Course Outlines: Biology 4115 FA

Ecology of Disturbed Habitats

Course Description

Ecology of Disturbed Habitats (Biology 4115)

With the ever increasing human population and recent technological advancement, disturbance in natural ecosystems is a fact of life world wide. Most of the influential ecological theories and concepts such as ecosystem, succession, energy flow, competition, biodiversity, material cycling etc. are developed with an underlying assumption that ecosystems are relatively undisturbed. Our increasing demands for resources, however, have touched every hidden corner of the earth. Under the circumstances, can we explain or predict changes in ecological systems and processes on the basis of the existing ecological theories and concepts? This course will discuss the role of disturbance on ecosystem integrity and degradation. It will attempt to identify the nature and type of disturbances and the resiliency, sensitivity and recovery of ecosystems that are subjected to stress. Solutions to overcome chronic ecosystem disturbance and ways to revitalize the degraded habitats will be sought with examples of case studies.

Required textbook

The biology of disturbed habitats. By Walker, Lwrence R. 2012. Oxford University Press, New York. 319 p. $136.50 (cloth), ISBN: 978-0-19-957529-9; $62.95 (paper), ISBN: 978-0-19-957530-5.

Other optional textbook

Environmental Biology (1989, second edition) by Bill Freedman, Academic Press, London.

In addition to the textbooks, this upper level course will cover classic & contemporary peer-reviewed articles relevant to the subject.

Course Structure

Two lectures/discussions per week

i) First 8-10 lectures by the instructor.
ii) Subsequent classes will be devoted to reviewing and critiquing selected journal articles on the subject.

Lab Assignments

i) Two field trips including a full day of fieldwork on a Saturday or Sunday.
ii) One controlled experiment in the laboratory.

One Term Paper

A ten-page term paper (nine to ten pages, 1.5 space) selected from one of the topics listed in the manual or a mutually agreed topic.

One Class Presentation

A 20-minute oral presentation and 5 minute question period on a topic other than the topic selected for the term paper.

Distribution of Marks

Break up			Marks*
Term Paper			10
Mid-term exam			10
Class discussion			5
Oral presentation			
Lab reports (Total)			35*
	Lab 1	5	
	Lab2	20	
	Lab3	10	
Final exam			30
Total			**100**

*** Details of assessment criteria are in appendix VI**

Lecture Topics

1. Growth of human population: increasing demand for natural resources and ecosystem disturbance.
2. Types of disturbances: natural and human induced.
3. Effects of stress on ecosystems: resiliency, sensitivity and recovery.
4. Air pollution and ecosystem stress: natural and industrial emissions.
5. Pesticide, herbicide and fertilizer effects on ecosystems.
6. Effects of disturbance on terrestrial habitats: clear-cutting of forests. Can clear-cutting emulate natural disturbance?
7. Influence of societal demands and government policy on ecosystem health.
8. Ecosystem management: watershed management approach.
9. Environmental impact assessment
10. Restoration ecology: rehabilitation of degraded ecosystems.

Class Discussion Topics

At the end of the class lectures one or two articles from contemporary publications (in journals, books, reports) will be assigned each week for discussion in the class. One student will lead the discussion with a 5-10 minute briefing on the objective, major findings and criticisms of the results and interpretation. This will be followed by class discussions based on assigned readings of selected peer-reviewed papers.

