Biology 3114 Course Outline

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Introduction

Complex interactions of many biotic and abiotic factors exist in natural plant communities. The lecture component of this course was designed to offer a theoretical understanding of these interactions. In this course broad descriptive, as well as specific quantitative approaches will be used to identify and understand the structural and functional attributes and functional mechanisms of plant communities. Dominant biotic interactions (plant-to-plant, plant-microbe, interactions such as competition, symbiosis, and allelopathy) and the role of environmental factors such as fire, microclimate and soil will be studied.

A general introduction will be given before each laboratory exercise followed by an outline of objectives and methods. While some of the exercises are original, a large part of this manual contains borrowed and modified versions of published texts, unpublished manuals, and handouts. I would like to thank Robin Bloom and Eric Lamb for their help with an earlier revision of this manual. Lab manuals always need changes and refinements as new knowledge comes to light. I welcome feedbacks from students and colleagues for its further improvement.

The course will begin with a general introduction to history of plant ecology followed by more advanced treatments of selected topics on the subject. It will cover the theoretical concepts of ecosystem, plant community structure and function with particular emphasis on plant community response to disturbance with some examples. These aspects will be emphasized in lectures and discussions, field and laboratory exercises, and student presentations. Lecture topics include the following:

1. Introduction of plant ecology
2. Plant geography and vegetation description
3. Association and plant community concepts
4. Descriptive classification of vegetation
5. Ecosystem concept
6. Quantitative classification of vegetation
    - i) vegetation sampling techniques
    - ii) direct and indirect gradient analysis,
    - iii) cluster analysis
    - iv) association analysis
    - v) ordination
5. Vegetation dynamics: Succession
    - i) successional pathways/mechanisms

ii) progressive succession
iii) retrogressive succession
iv) cyclical process

6. Functional classification of plant communities
    i) vital attributes of species
    ii) species traits (CSR model)
    iii) R* hypothesis
7. Species interactions
    i) competition
    ii) allelopathy
8. Competition and allelopathy in natural and managed ecosystems
    i) fire suppression and vegetation change
    ii) restoration ecology
9. Forest ecology and management
10. Soils
    i) classification
    ii) soil physics
    iii) soil chemistry
    iii) soil biology
    iv) soil erosion and soil conservation
11. Ecological modeling
    i) concept
    ii) classification
    iii) model building
    v) model use for prediction and forest management
12. Class review for final exam.

Schedule for Plant Ecology Labs

Week	Date	Topic	Lab report due date
1	9/12/23	Intro to Lab and Lab Instructor, Plant ID	
2	9/29/23	Field trip to Mt. McKay	
3	9/23/23	Hawkeye Lake fieldtrip (**all day Saturday)**	
4	10/26/23	Succession lab	Mount McKay lab (3%)
5	10//03/23	Ordination Lecture	
6	10/17/23	Ordination Lecture/R programing	Quadrat size lab (3%)
6	10/19/23	Climate change essay	Due date (5%)
7	11/24/23	Allelopathy intro and experiment set up	Succession lab (7%)
8	11/31/23	Allellopathy, description of ANOVA	Ordination lab (10%)
9	11/07/23	Allelopathy measurement & data analysis	Ordination lab (2nd sub)
10	11/14/23	Student presentations	
11	11/21/23	Student presentations	Allelopathy lab (7%)
12	12/28/22	Lab Exam	

Please be sure to regularly check your Lakehead University e-mail account for updates and unavoidable changes to the laboratory schedule.

Mid-term (in class) exam……Thursday, October 5, 2022

Distribution of Marks

A.	Theoretical	
	1. Active learning	10
	2. Mid-term exam (during class time on **October 6**)	10
	3. One class presentation and participation in discussion	10
	4. A three-hour final exam (**early December**)	25
		55%
B.	Practical (laboratory and field work)	
	1. Laboratory examination	15
	2. Comprehensive Laboratory and Fieldwork Reports	30
		45%
	TOTAL	**100%**

Lab Report and Class Presentation Criteria and Evaluation

Laboratory projects will involve several outdoor field exercises surveying vegetation, collecting plant and soil data following transect and quadrat methods. Vegetation data will be analyzed using computer programs designed for this purpose. A total of 8 labs will be distributed over the term. Several of the exercises will require more than one lab period. Following the completion of selected exercises students will be required to submit a lab report on predetermined due dates. Both the qualitative (descriptive) and quantitative (analytical) techniques will be used in dealing with the ecological issues and problems. Formal lab reports should include an introduction, methodology, results, discussion, and reference sections.

