ENVS 469
Landscape Ecology, Restoration, and Rehabilitation

YOU ARE EXPECTED TO READ THIS DOCUMENT IN ITS ENTIRETY DURING THE FIRST WEEK OF CLASS AS A NON-GRADED COURSE REQUIREMENT

Part 1. Reference Information

Term & year of offering: Winter 2019
Instructor: Michael Drescher
Email address: LEARN preferred for all electronic communication
Phone: 519-888-4567 x38795
Office: EV3-3213
Office hours: Thursdays by drop-in 3.30pm-4.30pm or by appointment
Class time & location: Lectures: Tuesdays, 1:30pm-4:20pm, OPT-309 (some meetings will be in EV1-240, please see Schedule of course topics and activities)
Computer labs: Tuesdays, 1:30pm-4:20pm, EV1-240 (Galileo)

LEARN will be the main communication system for this course. Emails from non-university email accounts will not be answered. Questions regarding the course and material can best be asked during class or during office hours.

Part 2. Course Content, Learning Process & Outcomes

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. [Note: Field trip fee up to $100 depending on destination]

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

Introduction
Practitioners and researchers in landscape and restoration ecology are led in their work by their knowledge of ecological concepts and models, their experience in the field, and their experience and skills with restoration projects. This course is intended for upper year students with a background in ecology. It builds and expands on previously learned theory and models of ecological states and dynamics used in landscape ecology and restoration ecology and it develops your knowledge and skills in restoration project design, planning, modeling, evaluation, and presentation.

This course is NOT primarily meant to teach you how to do the practical fieldwork of ecosystem restoration (e.g., how to put a shovel in the ground), but with all other issues around it (e.g., why we want to restore anything, what the endpoint of restoration might be, and how a restoration project is planned). This is the final course leading to the Diploma in Ecological Restoration and Rehabilitation, but should also be of interest to other students with general concern for landscape ecology and restoration ecology.

The broad goal of this course is to further your skills and knowledge of states and dynamics of landscapes in relation to ecological restoration across scales. I hope to demonstrate a wide range of topics and issues in landscape ecology and restoration ecology, of which some also will contain elements from other fields such as computer sciences, social sciences and political sciences. This course has a credit weight of 0.5.
Course Objectives
- Improve your basic and advanced knowledge of ecological theory and models used in landscape ecology and restoration ecology.
- Acquire basic knowledge and skills necessary in using ecological models for developing landscape-level ecological restoration strategies.
- Acquire basic and advanced knowledge and skills necessary for designing a restoration project.
- Improve your basic and advanced knowledge of restoration ecological issues as they pertain to a variety of landscape types.
- Improve your research and proposal writing skills.
- Acquire basic knowledge of invasive species management.
- Improve your teamwork and communication skills.

Learning Modes
You are expected to mainly work in groups but also independently to generate, synthesize, analyze and report on your intellectual products.
- Traditional lecture style: To convey information about ecological theory and models and general issues in landscape ecology and restoration ecology.
- Lab style: To gain experience and practice your skills in the use of ecological models for developing landscape-level ecological restoration strategies.
- Restoration plan, lab report & essay writing: To practice and improve your presentation skills.
- Field trips & fieldwork: To gain skills and knowledge necessary in the planning and execution of ecological research and ecological restoration projects.
- Teamwork: To improve your skills in working with others (you will have to do this A LOT, when you get a job).
- Independent work: To give you the opportunity to excel by yourself.
- Readings & videos: To give you the opportunity to deepen your knowledge of topics dealt with in class; important for practicing extraction and critical evaluation of scientific & technical information.
- In-class discussions: To improve your skills and level of comfort with speaking in front of groups (if you want to have a career, sooner or later you will have to do this).

Required readings: textbook, journal articles and other sources
The backbone of the course is the following textbook: “Ecological Restoration – Principles, Values, and Structure of an Emerging Profession” by Clewell and Aronson (2008). It covers a broad range of topics relevant to restoration including social questions and project design. I advise everyone to buy the kindle edition of the book, which is the cheapest you can go for under $32.-. Note: I am using the first edition of the Clewell and Aronson book published in 2008. A second edition of this book came out in 2013, but it is missing a few of the sections that I find important. If you want to consult the 2013 edition, you are welcome to, it does contain some interesting new material, but in the course we will focus on the 2008 edition.

