ENVS 469/PLAN 669

Landscape Ecology, Restoration, and Rehabilitation

Winter 2021

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COURSE OUTLINE

Territorial Acknowledgement
The University of Waterloo (including the Waterloo, Kitchener, and Cambridge campuses) is situated on the Haldimand Tract, land that was promised to the Haudenosaunee of the Six Nations of the Grand River, and is within the traditional territory of the Neutral, Anishinaabeg, and Haudenosaunee peoples.

Calendar Description
Survey of the major ideas and techniques of landscape ecology. Application of these concepts to a case study in restoration and/or rehabilitation. Interaction with professionals from government, NGOs and private industry on ecological issues will also be part of the course. The course includes a practical project on ecological restoration or rehabilitation.

Prerequisite: ERS 211 or ERS/BIOL 381; Level at least 4A

Course Objectives:
1. To enhance knowledge of theory and methods used in landscape ecology
2. To develop skills in applying theory and models to a case study

Learning Modes:
The course has been designed to strike a balance between understanding theory and demonstrating applications of relevant methods or tools. The theory-based portion of lectures will provide an in-depth overview of relevant concepts and ideas and how they apply to planning and sustainability. The demonstration-based portion of lectures will introduce a method or tool and then guide students through an applied exercise associated with the method or tool. All classes will be interactive, and students are expected to come prepared to discuss, interpret and critique the
assigned readings as well as undertake critical applied work. The course will draw from a wide range of interdisciplinary literature.

SCHEDULES

Class Meetings
This course will be held asynchronously.

Student Hours
The instructor will be available for online meetings every Friday between 1 pm and 3 pm. To schedule a time to chat, please use the following website:
https://outlook.office365.com/owa/calendar/OfficeHours5@uofwaterloo.onmicrosoft.com/bookings/.

You must book an appointment with 72 hours notice.

Required textbook
The textbooks are available in electronic format at the library.


Optional textbook
The textbooks are available in electronic format at the library.

## Sequence of Course Topics

LLE refers to Gergel and Turner (2017)

LETP refers to Turner and Gardner (2015)

<table>
<thead>
<tr>
<th>Week</th>
<th>Theme</th>
<th>Mandatory Readings</th>
<th>Optional Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 – Jan 11</td>
<td>Overview of syllabus and introduction to group project</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Week 2 – Jan 18</td>
<td>Historical Aerial Photography for Landscape Analysis</td>
<td>LLE Chapter 2</td>
<td>LETP Chapters 1, 2, 4, 6</td>
</tr>
<tr>
<td>Week 3 – Jan 25</td>
<td>Citizen Science for Assessing Landscape Change</td>
<td>LLE Chapter 3</td>
<td>None</td>
</tr>
<tr>
<td>Week 4 – Feb 1</td>
<td>Group project time – connect with Waterloo Ecology Lab</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Week 5 – Feb 8</td>
<td>Understanding Landscape Metrics</td>
<td>LLE Chapter 4</td>
<td>LETP Chapter 4</td>
</tr>
<tr>
<td>Week 6 – Feb 15</td>
<td><strong>No class – Reading week</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7 – Feb 22</td>
<td>Introduction to Markov Models</td>
<td>LLE Chapter 8</td>
<td>LETP Chapters 2, 3</td>
</tr>
<tr>
<td>Week 8 – Mar 1</td>
<td>Group project time – connect with Instructor</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Week 9 – Mar 8</td>
<td>Group project time – connect with Instructor</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Week 10 – Mar 15</td>
<td><strong>No class – Scheduled pause</strong></td>
<td></td>
<td></td>
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<tr>
<td>Week 11 – Mar 22</td>
<td>Simulating Management Actions and Their Effects on Forest Landscape Pattern</td>
<td>LLE Chapter 9</td>
<td>LETP Chapter 3</td>
</tr>
<tr>
<td>Week 12 – Mar 29</td>
<td>Modeling Spatial Dynamics of Ecosystem Processes and Services</td>
<td>LLE Chapter 16</td>
<td>LETP Chapters 3, 8, 9</td>
</tr>
<tr>
<td>Week 13 – Apr 5</td>
<td>Heterogeneity in Ecosystem Services: Multi-Scale Carbon Management in Tropical Forest Landscapes</td>
<td>LLE Chapter 17</td>
<td>LETP Chapters 8, 9</td>
</tr>
<tr>
<td>Week 14 – Apr 12</td>
<td>Group project time – connect with Instructor and/or Waterloo Ecology Lab, as needed</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
Student Evaluation

Students will be evaluated based on the assignments and activities outlined below. To obtain a passing grade in the course, students are expected to achieve a pass in each graded course component. When determining a student's final grade in the course, the professor will examine the record of each individual student's achievement; the final grade may be adjusted to take into account the component passing requirement, extenuating and compassionate circumstances and the student's general pattern of achievement in the course.

