ERS 211
Environmental Analysis & Solutions IV:
Restoration Ecology
Syllabus for Fall Term 2014

Required Field Guides (@ UW Bookstore or Other Sellers); all other readings will use sources available on-line at LEARN:

- Newcomb L; Morrison. G. 1977/1989. Newcomb's wildflower guide. Little Brown and Company.

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Twitter: @prof_smurph & @restored_smurph. I will be at a restoration/resilience conference in Sydney AUS Nov 14-23 so I have guests during the two classes I miss.

Classes & Themes (M & Th 1430-1550 h; DWE 1501)	**Student Activities**		**Learning Outcomes**
	ASSIGNED CLASS READINGS	FIELD OR IN-SERVICE ACTIVITY	
Se 8: Foundations of Restoration Ecology	Society for Ecological Restoration (SER) Primer	Find the classroom. Find a seat. Stop picking your nose. Yes, you.	Foundations for complex problem solving in applied ecology fields
Se 11: Biodiversity Monitoring	Booth et al 2010; Heip & Engles 1974	Read. Prepare for field work.	Field skills for diversity assessment
Se 15/18: Environmental informatics in restoration I	Booth et al 2010	Field Work + Analysis I (Alternating Field/Lecture Series)	Use proper field methods & analyses to interpret field data
Se 22/25: Environmental informatics in restoration II	Booth et al 2010	Field Work + Analysis II (Alternating Field/Lecture Series)	Use proper field methods & analyses to interpret field data
Se 29/Oc 2: How to Do Statistical Analyses in Restoration	Materials for Assignments on the ERS 211 LEARN site	We'll Learn How to Not Be Afraid of Stats	I show you how to do analyses; very important for your Assignments
Oc 6: Restoration ecology as a business and a job	*Smurph's experience (uh-oh)*	We'll discuss how to actually get employed	Get a job, sha na na, na, na, na, na; dip dip dip dip boom boom....

Oc 9: Ecological indicators in restoration	D'Amico et al 2004	Explores the use and misuse of ecological indicators in restoration	Understand how indicators are chosen & how to use them
Oc 13 (holiday - no class Monday)	*Look to your right →*	**Assignment 1 Due 2359 Wed Oc 15 - *before* our next class**	*← Look to your left*
Oc 16: Restoration at population scales	Larkin et al 2004	Provides examples of how community scale restoration works	Use population theories in problem solving for restoration ecology
Oc 20: Restoration at community scales	*Smurph's experience (double uh-oh)*	Provides examples of how community scale restoration works	Use community theories in problem solving for restoration ecology
Oc 23: Landscape scale restoration	Jacquemyn et al. 2003	Explores spatial processes in restoration	Use landscape ecology theories & apply to restoration ecology
Oc 27: Review for assignment 2	Materials for Assignments on the ERS 211 LEARN site + Murphy 2013	Analysis can be tricky; learn how to not drive yourself batty	Learn to write properly and do proper analysis
Oc 30: Cross-scalar restoration	*Smurph's experience (triple uh-oh)*	Scale is not meant to be a constraint	Examines complexities of restoration ecology in real time
No 3: Trajectories, alternative states and feedbacks in restoration	Holmgren and Scheffer 2001 Suding et al 2004	Explores complex and advanced concepts in restoration	Use advanced approaches in restoration ecology
No 6: Measuring outcomes of restoration I	Allison 2002 Anand & Desrochers 2004	**Assignment 2 Due 23:59 Fri No 7;** afterwards, get the munchies	Relate all of previous weeks in terms of outcome measures
No 10: Measuring outcomes of restoration II	Cramer et al 2008	Provides advanced examples of how restoration outcomes are measured	Relate all of previous weeks in terms of outcome measures
No 13: Strategic planning in restoration ecology	Quon et al. 2001 Pellant et al 2004 Murphy 2011	This examines social science aspects of restoration ecology	Connect strategic planning and ecological field skills
No 17: New Directions in Restoration Ecology I - Invasives	TBA	Michael McTavish will discuss how to incorporate invasives in restoration	Learn from those who are the next generation of restoration ecologists
No 20: New Directions in Restoration Ecology II - Techniques	TBA	Heather Cray will discuss how prairies should be restored	Learn from those who are the next generation of restoration ecologists