The **introduction** should give background information and the purpose of the lab exercise; define terms used in the report and provide a site description. The **methods** section should describe the materials used and the steps taken to complete the lab exercise. The reader should be able to duplicate your experiment precisely by following the steps you have outlined. Equations for calculations should also be identified in this section. The **results** section should contain tables and figures appropriately labeled and preceded by a paragraph describing significant values or trends that you can identify. Raw data calculations should be included as an appendix for reference purposes (if necessary). The **discussion** section should use the results to try to explain the trends represented. Use references to help support your ideas. The report should be organized so that the concepts and objectives are identified in the introduction; methods and results are described clearly followed by a discussion of the main results with the help of relevant literature as is done in a typical journal paper.

Please read a detailed discussion on the appropriate format and tips for writing in Appendix III.

Note: Species names must be underlined (e.g., *Maianthemum canadense*) or typed in italics

Report Evaluation Criteria

Organizational Format	1.0
Introduction	2.0
Methods	1.0
Results	2.0
Discussion	3.0
Overall Writing Quality	1.0
Total	**10 marks**

Reports will be marked out of ten and then weighted accordingly (see lab outlines for weighting). For each day of late submission of the lab report 5% marks will be deducted.

General Marking Criteria

Keep these questions in mind for each section of your paper, as they will be the general criteria used to mark each lab assignment. Specific details of each assignment will however differ.

Introduction (/2) – Gives a background on the concept being studied. Introduction should include references to other similar studies pertaining to the concept. Purpose or objectives should be clearly outlined.

- Has the student made an effort to compare conflicting views, or follow the progression (over time) of ideas on the concept being studied?
- Is there a good understanding of the concept studied?
- Are the objectives clearly outlined?

Methods (/1) – Should outline where (site description) and how (data collection and data analysis) the study was carried out.

- Does the student list the study area, data collection, and data analysis methods correctly?

Results (/2) – This section presents the important findings of the study in the form of tables and figures. Any table or figure that has important information should be listed in this section and **not** listed in the appendix. The student should only focus on the **immediate results** in this section. Interpretation of results is what the discussion section is for. Any raw calculations should be listed in an appendix, following the discussion or conclusion section of the report. Tables and figures should follow brief introductory paragraphs directing the reader's attention to relevant findings.

- Are tables and diagrams used and labeled appropriately?
- Does the student avoid using discussion material in this section?

Discussion (/3) – This section should include interpretation of the results. Trends within your analysis should be recognized. Comparisons can be made between your findings and what other studies have shown (this is where a little literature review may be required). Objectives should

be kept in mind when writing the discussion.

- Are trends within the results interpreted correctly?
- Does the student make reference to other similar studies and how they compared to their findings?
- Does the student answer the objectives set out in the introduction section?

Organizational Format (/1)

- Is the report well structured?
- Is there consistency within the report? e.g., headings & sub-headings formatted consistently.
- Is literature cited correctly?
- Marks will be deducted as follows: 0.1 mark for each incorrect citation for a total of 0.5 marks; this includes neglecting to cite the results/ideas of other people. If there is blatant plagiarizing of peer reviewed or other student's work, a mark of 0 will be assigned for the paper.

General Writing Quality (/1)

- Is grammar acceptable? e.g. Are sentences written in proper tense?
- Are there any spelling mistakes? – Deductions: 0.1 mark for each mistake for a total of 0.3.
- Scientific names of organisms must be underlined or *italicized*! – Deductions: 0.1 mark for each mistake for a total of 0.3.

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.

RECOMMENDED TEXTBOOK

Ecology by W.D. Bowman & S.D. Hacker (5th Edition). Oxford University Press p. 591
Kimmins, J.P. 2004. *Forest Ecology: A foundation for sustainable forest management and environmental ethics* (3rd Ed). Prentice Hall, New Jersey, U.S.A. p.611.

OTHER REFERENCE TEXTBOOKS

Barbour, A.G., J.H. Burk, W.D. Pitts, F.S. Gilliam, and M.W. Schwartz. 1999. *Terrestrial Plant* Ecology (3rd edition). Benjamin/Cummings Publishing Co. Inc., Don Mills, Ontario, p. 649.
Gurvitch, J., Scheiner, S.M. and Fox, G.A. 2006. *The Ecology of Plants* (2nd edition). Sinauer Associates Inc., Publishers. Sunderland, Massachusetts, U.S.A. p. 574.
Perry, D. A. 1994. *Forest Ecosystems*. John Hopkins University Press, Baltimore, p. 649.
Brewer, R. 1988. *The Science of Ecology*. Saunders College Publishing, Toronto, p. 921.
Cherret, J.M. ed. 1989. *Ecological Concepts*. Blackwell Scientific Publications, p.385.
Many other textbooks and journal articles on plant ecology and general ecology are available in the Lakehead University Library.