Assigned readings for class discussion

Dates	Articles
Oct. 1	Cohen, J. 1997. Population, economics, environment and culture: and introduction to human carrying capacity. Journal of Applied Ecology 34, 1325-1333.
Oct.3	Turner, M. 2010. Disturbance and landscape dynamics in a changing world. Ecology, 91(10), 2010, pp. 2833–2849
Oct. 8	Carleton, T.J. & MacLellan, P. 1994. Woody vegetation responses to fire versus clear-cutting logging: A comparative survey in the central Canadian boreal forest. Ecoscience 1: 141-152
Oct. 10	Mallik, A., Bell, F., and Gong, Y. 1997. Regeneration behaviour of competing plants after clear cutting: implication for vegetation management. Forest Ecology and Management 95, 1-10.
Oct. 15	Biswas, S.R. and Mallik, A.U. (2010) Disturbance effects on species diversity and functional diversity in riparian and upland plant communities. Ecology 91(1): 28-35.
Oct. 17	Jasinski, J.P.P., and S. Payette. 2005. The creation of alternative stable states in the southern boreal forest, Quebec, Canada. Ecological Monographs 75 (4): 561-583.
Oct. 22	Siegwart-Collier, S.C. and Mallik, A.U. (2010). Does post-fire abiotic habitat filtering create divergent plant communities in black spruce forests of eastern Canada? Oecologia, DOI: 10.1007/s00442-010-1642-0
Oct. 24	Grime, J.P. 1998. Benefits of plant diversity to ecosystems: immediate, filter and founder effects. Journal of Ecology 86: 902-910.
Nov. 29	Mallik, A.U., Bloom, R.G and Whisenant, S.G. (2010). Seedbed filter controls post-fire succession. Basic and Applied Ecology 11(20: 170-181.
Nov. 31	Bullock, J. 2009. A long-term study of the roles of competition and facilitation in the establishment of an invasive pine following heathland fires. Journal of

	Ecology 97: 646-656.
Nov. 5	Walker, L., Landau, F., Velázquez, E., Shiels A. and Sparrow, A. 2010. Early successional woody plants facilitate and ferns inhibit forest development on Puerto Rican landslides. Journal of Ecology 98(3): 592-140
Nov. 7	Merrti, D.M., Nilsson, C. and Jansson, R. 1010. Consequences of propagule dispersal and river fragmentation for riparian plant community diversity and turnover. Ecological Monographs, 80(4), 2010, pp. 609 –626
Nov. 12	Peñuelas, J and Boada, B. 2010. A global change-induced biome shift in the Montseny mountains (NE Spain). Global Change Biology 9 (2): 131 – 140.
Nov. 14	Harris, J.A., J. Hobbs R.J., Higgs, E. and Aronson J. 2010. Ecological Restoration and Global Climate Change. Restoration Ecology 14(2) 170-176.
Nov. 19	Vanbergen, A.J. and the Insect Pollinators Initiative 2013. Threats to ecosystem service: pressures on pollinators. Frontiers in Ecology and the Environment 11(5): 244-251.
Nov. 21	Pringle, C. 2001. Hydrologic connectivity and the management of biological reserves: A global perspective. Ecological Applications 11: 981-998.
Nov. 26	Gleick, H. 2000. How much water is there and whose is it? In the world's water 2000-2001 the biennial report on freshwater resources. Island Press: Washington, D.C.
Nov. 28	Arnett, E.B, Huso , M.P., Michael R Schirmacher, M.R., and Hayes, J.P. (2011). Altering turbine speed reduces bat mortality at wind-energy facilities. Frontiers in Ecology and the Environment 9(4): 209–214, doi:10.1890/100103

Lab and field trip schedule

Date	Lab Activity	Time	Meet@
Fieldtrips			
September 18 Wednesday	Field Trip (Beaver & Clearcutting Disturbance)	2:30PM	Lot 5
September 28 **Saturday**	All Day Field Trip**,** Spruce River Rd.	8:00 AM	Lot 5
Labs (All Wednesdays)			
September 25	Data Entry and ANOVA	2:30 PM	ATAC 3003
October 2	Data Entry and PC-ORD	2:30 PM	ATAC 3003
October 9	PC-ORD	2:30 PM	ATAC 3003
October 16	Preparation for Soil Respiration Lab	2:30 PM	CB 3010A
October 23	Soil Respiration Lab	2:30 PM	CB 3010A
October 30	Data Entry and Analysis	2:30 PM	ATAC 3003
Class presentations			
November 6	Class Presentations	2:30 PM	CB 3010A
November 13	Class Presentations	2:30 PM	CB 3010A