No 24: Review for Assignment 3 by TAs	(none)	Ask your TAs about Assignment III	I figured you needed a breather to either get work done or ask TAs questions during class time
No 27: New Directions in Restoration Ecology III: Socioecological factors in restoration ecology	Murphy 2013	**Assignment 3 Due 23:59 <u>Fri No 28</u>**; afterwards, go nucking futs	We'll chat about how we make sense of all that we learned
De 1: New Directions in Restoration Ecology IV: Novel ecosystems?	Jackson and Hobbs 2009; Hobbs et al 2009; Murphy 2013	Exam review; might be a good idea to come to class, eh?	Pull my finger: How restoration ecology is changing

We Have An Alternating Schedule Se 15/18 - Se 27/Oc 2
(Outdoor Field Study Alternates With In Classroom Class Lesson)

During these 3weeks, we will have ½ the students outside and ½ the students inside on alternating days.

This means ½ of you go outside on the Wednesday and ½ are in class; then you switch places for the Friday class. I give the same class lesson to each group, so you won't miss anything.

This was the best way to ensure everyone got a chance to do some experiential learning during the late summer and early fall.

I will be sectioning people off and sending this information out (and posting it in class) once the final class rosters for ERS 211 stabilize in 1st week.

We will all convene as a single group for all other course days.

Course Philosophy

This is a transdisciplinary course that reflects the essence of ecological integrity and restoration ecology – but there still is a clear emphasis on natural sciences, ecosystem function, and quantitative analysis. The philosophy of restoration ecology is consistent with a version of a quotation attributed to the Taoist philosopher *Zhuangzi*:

> "You have this big tree and you are distressed because it is useless? Why don't you plant it in Not-Even-Anything Village, or in the field of Wide and Boundless, then relax and do nothing by its side, or lie down for a free and easy sleep under it? If there is no use for it, how can it come to grief or pain?"

Before and After Ecological Restoration – Cape Breton NS (15 Years Apart & $275,000 Investment)

Course learning objectives

By the end of this course, you will be able to:

- Acquire and improve field identification skills of organisms for the purposes of ecological monitoring (and assessment)
- Acquire and improve experimental design and advanced data (quantitative statistical) analysis skills related to measuring outcomes of ecological restoration and whether ecological integrity is achieved or achievable
- Perform basic implementation of ecological restoration in a long term project (i.e. an ongoing restoration project implemented and monitored by UW students every year)
- Apply explanatory theories to case studies in a range of examples at various spatial and temporal scales
- Critique & evaluate use of explanatory theories in their application in case studies
- Synthesize lessons from case studies in terms of general practice of restoration ecology and assessment of ecological integrity
- Using the comparative method, apply learning outcomes to your field assignments, the final exam, and beyond
- Use all of the above skills in a consultant style report (professional communication) and in creative design for ecological restoration

How TAs and I Grade You as Part of ERS 211
(See the 211 Assignment Folders in the Course LEARN Site for More Details)

- Assignment 1: Each student will combine their data with a longer-term set of on-campus data and perform basic biodiversity analyses. This will make use of the biodiversity assessment software (an Excel file) available on the course LEARN site. Given this is an early phase of restoration on campus, it is expected that you cannot yet assess any true success or failure of your restoration efforts in 2013 or previous iterations of 211. Each student will do a short 2-page reflection on interpreting their data with the expectation that this will be expanded upon in Assignment 3. 10% of final grade.
- Assignment 2: Each student will use a dataset that I provide to perform advanced parametric and non-parametric statistical analyses. This is to lessen the chances you will self-intimidate and procrastinate for assignment 3. Each student will do a short 2-page reflection on interpreting their data with the expectation that this will be expanded upon in Assignment III. 15% of final grade.
- Assignment 3: Each student will now write a more formal technical report that expands upon interpreting the data and analyses in Assignments I and II. 25% of final grade.
- A final exam is based on our discussions (including all lecture and field days). 50% of final grade. Scheduled in December exam period by Registrar. Do not schedule an early vacation because the Registrar can schedule us for a late exam or there can be a snow day forcing a late reschedule. The exam will focus on point form explanatory style answers to questions largely posed as synthesis or problem solving exercises. Typically, I will have 6-8 questions but there will be some choice in selecting options within the questions given. *Those who like to skip the last week on principle - that approach would be a very bad idea.*

Course Process & Other Key Information

- You are expected to review assigned readings before and after each class. I selected peer-reviewed readings (see LEARN Lessons Folder & Class Schedule) for your use as background on the topics we will discuss in class and as sources for your assignments. You can also use these to help you find other relevant references. I follow the readings in class and base my lessons on them; whatever we emphasize in class will be emphasized on the final exam. I do not play Trivial Pursuit on exams.