A variety of journal articles and reports are required reading. They can be accessed through the University of Waterloo library portal or accessed directly on the Internet.

In preparation for the modeling of invasive species spread and the subsequent test, you are required to watch two introductory videos to the statistical modeling language R and perform a number of practice exercises. We will conduct the modeling exercise together in-class, but it is recommended that you install R on your computer, which is freely available for download from the Internet, and practice at home.

Interesting textbooks
Other interesting, though not required, textbooks are: (1) “New Models for Ecosystem Dynamics and Restoration” by Hobbs and Suding (2009). It explains many of the theoretical underpinnings and models that should guide practical restoration efforts. (2) “Ecological Restoration” by Galatowitsch (2012). This book covers restoration in various ecosystems as informed by research.

Recommended readings
Next to the required readings, recommended readings and videos are suggested. As I say, they are not required, but reading them will benefit you for the quality of your course work and test.
Evaluation and Assessment
The instructor determines the content and establishes the grading rules for all graded components. When determining a student's final grade in the course, the instructor 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>Graded components</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>Restoration Project Plan (3 steps: 3p, 20p, 30p) (group)</td>
<td>53</td>
</tr>
<tr>
<td>Modeling lab test (individual)</td>
<td>25</td>
</tr>
<tr>
<td>Essay (individual)</td>
<td>15</td>
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<tr>
<td>Participation (individual)</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
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Writing the restoration project plan is group work. While group work usually involves allocation of specific tasks to individual group members, all students in a group are expected to show initiative and produce quality work in a timely fashion. If there are issues arising during group work, do not wait to resolve them until the end. Try to resolve them right from the start or talk to the instructor about it.

It is mandatory that all students in a group read the entire restoration project plan. If somebody does not agree with a part of the document, it needs to be changed before submission. Also, all students should indicate which part of the document is their main contribution; no part of the document can be without at least one person being responsible. If all students contribute to all parts of the document, everybody will be responsible for the whole document. This is of particular importance, should a case of plagiarism be detected. Please note that in the case of plagiarism the whole group will be penalized, but the person most responsible may be penalized most severely.

Peer evaluation will be part of this project. To assess individual students’ contributions to the essay, peer evaluation forms will be made available at the end of the course. Filling the peer evaluation form is mandatory and contributes to your participation mark. This information will be used to raise or lower individual marks from the overall average group mark.

The restoration project plan is the centerpiece of the course. To obtain a passing grade in the course, students are expected to achieve a pass for the final restoration project plan, i.e., if you receive less than 50% for this product, you do not pass the course. When determining a student's final grade in the course, the instructor 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.

Graded components
Restoration project plan (group work): In the first class, groups of about 5 students will be formed. Each group will work on developing a restoration project plan that will deal with a restoration problem on campus. Though this project may not be dealing with landscape scale issues, working on a campus restoration problem provides several advantages: working on campus is logistically more feasible, especially when collecting baseline data; there are less concerns about required permits; and the final restoration project plan may in fact be implemented. The instructor may make suggestions for feasible restoration problems. The chosen restoration problem must be discussed with the instructor and approved by him.

The preparation of your restoration project plan will occur in 3 steps. The intent of this 3-step process is to give you guidance regarding the direction and quality of your writing and to help you with your time management. We will discuss the general components of a restoration project during class and examine a number of example restoration reports. During this class we will also discuss the components that should be included in your final restoration project plan; you must follow the guidelines set out by the instructor. A sheet with marking rubrics will be made available for your information. The draft restoration proposal should be 20 pages, and the final restoration proposals should be 25-30 pages. All paper lengths are excluding abstract/summary, table of contents, references and appendices (if applicable). More direction regarding the restoration project plan will be provided in class.
The overall restoration project plan is worth 53 points, divided into 3 steps: (1) outline & refs: 3 points; (2) draft: 20 points; (3) final: 30 points.