Due Dates for Course Work

Lab #1- Observations and Labs on Disturbance	September 25
Term Paper Outline	October 2
Term Paper	October 16
Lab #2 – Microclimatic, Soil and Vegetation Response to Disturbance	First Submission: October 30 Final Submission: November 20
Class Presentation Outline	October 23
Class Presentation	November 6th and 13th
Lab #3 – Soil Respiration	November 27th

*** All papers are due by 2:30PM on due dates either as hard copy or as a soft copy (only pdf or MSWord version) through e-mail to TA/GA of the course.**

Suggested Term Paper Topics

- Discuss the strategies plant species use in adapting to disturbance, selecting at least three species to illustrate different types of adaptation.
- Plant species have diverse methods of dispersal and colonization. Discuss how different dispersal methods might assist or inhibit the ability of a species to colonize post-disturbed habitats.
- Invasive species have the ability to create disturbance in an ecosystem. Discuss how introduced species affect an ecosystem and methods employed to control invasive species for ecosystem restoration.
- Evaluate forestry practices, such as stand retention in large cutovers that aim to emulate natural disturbance regime.
- Discuss how habitat fragmentation affects plant community. Using specific examples, suggest possible solutions.
- Discuss how the frequency and intensity of natural disturbance (fire) play a role in post-disturbance ecosystem recovery.
- Discuss the role of disturbance in maintaining biodiversity.
- Compare and contrast natural and anthropogenic disturbances.
- Discuss how landscape ecology and recent technological advances in remote sensing and GIS can broaden ecological understandings and contribute to sustainable land management.
- Compare and contrast hydrological changes in areas disturbed by clear-cutting and fire. Include a brief discussion of plant species responses to these changes.
- What is edge effect and edge sealing? Discuss why blowdown occurs at the forest edges and how edges can be designed to improve structural stability of edges.
- Discuss the difficulties in determining a landscape's "natural state" and the role of disturbance in maintaining biodiversity.
- Discuss the threats and benefits (if any) of global climate change.
- Discuss global and regional fresh water supply, use & conservation in a changing climate.
- What is restoration ecology? How can restoration ecology help in recovering degraded habitats and how can we plan for restoration in a changing climate?

Note: If you have your own idea for a paper, please consult with Dr. Mallik

Suggested Class Presentation Topics

- Discuss the underlying principles of restoration ecology with an example of a current restoration project
- Discuss how water pollution is threatening drinking water supply
- Discuss the threat of spruce budworm to forest resources and some of the management solutions
- Discuss some of the disturbance related issues facing the fishing industry and the potential use of aquaculture
- Discuss environmental disturbances resulting from war (ex. oil fires in Kuwait/Iraq)
- Discuss global warming and expected climate changes and the potential change in world vegetation, fresh water and human diseases and death
- Discuss the use of herbicides and pesticides in agriculture and some of the alternatives
- Discuss the potential ecological, social and political effects of the damming of the Kamanistiqua River near the gorge
- Discuss the effects of oil spills and some of the clean-up options in relation to a recent spill
- Discuss ecological effects of fire suppression and use of controlled burns
- Discuss some of the ecological effects of noise pollution and/or light pollution
- Overview of the common disturbances plant communities experience in the boreal region (topics include forestry, infestations, mining, hydro dams, industry, etc.)
- Discuss methods (may include policies and regulations) in place to mitigate disturbance impacts such risk assessment/cumulative impact assessment and how they could be more effective
- Discuss how species diversity and trait diversity respond to disturbance intensity
- How is the rate and direction of secondary succession affected by fire severity?

Note: If you have a current issue relating to disturbance you would like to discuss you are encouraged to consult with the instructor.

Lab components

The laboratory component of the course is divided into 3 parts:

1) Observation and description of natural and anthropogenic disturbance on the ecosystem

2) Measurement of microclimatic soil parameters and vegetation recovery in response to disturbance, and

3) Determination of soil CO_2 evolution at varying moisture and organic matter contents

Guidelines to Writing Formal Reports

Developing the ability to write in a clear, concise style is a most important communication skill. Scientists must strive for clarity and precision in the communication of their ideas. The preparation of the series of formal reports expected in Biology will give you the opportunity to fine-tune your writing skills as well as introduce you to the "art" of writing in the scientific style.