- **Your assignments will be submitted on line via LEARN to reduce use of paper**. They are due @ 2359 h on the date indicated in the syllabus. They will be graded and commented on using the track changes feature of MS Word. 10 MB limit on file size.

- **Read, explore databases, & start work on assignments during the first week of classes – you can do a lot of the work on reports early; if you don't, you will be cursed (and will curse).** Late assignment penalties apply to all cases except for those few extensions granted for medical reasons or for professional counseling for serious personal problems – extensions can be granted with proper documentation or discussion well in advance. There is a three-tier system:
  - If the assignment is up to 72 hours late, a flat 10% is deducted. No exceptions barring the reasons above. This is a relatively small penalty and it means that if you are 6 hours late you might as well take another few of days anyway.
  - If the assignment is >72 and < 144 hours late, a flat 20% is deducted.
  - Assignments later than 144 hours past deadline receive a grade of 0.

The University of Waterloo has a series of specific *academic policies, procedures and guidelines* that students must be aware of and follow; all course syllabi in the Faculty of Environment are required to include the following information:

- ***Students with Disabilities***: Help is available via the Office for Persons with Disabilities
- ***Academic Integrity*:** To create and promote a culture of academic integrity, the behaviour of all members of the University of Waterloo is based on honesty, trust, fairness, respect and responsibility.
- ***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.
- ***Discipline*:** A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs 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. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline (this also has information on categories of offenses and types of penalties).
- ***Appeals:*** A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals.

For those who have read this far: Who is this "Stephen David Murphy" anyway?

Diverting from music (I was once in love with my guitar; it didn't last due to religious differences), I earned a B.Sc. (Hons.) and a Ph.D. from Queen's University in Biology, specializing in plant ecology. I completed a post-doctoral fellowship at the University of Guelph in agriculture. I've been at UW in Environment and Resource Studies since 1996, focusing on management, conservation, restoration and mitigation of invasive species in ecosystems. I am helping write 2 textbooks on restoration ecology. One of our best restoration ecologists, Richard Hobbs, has bestowed on me flattery - and I quote – when he said "You are a seriously deranged individual."[1]

In terms of restoration ecology, I have been both practitioner (consulting) and an academic. Since I first volunteered as a teenager with one of the 1st formal landscape-scale ecological restoration projects in 1979 (yes, 1979; *STFU*), I helped or led on over a thousand ecological restoration projects world-wide. This means a lot of field work and a lot of teamwork because I sure as hell didn't do a thousand plus projects all by my little 5'6" self.

I am past-chair of the Board of the Ontario Chapter of the governing academic and practitioner organization, the Society for Ecological Restoration International (if you want opportunities beyond this course, SER Ontario recruits students for networking and educational purposes at a nicely reduced membership fee rate). I am the editor-in-chief of Restoration Ecology, on the Board of the Restoration Institute, and was co-chair the 2013 25th Anniversary Conference of SER International at Madison WI. I am part of the Centre for Ecosystem Resilience and Adaptation (as Director) and the Summit Centre for the Environment @ Huntsville Ontario (a founder) where ecological restoration is be front and centre though by no means the only domain studied. I am also Chair of the Centre for Applied Sciences in Ontario Protected Areas. Don't read this line because it is cursed by a one-eyed wizard named 'Poindexter'. Just checking to see if you were reading this or not. I was part of the advisory council to Parks Canada that revised the strategic planning and standard for ecological restoration. I also am on some teams at "rare" in Cambridge ON, a Reserve that represents one of the largest contiguous ecological restoration and conservation projects in an urban area. I sit on the Boards or advise another two dozen or so organizations that are involved in restoration from municipal to international scales. Essentially, I began to practice "restoration ecology" before it was really codified but I am only part of the 3rd or perhaps 4th "generation" of restoration ecologists who followed people like Aldo Leopold, Theodore (Ted) Sperry, John Curtis, Tony Bradshaw, Bill Jordan III, George Gann, Keith Winterhalder, John Reiger, Jack Ewel, Keith Bowers, Richard Hobbs, Eric Higgs, and Bob Dorney, among many others. I won't burden you with too many details on the history in the syllabus or in lessons; see www.ser.org for more on the history of Restoration Ecology if you want some ideas of where this field originated.

[1] Yes he meant this in jest but you will find out why he said this soon enough – Bwa ha ha ha ha!! He also called me evil when we were in New Orleans at a conference this year…