

SC 281
Invasive Plant Ecology & Management
3 Credits

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Invasive Plant Ecology & Management

Calendar Description

This course focuses on vegetation management with emphasis on invasive weedy plants. Weed biology and competitive strategies of these plants are studied in detail. Tools and techniques for control, such as fire, grazing, and herbicides, are described for control of invasive plants in native and nonnative communities. Students spend considerable time in lab identifying weed species, seedlings, and seeds.

Rationale

This is a required course for the Environmental Conservation and Reclamation and the Conservation and Restoration Ecology students. Invasive native and non-native plants present challenges for environmental professionals involved with the vegetation management of conservation areas, rangelands, industrial sites, or any other type of disturbed ecosystem. Invasive native plants are typically difficult to control in their natural environment and managers must have a solid understanding of ecosystems in order to manipulate these plants. Non-native plants (weeds) compete with native plants, and may disturb the natural function of an ecosystem and displace plants and animals. In agricultural environments, weeds are responsible for substantial economic losses related to cropping and livestock systems. Industry and industrial sites such as pipeline and transmission line rights-of-way require long-term vegetation management. As well, in reclamation, success may be delayed by weed competition and presence of noxious weeds, so that vegetation control and management is critical. Identification of invasive species, of associated vegetation problems, development of appropriate management plans, and application of appropriate techniques including herbicides, grazing, fire, and mechanical techniques for controlling invasive plants are all essential skills for conservation and reclamation professionals. As herbicides are a common method of control, a thorough understanding of legislation, applicator certification, personal and environmental safety, and herbicide toxicity and proper use is critical.

Prerequisites

BI 270 and BO 120

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. identify 60 or more common non-native weeds at various stages in their life cycles, as well as cotyledon and seed identification.
2. identify common invasive native plants and recognize under which ecological settings they become invasive.
3. describe and discuss plant biology and physiology strategies used by invasive weed species to invade, compete and reproduce.
4. assess plant characteristics and strategies for success, as well as site characteristics, and apply this information to a successful integrated pest management plan.
5. recognize the various levels of provincial and federal regulations that exist in Alberta and Saskatchewan in regards to weed control.
6. describe a variety of manual and mechanical techniques for vegetation control for native and non-native environments.
7. describe animal grazing and apply management principles of timing, intensity, and frequency of grazing in natural areas to control native and nonnative species.
8. describe the use of prescribed burning in natural areas to control invasive native and nonnative species.
9. describe and evaluate the use of biological agents for control of noxious weeds.
10. describe, evaluate, and apply principles of herbicide use for chemical control of invasive species, with special emphasis on industrial and native sites.
11. identify and demonstrate competency in the necessary safety precautions for safe and effective application of herbicides for personal and environmental safety, as related to the provincial and federal legislations to which pesticide applicators must adhere, and shown by the certification of the student as an authorized assistant.
12. assess all vegetation control methods for their effectiveness, cost, and advantages and disadvantages.
13. apply effective options and management methods to deal with vegetation problems to create an integrated weed management plan for various situations.
14. assess and apply techniques in monitoring and assessing management actions.

Essential Employability Skills

Essential employability skills are critical for workplace success and lifelong learning. Lakeland College prepares its graduates for the workplace and lifelong learning by integrating and promoting essential employability skills development in its curricula. Each credit course offered at Lakeland College emphasizes one or more of the following five essential employability skills:

- A. **Communication Skills** that enable individuals to listen, interpret, express, and convey knowledge and ideas so that they are received and understood.
- B. **Teamwork Skills** that enable individuals to respect the thoughts and opinions of others as they work together to plan activities, meet deadlines, complete projects, and contribute to an organization's goals.
- C. **Critical Thinking Skills** that enable individuals to conceptualize and analyze issues from various perspectives while rationally evaluating the strengths and limitations of each perspective and deciding what action to take.

- D. **Adaptability Skills** that enable individuals to respond quickly, willingly, and positively to new conditions and changing times.
- E. **Positive Attitude and Behavioural Skills** that enable individuals to be confident about themselves and to deal with people, problems, and situations with honesty, integrity, and personal ethics.

Please refer to the Knowledge/Skills Matrix of this course outline to review the essential employability skills emphasized in this course.

Resource Materials

Required Texts:

Bubar, C.J., S.J. McColl, and L.M. Hall. 2000. Weeds of the prairies. Alberta Agriculture, Food and Rural Development, Edmonton, Alberta.

Lakeland College. 2010. Pesticide applicator core lesson. Pesticide applicator homestudy course. Alberta Environment.

Moss, E.H. 1983. Flora of Alberta. 2nd ed. University of Toronto Press, Toronto, ON, Canada.

Tannis, K. 2003. Common plants of the western rangelands. 2nd ed. Vol 1: Grasses and Grass-like species. Olds College, Olds, AB. Alberta Agriculture, Food and Rural Development. Edmonton, AB.

Morton, D. and N. Kimmel. 2016. Weed Seedling Guide. 2nd Edition. Alberta Agriculture and Forestry Information Management. Edmonton, Alberta. Agdex640-9.