Modeling Lab Test (individual): The modeling lab is focused on a real restoration problem on campus: The invasion of the UW Urban Forest by European buckthorn (*Rhamnus cathartica* L., subsequently called: buckthorn). Using a spatial model of the spread of buckthorn, students will develop a strategy for eradication of this species from the UW Urban Forest and ongoing landscape-level management. Both of these activities (i.e., site-level eradication and landscape-level management) are in fact required for the restoration of the UW Urban Forest that has started in the summer of 2013 and will ultimately lead to an (more or less) invasive-free and native-enriched woodlot.

For the purposes of this project, we make use of a computer lab (EV1-240: Galileo). Using empirical data about buckthorn presence in the UW Urban Forest as input to the spatial model of buckthorn spread, scenarios of invasive species management will be explored and strategies for control of this species proposed. You are welcome to work on the modeling lab in groups, but you will be tested alone. I therefore recommend that all students pay close attention to the background materials, model, and exercises. In the modeling lab test, you will be tested on background information (including lectures, readings & videos), methods and materials of data collection and the model itself, analyses and results, as well as recommendations for buckthorn management in the UW Urban Forest. Questions will be of types short answer and/or multiple choice and/or graphs. Worth 25 points.

Essay (individual): You will be asked to write an essay about one of two topics (essay A or essay B) in the fields of landscape / conservation / restoration ecology. The general topics will be announced at the beginning of the course at which time you will have to decide whether you want to write essay A or essay B, which are due on different dates. Once you have decided which essay you want to write you cannot switch anymore. Two weeks before the due dates for each essay, the exact essay question will be released. More information about the essay will be provided in class. Worth 15 points.

Participation (individual): The lectures will be interactive and will include active learning experiences that may, at times, involve group work. I expect you to make regular, meaningful contributions to in-class discussions (group and whole class), which count towards your participation mark. In-class presence without talking does not count as participation. Attendance will be recorded and absence from class activities will result in point reductions. Worth 7 points.

Required writing style
Your essay is required to follow the APA (American Psychological Association) formatting rules. For all other submitted works, you are required to use APA style for referencing and citing (not for other formatting elements). Please ensure that you are adhering to APA style in its latest version. The complete style outline can be found in the *Publication Manual of the American Psychological Association*, located in the Dana Porter Library or on sale in the Book Store. On the web, you can find quick references at URLs such as:

Purdue Online Writing Lab: [http://owl.english.purdue.edu/owl/resource/560/01/](http://owl.english.purdue.edu/owl/resource/560/01/)

Unless instructed otherwise, write your works in 12 point font size, single-spaced and in Arial. Not adhering to the style requirements will result in a grade reduction. Logical inconsistencies, insufficient grasp of content, overall poor style, frequent spelling and grammar mistakes, poor quality tables and figures and other problems can all negatively affect a paper’s grade. Also please note that at least half of all references have to consist of sources from the primary literature (here meaning: journal articles, text books & technical reports); using less primary sources will result in a grade reduction. More detailed instructions will be provided in class.

Submission of works
All assignments have to be submitted through LEARN by 1.30pm on the due date. Late assignments are penalized 1 point per started 24-hour period. An assignment more than five 24-hour periods late will receive a grade of zero. You can be exempted from these penalties if you have a medical certificate or other documentation validated by your undergraduate advisor or by counseling services.

Midterm and final exam
There is no midterm or final exam.
## Schedule of course topics and activities

There may be adjustments, e.g. in sequence and date. Some adjustments to the required readings may occur but will be announced. Guest lectures may be planned during the course and will be announced.