The importance of uncluttered communication in the Sciences cannot be emphasised enough. Most readers of technical papers are not reading for enjoyment; they are reading to extract the largest amount of information in the shortest possible time. Clear concise writing will get your point across quickly and effectively. If you can make your point in 10 pages do not pad your report with an extra four pages of superfluous and flowery prose. Construct your sentences with an economy of words, using correct spelling and grammar. Avoid useless, repetitive sentences and filler phrases and always remember that a good diagram, table, chart, or picture may be worth a thousand words.

This section is designed to give you an outline for good scientific writing. If you want information "Writing to Learn Biology" (Moore 1992) is a good reference, available in the LU bookstore. Another short and inexpensive guide is " A Short Guide

for Writing About Biology" (Pechenik 1993). "Technical Communication" (Rodman 1996) is an excellent book that covers scientific and business writing in great detail. You can borrow either of these books from your TA

The Writing Process

Good writing is a skill that must be practised. Do not expect your first reports to be perfect, but always learn from your mistakes. The following series of steps may help you to begin writing.

Report Format

At this point you should have finished your research and data analysis; now sit down with all your notes and think about the material to go into each section. Write out a brief outline.

With your outline and notes at hand, start to write. It is a good idea to start with an easy section such as the Methods or Results. When you have them written move on to the Discussion and finally the Introduction. At this point you should write as fast as possible – if you don't have a piece of information on hand leave a blank space and continue.

Look back at your paper. Skim through and, if necessary, make changes in the overall approach of the paper – items such as paragraph structure and the order and flow of ideas. Fill in all of the blanks you have left and write the Abstract, Literature Cited, and Acknowledgement sections.

Edit the paper in detail. At this point you should check the structure of every sentence to ensure good grammar and the smooth flow of ideas. You should be able to justify why you worded every sentence the way you did. Correct spelling, especially of species names and technical terms, is very important.

More than anything else, editing is the key to good writing. It is the biggest difference between poor and excellent writing – professional writers may spend 20 times the time and effort on editing than on writing the first draft!

A typical scientific report consists, in order, of the following sections: Abstract**,** Introduction, Materials and Methods, Results, Discussion, Acknowledgements and

Literature Cited**.** This section details what is to be found in each. A Title Page is mandatory and should include an interesting title for the paper and your name. Be sure that your title is informative and says something about the topic of your paper.

Abstract

This section is usually written in the past tense, has no references and is a concise (~½ page) summary of your paper. It is normally only a few sentences long, and includes a brief outline of the study area, purpose (objective), methods, major results and major conclusion(s) of the study.

Introduction

This section presents the reason(s) why you are doing the study and the background information that led to its development. It is generally written in the present tense. A summary of the relevant literature should be given, keeping in mind that it be logical, clear and precise. Past tense may be used when referring directly to an author (e.g. "Smith (1994) studied growth in adult fish."). You may define specialised terminology that you will be using and most importantly, support statements of fact with appropriate references.

The Introduction is critical to your paper as it provides the foundation on which to build your Discussion. If the Introduction is weak and directionless, you will find that you have nothing to discuss in the end and the whole paper will be weak and directionless. Relevant background information to present the broad sense of the subject area is generally provided first, narrow down to the subject at hand, then end with the specific objectives of your research. In this way, you will lead the reader smoothly into the next section of the paper. This probably will require that you write several drafts so have your peers help you by asking them to read and provide constructive comments on your lab report.

Materials and Methods

Written in the past tense, this section offers a detailed description of the study area. This is necessary to put the report in its context. Typically information on the local geology, vegetation, and climate are found here. In the second part of this section you will also

describe, in order, when, how and what you did and the materials you used so that someone else can replicate it. Do not simply put in lists of equipment used, and remember that common items like measuring tapes generally do not need to be included. The most important part of this section is the description of the **sampling design** and the **statistical analyses** (if any) that were used.