Required readings as provided through books, handouts, library resources, and Internet sites. Other resources may be provided for the student by the instructor based on availability and will be discussed at the beginning of term.

Other Reference Texts:

Ali, S. (Ed.). 1997. Crop protection with chemicals. Alberta Agriculture, Food & Rural Development. Edmonton, AB: Agdex 606-1 (blue book).

Dorrance, M.J. 1994. Practical crop protection. Alberta Agriculture, Food & Rural Development (Ed.). Edmonton, AB: Agdex 606-3 (green book).

Cuthbertson, E., and L. Hall. 1997. Common winter annual weeds in Alberta. Alberta Agriculture, Food & Rural Development, Edmonton, AB.

Royer, F., and R. Dickinson. 1999. Weeds of Canada and the Northern United States.

University of Alberta Press. Edmonton, Alberta.

Stern, K.R., S. Hansky, and J.E. Bidlack. 2003. Introductory Plant Biology. 9th ed. McGraw

Hill, New York, NY.

Conduct of Course

This course is a 70 hour course split between 42 hours of lecture and 28 hours of laboratory. Lecture component is a formalized lecture situation where student questions and participation are encouraged to clarify subject areas. Students may be assigned readings and case studies in preparation for lecture. The main ideas are reviewed and discussed in class. Students may be required to summarize and present information from readings, case studies and library research. The assigned readings are an integral component of the course and help the student apply principles from the lecture content. Preparation and in-class participation are essential to the learning process. In class quizzes demonstrate student understanding of concepts presented in lecture component.

Labs are mostly in a laboratory setting and focus on developing skills required to identify mature and juvenile plants, cotyledons and seeds, to understand lecture content, and to apply principles related to lecture and lab content. Plant identification and the characteristics related to control are studied during the lab period. As well, the lab provides the opportunity for students to investigate problem weeds and work on assignments when time permits. In addition, labs may be used to study case studies related to lecture content, and presentation of information by students may occur at this time. Plant identification quizzes are an important component of the lab for exam preparation. Plant quizzes or practise id sessions are held in lab time, as well as laboratory exams, with the exception of the large plant identification completed closer to the end of term, held in the evening.

If the Pesticide homestudy course is delivered in the course, the units are reviewed in lab with opportunity to work on the home study course questions in preparation for the authorized assistant applicators certificate.

Evaluation Procedures

	Course Weight (%)
Midterm I	20%
Midterm II	10%
Lab exams I and II, quizzes	30%
Assignment(s)	20%
Final	<u>20%</u>
Total	100%

Lecture exams contain short-answer, true-false, multiple choice, illustrative, matching, short answer, and discussion questions. Material for the written exams is from lecture, relevant lab

content and assigned readings, study questions, and case studies. Formative non-graded exercises and reading assignments are periodically required which give students a high level of competence in the course material.

There are two lecture exams. Midterm I is based on Units 1 to 2, and the Midterm II is based on the Pesticide Core Unit Homestudy course. The Final exam is based on the remaining class units, and may include some content from the other exams that applies or lab material that applies.

As discussed, Midterm II is based on the Core Unit of the Pesticide Handbook. Students have the option to write the authorized assistant through Lakeland College (fee to be paid by student and delivered by Lakeland College) or the authorized assistant through Train the Trainer (no fee) as Midterm II. A mark of 70% or better in Midterm II results in a certification of Authorized Assistant; the 10% evaluation for the Midterm II applies for the course based on the student mark. Students already certified are expected to participate in the course delivery and write the midterm regardless of their past certification.

Two lab exams involve plant identification. Lab exam I focuses on cotyledons and juvenile forms of the weed species and occur typically prior to Reading Week or directly after during the laboratory session. Lab exam II, closer to the end of term, focuses mostly on juvenile and mature samples of species, and will likely be held in the evening if a time during the day cannot be arranged. Latin names and species characteristics such as lifecycle, growth form, and origin are required for some species. Quizzes may occur throughout the term as practise and is worth 5% of the lab exam total percentage weight.

The assignment as it pertains to content and time commitment is discussed in class. It is typically a written management proposal related to a weed management plan that may be presented as one assignment or presented in parts as multiple assignments. Assignments are created to enhance communication skills and applied knowledge of the course content and requires research, integration of course material and relevant material from other classes, and writing. Students are expected to take assignments seriously and follow the outlines provided with each assignment. The instructor may ask for a rough draft of the assignment. If an assignment is poorly written or presented, the instructor can require a rewrite for that assignment. Each assignment has a written outline of expectations and requirements.

To obtain credit for this course a minimum overall grade of D must be achieved. All assignments must be handed in or an incomplete or fail is given for the course. Late assignments are not graded and a zero mark is assigned. All labs must be attended to obtain credit for the course and any missed lab periods, unexcused or excused, requires a makeup lab activity. An assignment may be given in lieu of, or in addition to the lab, if deemed necessary by the instructor.