<table>
<thead>
<tr>
<th>Date</th>
<th>Theme</th>
<th>Readings</th>
<th>Activities &amp; Assignments, Deadlines</th>
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| Jan. 8        | **Class 1**                                                | **Foundations of restoration ecology** (drivers & concepts of ecosystems & restoration) | - Forming workgroups  
- Course Administration  
- Lecture  
- Introduction to restoration projects |
| Jan. 15       | **Class 2**                                                | **Restoration project plans** (ecological models & components of restoration plans) | - Essay topic choice due  
- Lecture  
- Conceptual restoration project model |
| Jan. 22 (EV1-240) | **Class 3**                                                | **Urban forest restoration** (UW Urban Forest, invasive & native species) | - Restoration project plan outline due  
- Release essay A question  
- Lecture  
- Fieldtrip: introduction to UW Urban Forest & field methods |
| Jan. 29       | **Class 4**                                                | **Landscape ecology & restoration** (urban & natural environments)        | - Lecture |
| Feb. 5        | **Class 5**                                                | **Grassland ecology & restoration** (herbivores & fire → heterogeneity) | - Essay A due  
- Release essay B question  
- Lecture |
| Feb. 12       | **Class 6**                                                | **River & marine ecology & restoration** (dynamic environments)          | - Lecture |
| Feb. 19       | **Reading week: no class; no assigned readings**           |                                                                           | - Essay B due  
- Fieldwork: data collection invasive species UW Urban Forest |
| Feb. 26 (EV1-240) | **Class 7**                                                | **UW Urban Forest & invasive species**                                   | - Restoration project plan draft due  
- Lab: Introduction to R & introduction to invasive species spread model |
| Mar. 5        | **Class 8**                                                | **UW Urban Forest & invasive species**                                   | - Lab: Modeling invasive species spread |
| Mar. 12 (EV1-240) | **Class 9**                                                | **UW Urban Forest & invasive species**                                   | - Self-study |
| Mar. 19 (EV1-240) | **Class 10**                                               | **UW Urban Forest & invasive species**                                   | - Fieldtrip: visiting rare Charitable Research Reserve |
| Mar. 26 (Ring Rd) | **Class 11**                                               | **Multi-use management of peri-urban working landscape**                 | |
| Apr. 2        | **Class 12**                                               | **Coupled human and natural systems**                                    | - Invasive species modeling lab test  
- Restoration plan presentations (grads)  
- Lecture |
| Apr. 10 (Wednesday) | No class                                                 |                                                                           | - Final restoration project plan due |

*Required: Clewell & Aronson 2007 (Ch 3); Suding et al 2004  
Recommended: Clewell & Aronson 2007 (Ch 1-2, 4)  
Required: Vidra et al 2007; Vidra & Shear 2008  
Recommended: Labatore et al. 2017  
Required: Huxel & Hastings 1999; Goddard et al 2010; With 2002; Rudd et al. 2002; Krasny & Tidball 2012  
Required: Barbaro et al. 2001; Fuhlendorf & Engle 2001  
Recommended: Fuhlendorf & Engle 2004  
Required: Ward 1998; Elliott et al. 2007; Carey 2013  
Recommended: Boesch et al. 2001; De Jonge & De Jong 2002; Pedroll et al. 2002  
Required: Condit 1998 (Ch 2.2); Hayley 2012  
Required: An Introduction to R - A Brief Tutorial for R 2012; How to R 2013a & 2013b; Rodriguez 2014  
Required: Endicott et al 2017; Delanoy & Archibold 2007; NRCS NoDate  
NA  
NA  
NA*
Reading List of Journal Articles and Other Sources


Condit, R. 1998. Tropical Forest Census Plots. Springer Berlin. (pls contact me for a copy)


How to R. 2013b. Basic functionality in R. Retrieved from https://www.youtube.com/watch?v=h_Nruq9-NQw


Part 3. Academic Integrity, Requirements, and Considerations

Avoidance of academic offences

Students are expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions. Students 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, TA, academic advisor, or the Undergraduate Associate Dean. For information on categories of offenses and types of penalties, students should refer to Policy #71, Student Academic Discipline, http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. Students who believe that they have been wrongfully or unjustly penalized have the right to grieve; refer to Policy #70, Student Grievance, http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm.