Results

This section presents your data as you observed them. Write it in the past tense. Present the data, drawing attention to major observations and key trends. When reporting numerical results, tables and figures are useful tools, keeping in mind that you must refer to these tables or figures in the text of the Results. This is generally done by mentioning a specific figure or table in parentheses at the end of a sentence (e.g. "Thirteen species of herbs and four shrubs were identified at Site 6 (Table 1)."). Avoid providing the same details in text and table format. Insert the table or figure immediately after it is mentioned in the text of your report.

When you have occasion to use tables and figures in your report, note that there may be more than one per page but that each table must have its own number and title **above** and each figure its own number and caption **below**. Titles and captions must contain sufficient information that they are capable of standing independently from the text, i.e. the reader must not have to refer to the text to understand it. Tables and figures appear in numerical order and are introduced in the text in the same order. Descriptive results are best presented in text form. **Avoid interpreting your results in this section.**

Discussion

In this section, you interpret your results within the context of the problem and the objectives set out in the Introduction. A good Discussion will relate back to the ideas and published materials presented in the Introduction, resulting in a well organised, logical, and cohesive unit. Be careful not to rehash all the background information but, if appropriate, you might repeat selected bits.

It is useful to begin with a brief reiteration of your results so it is clear what you are discussing. Address your major findings in the same order in which they are reported in

Results. Explain their significance by relating the findings to the relevant research you cited in the Introduction.

End the Discussion with a conclusion. This consists of one or two sentences that specifically state what you discovered after all your hard work and research. Avoid generalisations such as "climate influences rate of growth in plants". We want to know the gory details, but be brief!

Keep in mind the following as you write the discussion:

- Did you find what you expected?
- How do your results compare with those expected?
- If you obtained unexpected results, did you attempt to explain them?

Acknowledgements

This is an optional section where you, the author, can take a line or two to acknowledge those who helped with the paper or the research. Avoid flowery phrases, as this is a professional courtesy.

Literature Cited

This section contains the publication information of all the different references you cited in the text of your paper. It is not a bibliography. For example, if five different citations appear in your paper, this section would contain five references. At least three references in addition to your text and the lab manual will indicate that you have done an adequate literature search. Dictionaries and Encyclopaedias are unacceptable references. The Internet is a good way to conduct a literature search, but you must be **very careful** what you cite from it. The vast majority of the material on the Internet is **not peer reviewed**, in other words, the material has not been examined by an independent scientist for an acceptable level of scientific merit. There are some sources on the Internet that are reputable. Many respected scientific journals maintain on-line versions; these should be cited in the usual manner for a journal. There are also many government websites that contain a great deal of information that is difficult to find in other areas. Websites maintained by governments are generally good sources, but you should be able to back up any controversial material you use with non-Internet references. References are cited

in the text in two different ways. The author's name may be the subject or object in the sentence. For example: Smith (1994) was the first person to observe the flight of fledgling condors. Or, the person being credited with a statement or idea you are presenting is cited in brackets and this citation, structurally, is not part of the sentence. For example: Boreal ecosystems have adapted to periodic wildfire (Williamson 1968, Bryan *et al.* 1995) and when vigilant fire suppression is practised, the natural succession and patchiness of the forest does not develop (Wilson 1983, 1990). Do not number your references. List them in alphabetical order, by surname of the first author. If you cite more than one article by a particular author, list that author's articles in chronological order (i.e. date of publication) with a lowercase letter after the date (i.e. 1998a, 1998b). Examine Moore (1992), journals such as the *Canadian Journal of Botany* or *Ecology*, or consult Table 1 for examples of the manner in which to format your Literature Cited.

Table 1. Format for citing references for formal lab reports.

