<tr>
<td>2</td>
<td>More on US EPA Ecological Risk Assessment Framework (ERA); Case Study: Ecological Risk Assessment of Atrazine</td>
</tr>
<tr>
<td>3</td>
<td>Problem Formulation; Assessment Endpoints; Conceptual Models; Causal analysis; Mode/mechanism of action of chemicals; Analysis of exposure; Analysis of Effects; Risk characterization</td>
</tr>
</tbody>
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Exam I (Tuesday, April 25, 10:00-11:50 AM)

Module Two. Risk Assessment at Ecosystem Level: Lotic Ecosystems

Introduction of lotic ecosystems (streams and rivers)

Field study design (BACI, gradient, spatially-balanced probability design); Watershed & Physical Habitat Characterization;

Water Quality Assessment; Biological Assessment I: Periphyton, Macroinvertebrates, and Fish

Biological Assessment II: Multimetric Biotic Indices; Multivariate Models; ERA at watershed level

Exam II (Thursday, May 18, 10:00-11:50 AM)

Module Three. Risk Assessment at Ecosystem Level: Lentic Ecosystems

Introduction of lentic ecosystems (lakes and wetlands)

Eutrophication; Nutrient cycles; Phytoplankton and food-web; Occurrence and ecology of harmful algal blooms;

Management of environmental risk

Final Exam (Tuesday, June 13, 10:15-12:05)

Other information on the University Policy, Resources and Services:

- General PSU Policies (e.g., Student Conduct and Responsibility Policy) <https://www.pdx.edu/ogc/adopted-policies>
- PSU Student Resources and Centers (e.g., campus public safety, veterans resource center, etc.) <https://www.pdx.edu/dos/student-resources>
- Title IX reporting <http://www.pdx.edu/sexual-assault/sites/www.pdx.edu.sexual-assault/files/Syllabus%20Statement%20for%20Title%20IX%20Reporting%20Obligations-1_0.docx>