Plagiarism: The work of others must not be plagiarized. According to Policy 71 plagiarism is: “The act of presenting ideas, words or other intellectual property of another as one’s own. The use of other people’s work must be properly acknowledged in all written material such as...essays, laboratory reports, design projects, statistical data, computer programs and research results. The properly acknowledged use of sources is an accepted and important part of scholarship. Use of such material without complete and unambiguous acknowledgement, however, is an offence under this policy.” Students are expected to keep a copy of all materials used to prepare assignments in case of disputed work and should be able to provide working notes and original data for any assignment within 4 hours of this being requested.

For this course, plagiarism includes (among other activities) submitting without appropriate acknowledgement any report (or part thereof, including software, designs, photos, computer images, models, drawings, maps, statistics, samples, results of lab or field work etc.) which has been submitted previously to any course anywhere by any person, submitting a report in which the production has been shared by more than one student and each has submitted it as their own without acknowledgement of the other’s contributions, submitting any work created in whole or in part by another without the usual acknowledgement. Policy 71 states that one should not submit “an essay, report or assignment when a major portion has been previously submitted or is being submitted for another course with the express permission of all the instructors involved”. If in doubt, ask the course instructor if your intended assignment submission is acceptable.

Within ENV, those committing academic offences (e.g. cheating, plagiarism) will be placed on disciplinary probation and will be subject to penalties, which may include a grade of 0 on affected course elements, 0 on the course, suspension, and expulsion.

All suspected academic infractions are investigated and formally reported to the Associate Dean, Undergraduate of Faculty of Environment.

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).
Academic Integrity: 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/ 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

Students are also expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions. Students 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 complete the following 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. See Policy 70 - Student Petitions and Grievances, Section 4, 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

Unclaimed assignments:
Unclaimed assignments will be retained until one month after term grades become official in quest. After that time, they will be destroyed in compliance with UW’s confidential shredding procedures

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.
Recording lectures:
Use of recording devices during lectures is only allowed with explicit permission of the instructor of the course. If allowed, video recordings may only include images of the instructor and not fellow classmates. Posting of videos or links to the video to any website, including but not limited to social media sites such as: facebook, twitter, etc., is strictly prohibited.

Caution
This course includes field trips and fieldwork in cold weather. Students are expected to take care that they are appropriately dressed. They are also expected to have knowledge of and follow the necessary safety guidelines in using any equipment and performing any outdoor activities including course-related fieldwork.

Turnitin:
Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students’ submissions are stored on a U.S. server, and are subject to the USA PATRIOT ACT, 2001; therefore, students must be given an alternative (e.g., scaffolded assignment or annotated bibliography) if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin® in this course.

Grade Penalties and Special Considerations:
- **Readability and Clarity:** Students are expected to present well organized, and properly written work. Penalties may be applied in cases where readability and/or clarity are inadequate.
- **Lateness penalty:** All assignments are due on the date set by the professor. The first 24 hour period an assignment is late (i.e., delivered later than 11.30am) brings about a penalty of 1 point. An additional 1 point is assessed for each additional started 24 hours period. A student's assignment more than five 24 hours periods late will not be accepted and a grade of zero will be recorded for that assignment.
- **Requests for exemptions or compassionate considerations:** Exemptions or compassionate considerations are to be discussed with the professor in advance or as soon as possible.

Special Requirements in this Course

**Field trips and fieldwork**
This course includes field trips and fieldwork in cold weather. Students are expected to take care that they are appropriately dressed. Field gear will not be provided in-class but the equipment and materials necessary to perform required measurements will be provided by the Ecology Lab. Students will be introduced by the Ecology Lab to the techniques and proper use of the equipment. Students are expected to have knowledge of and follow the necessary safety guidelines in using any equipment and performing any outdoor activities including course-related fieldwork.

**Computer work**
This course requires the use of computers and specialized software to explore scenarios of invasive species eradication and management. While no advanced computing skills are required, it will be hugely beneficial for you to watch the required R tutorial videos, do the R exercises and be actively involved with the running of the spatial invasive species spread model. Unless you have previous experience with these topics, not following these recommendations will limit your learning outcomes and result in a low test mark.