<table>
<thead>
<tr>
<th>Assignment/Activity</th>
<th>Weight</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly quizzes (7 x 5% each)</td>
<td>35%</td>
<td>See below</td>
</tr>
<tr>
<td>Case study (group project) – proposal</td>
<td>5%</td>
<td>Feb 12</td>
</tr>
<tr>
<td>Case study (group project) – report</td>
<td>20%</td>
<td>Apr 23</td>
</tr>
<tr>
<td>Exercises (5 x 8% each)</td>
<td>40%</td>
<td>See below</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100 %</strong></td>
<td></td>
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</tbody>
</table>

Weekly quizzes

There will be 7 weekly quizzes throughout the semester. Quizzes will be based on weekly course content and they will be due on the Friday of the corresponding week (i.e., Jan 22, Jan 29, Feb 12, Feb 26, Mar 26, Apr 2, and Apr 9). Each quiz will be worth 5% of the final grade.

Exercises

Students will have to complete 5 exercises, which correspond to the weekly lecture themes and textbook chapters. The 5 exercises, their due dates and software requirements are listed in the table below. The Teaching Assistant and Lab Instructor will ensure all students have access to the software either by helping install it on the students’ computers or by obtaining virtual access to a computer lab.

The Instructor will demonstrate the methods used for the exercises during the online lectures. Subsequently, students will be required to conduct the exercises as outlined in the corresponding textbook chapter and hand in their results. The results should be accompanied by a write up of approximately **500 to 1,000 words**, which should answer the following questions:

1. What are the main results of your exercise?
2. Were the results surprising? If so, how?
3. How could you apply similar methods in the real world?

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Software requirements</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding Landscape Metrics</td>
<td>Fragstats</td>
<td>Feb 12</td>
</tr>
<tr>
<td>Introduction to Markov Models</td>
<td>Markov.exe</td>
<td>Feb 26</td>
</tr>
<tr>
<td>Simulating Management Actions and Their Effects on Forest Landscape Pattern</td>
<td>Harvest Lite</td>
<td>Mar 26</td>
</tr>
<tr>
<td>Modeling Spatial Dynamics of Ecosystem Processes and Services</td>
<td>Excel</td>
<td>Apr 2</td>
</tr>
<tr>
<td>Heterogeneity in Ecosystem Services: Multi-Scale Carbon Management in Tropical Forest Landscapes</td>
<td>Excel</td>
<td>Apr 9</td>
</tr>
</tbody>
</table>
Case study (group project)

The case study assignment involves working in small groups to analyze data relevant to a restoration project. The students will have the option to use existing datasets or collect their own with the assistance of the Waterloo Ecology Lab. The assignment has two parts.

The first part involves preparing a short plan or proposal for the project. The plans or proposal should be approximately 500 to 1,000 words and should detail the planned data set, how it will be analyzed, and why the data and analysis are relevant to landscape restoration. The proposal is due by Feb 12.

The second part involves preparing a report. The report should be approximately 3,000 to 3,500 words and is due on April 23. The report should expand on the information in the proposal in terms of the data set used and the analysis applied. Additionally, the report should included a detailed section on the results of the analysis and a discussion section, which details how the results could be applied to inform landscape restoration.

Requirements, Grade Penalties and Special Considerations:

Readability and Clarity: Students are expected to present well organized, and properly written work. Penalties of up to 25% may be applied in cases where readability and/or clarity are inadequate.

Computer Use: Assignments must be completed by using a computer. Assignments may not be accepted or penalties assessed if a computer is not used.