In the text of your paper	**In the Literature Cited section**
Hicks (1986) stated that moose populations were declining in New York.	Hicks, A. 1986. The history and current status of moose in New York. Alces 22: 245-252.
Moose populations were declining in New York (Hicks 1986).	same format as above
If there are three or more co-authors, the words '*et al.*' may be used in the text to replace all but the senior author. For example: The peppered moth in England is a classic case of industrial melanism (Mitchell *et al*. 1988).	Note that <u>all</u> authors are listed in the Literature Cited: Mitchell, L.G., J.A. Mutchmor and W.D. Dolphin. 1988. Zoology. Benjamin/Cummings, Don Mills ON. 862 pp.

Literature Cited

Moore, R. 1992. Writing to Learn Biology. Saunders College Publishing, Orlando FL. 344 pp.
Pechenik, J.A. 1993. A Short Guide to Writing about Biology. Harper Collins, New York.
Rodman, L. 1996. Technical Communication. Harcourt Brace and Co. Canada.

Marking Schemes for Labs 1, 2 & 3

Lab #1

Introduction (20 marks):

- Important concepts are introduced (eg: different types of natural disturbance, differences between natural and anthropogenic disturbance, etc.)

Observations (35 marks):

- a detailed description of field observations is provided

Discussion (35 marks):

- observations are compared to literature
- agreements and disagreements between literature sources and observations are outlined and **explained**
- Predictions on the appearance/composition of inspected areas in 15-20 years is made

Literature Cited (10 marks):

- Minimum of five sources are provided
- References are government or peer-reviewed documents
- "Literature Cited" guidelines provided in Appendix III are provided

TOTAL = 100 MARKS, converted to 5% of final mark

Lab #2

Abstract (10 marks):

- Concisely written (no more than 250 words)
- Includes study area, purpose/objective, methods, major results, major conclusions

Introduction (20 marks):

- Well researched with at least 5 relevant references
- Logical development from past research to the purpose of the study
- Links to discussion section are clear (i.e. helps set the foundations for the discussion).
- Broad to specific in structure

Materials and Methods (15 marks):

- Clear, comprehensive description of the study area
- All equipment is listed with full names
- Clear understanding of the sampling design (i.e. what was done, why and how)
- Brief description of the statistics used in the analysis, demonstrating an understanding of why these methods were used

Results (20 marks):

- Major observations and key trends identified
- Appropriate choice of species and environmental variables for interpretation of the axes
- Appropriate use of tables and figures
- Presents results without discussing them

Discussion (25 marks):

- Demonstrates an understanding of NMS and/or CCA

- Related to current literature
- Conclusions well developed based on interpretation of results
- Concise relevant conclusions showing depth of thought

General and References (10 marks):

- Writing style is clear, concise and written in past tense
- Logical progression of ideas (flow) and good transitions between sections
- Correct grammar
- Correct spelling
- References current and relevant
- References properly cited both within the paper and the reference list

TOTAL = 100 MARKS, converted to 20% of final mark

Lab #3:

Abstract (10 marks):

- Concise (no more than 250 words)
- Includes origin of soils, purpose/objective, methods, major results, major conclusions

Introduction (20 marks):

- Well researched with at least 5 references
- Logical development from past research to the purpose of the present study
- Links to discussion section are clear (i.e. helps set the foundations for the discussion)
- Broad to specific in structure

Materials and Methods (15 marks):

- All equipment is listed
- Clear description of the sampling design (i.e. what was done, why and how)
- Brief description of the statistics used in the analysis

Results (20 marks):

- Major observations and key trends are identified
- Appropriate use of tables and figures
- Presents results without discussing them

Discussion (25 marks):

- Demonstrates an understanding of 2-way ANOVA
- Related to current literature
- Conclusions well developed based on interpretation of results
- Concise relevant conclusions showing depth of thought

General and References (10 marks):

- Writing style is clear, concise and written in past tense
- Logical progression of ideas (flow) and good transitions between sections
- Correct grammar
- Correct spelling
- References current and relevant
- References properly cited both within paper and the reference list

TOTAL = 100 MARKS, converted to 10% of final mark