Lateness penalty: all assignments are due on the date set by the professor. The first day an assignment is late brings a 5% penalty. An additional 5% penalty is assessed for each additional late day. A student's assignment more than 4 days business days late will not be accepted and a grade of zero will be recorded for that assignment.

Requests for exemptions or compassionate considerations: are to be discussed with the professor in advance or as soon as possible.

Faculty of Environment Course Statements

♦ Intellectual Property:
Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student’s educational experience. However, sharing this intellectual property without the intellectual property owner’s permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).
Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

♦ **Unclaimed assignments:**
Assignments which are not picked up by students must be retained for one year after last use (i.e., after the end of the term in which the work was submitted or after the resolution of any grade revision request or appeal), unless students are notified that they will be retained for a shorter period of time. Instructors who do not wish to retain unclaimed assignments for one year may dispose of them sooner provided they include notification of this practice on the course outline.

♦ **Research Ethics:** Please also note that the ‘University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office’s Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.). If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see [https://uwaterloo.ca/research/office-research-ethics](https://uwaterloo.ca/research/office-research-ethics)

♦ **Academic Integrity:**
To provide appropriate guidance to students, all course outlines in the Faculty of Environment must address academic integrity and reference the web documents for Policy #71. The statement below is recommended for inclusion in the Course Outline. In addition, instructors are encouraged to discuss academic integrity during course meetings.

**Consequences of Academic Offences:**
*In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. The University’s guiding principles on academic integrity can be found here:*
[http://uwaterloo.ca/academicintegrity/](http://uwaterloo.ca/academicintegrity/)

*ENV students are strongly encouraged to review the material provided by the university’s Academic Integrity office specifically for students: [http://uwaterloo.ca/academicintegrity/Students/index.html](http://uwaterloo.ca/academicintegrity/Students/index.html)*

*Students are also expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions. Student who are unsure whether an action constitutes an offense, or who need help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. Students may also visit this webpage:*
[https://uwaterloo.ca/library/get-assignment-and-research-help/academic-integrity/academic-integrity-tutorial](https://uwaterloo.ca/library/get-assignment-and-research-help/academic-integrity/academic-integrity-tutorial)
When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline, https://uwaterloo.ca/secretariat-general-counsel/policies-procedures-guidelines/policy-71

Students who believe that they have been wrongfully or unjustly penalized have the right to grieve; refer to Policy #70, Student Grievance:
https://uwaterloo.ca/secretariat-general-counsel/policies-procedures-guidelines/policy-70

♦ Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

♦ Mental Health: The University of Waterloo, the Faculty of Environment and our Departments consider students’ well-being to be extremely important. We recognize that throughout the term students may face health challenges - physical and/or emotional. Please note that help is available. Mental health is a serious issue for everyone and can affect your ability to do your best work. Counselling Services http://www.uwaterloo.ca/counselling-services is an inclusive, non-judgmental, and confidential space for anyone to seek support. They offer confidential counselling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.
♦ **Religious Observances:** Student needs to inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

♦ **Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, [www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm). When in doubt please contact your Undergraduate Advisor for details.

♦ **Appeals:** A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 – (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) [www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm)

♦ **Turnitin:** Text matching software (Turnitin®) will be used to screen assignments in this course. This is being done to verify that use of all materials and sources in assignments is documented. Students will be given an option if they do not want to have their assignment screened by Turnitin®. In the first week of the term, details will be provided about arrangements and alternatives for the use of Turnitin® in this course. Note: students must be given a reasonable option if they do not want to have their assignment screened by Turnitin®. See: [https://uwaterloo.ca/academic-integrity/guidelines-instructors](https://uwaterloo.ca/academic-integrity/guidelines-instructors) for more information.

♦ **Communications** with Instructor and Teaching Assistants: All communication with students must be through either the student’s University of Waterloo email account or via Learn. If a student emails the instructor or TA from a personal account they will be requested to resend the email using their personal University of Waterloo email account. ([https://uwaterloo.ca/environment/undergraduate-teaching-resources](https://uwaterloo.ca/environment/undergraduate-teaching-resources))

♦ **LEARN:** Users can login to LEARN via: [http://learn.uwaterloo.ca/](http://learn.uwaterloo.ca/) use your WatIAM/Quest username and password

Relevant University Policies:
Policy 71 – Student Discipline
Policy 73 – Intellectual Property Rights