All reports, assignments, and exams are graded on a percentage (%) basis. Then, a total course percentage is calculated using the above weighting values. Finally, the total course percentage is converted to a letter grade.

Knowledge/Skills Matrix

Students apply and demonstrate their knowledge and skills to use

A. Communication Skills

A1. by listening, reading, interpreting information, and communicating effectively
Evaluation(s)/Goal(s): Midterm I/Goals 3, 4, 5; Midterm II/ Goals 7 and 8; Final/Goals 4, 6, 7, 8, 9, 12, 13, 14; Assignments/Goal 2, 4, 6, 7, 8, 9, 10, 12, 13, 14
A2. by using written, spoken, and/or visual formats and media to communicate and meet needs of each Particular audience
Evaluation(s)/Goal(s): Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14
A3. by using libraries, internet, technical publications, journals and other sources to find pertinent information
Evaluation(s)/Goal(s): Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14

B. Teamwork Skills

B1. by using interpersonal skills to create an atmosphere that maximizes the strengths of group members to accomplish tasks
Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14
B2. by using interpersonal skills to resolve conflict, relate to others, and assist others
Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14
B3. by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and Identifies resources and timelines
Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14
B4. by treating other members of the group open-mindedly and fairly
Evaluation(s)/Goal(s): Assignment 3/Goal 4, 6, 7, 8, 9, 10, 12, 13, 14
B5. by developing tactics/strategies to accomplish tasks
Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14

C. Critical Thinking Skills

C1. by seeing critical thinking as a lifelong process of self assessment
Evaluation(s)/Goal(s): Midterm I/Goals 3, 4, 5; Midterm II/ Goals 7 and 8; Final/Goals 4, 6, 7, 8, 9, 12, 13, 14; Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14
C2. by examining problems closely
Evaluation(s)/Goal(s): Midterm I/Goals 3, 4, 5; Midterm II/ Goals 7 and 8; Final/Goals 4, 6, 7, 8, 9, 12, 13, 14; Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14
C3. by examining beliefs, assumptions, and opinions, and weigh them against the facts
Evaluation(s)/Goal(s): NA
C4. by seeking out the truth
Evaluation(s)/Goal(s): NA
C5. by finding solutions; make decisions
Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14
C6. by incorporating new ideas that may not necessarily agree with previous thought on the topic
Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14

C7. by seeing connections between topics and use knowledge from other disciplines to enhance reading and learning experiences

Evaluation(s)/Goal(s): Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14

D. Adaptability Skills

D1. by working independently or as part of team

Evaluation(s)/Goal(s): Midterm I/Goals 3, 4, 5; Midterm II/ Goals 7 and 8; Final/Goals 4, 6, 7, 8, 9, 12, 13, 14; Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14; Lab exams/Goals 1 and 2

D2. by carrying out multiple tasks or projects

Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14; Assignment 3/Goal 4, 6, 7, 8, 9, 10, 12, 13, 14

D3. by being innovative and resourceful: identify and suggest alternative ways to get the job done

Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14

D4. by being open and respond constructively to change and uncertainty

Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14

E. Positive Attitude and Behavioural Skills

E1. by dealing with people, problems, and situations with honesty, integrity, and personal ethics

Evaluation(s)/Goal(s): Assignment 3/Goals 4, 6, 7, 8, 9, 10, 12, 13, 14.

E2. by showing interest, initiative, and effort

Evaluation(s)/Goal(s): Midterm I/Goals 3, 4, 5; Midterm II/ Goals 7 and 8; Final/Goals 4, 6, 7, 8, 9, 12, 13, 14; Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14; Lab exams/Goals 1 and 2

E3. by affirming the need for positive solutions and encourage positive interaction and feedback

Evaluation(s)/Goal(s): Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14.

E4. by balancing personal and family activities with job-related activities

Evaluation(s)/Goal(s): Midterm I/Goals 3, 4, 5; Midterm II/ Goals 7 and 8; Final/Goals 4, 6, 7, 8, 9, 12, 13, 14; Assignments/Goals 2, 4, 6, 7, 8, 9, 10, 12, 13, 14.

Grade Equivalents and Course Pass Requirements

A minimum grade of D (50%) (1.00) is required to pass this course.

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.

Attendance

Classroom and laboratory attendance is considered vital to the learning process and as significant to the students' evaluation as examinations and reports, therefore absenteeism is recorded.

- a. Students having a combination of excused and/or unexcused absence of 20 percent or higher for the scheduled course hours can be required to withdraw and would then automatically receive a "RW" (required withdrawal) for the course, regardless of any other evaluation results. (RW is a failing grade).
- b. An excused absence is one that is verified with your instructor. Verification should be prior to the absence or the next class day following the absence. Verification of the absence may take the form of a note from your doctor/College nurse regarding illness, or a note from another instructor regarding a field trip or other activity, or authorization by your instructor following an in-person meeting. Be sure to contact your instructor and ask what they will require from you as verification of each absence. An unexcused absence is anything NOT verified by the instructor prior to the absence or the next class day following the absence.

NOTE: Any exceptions to the above attendance policy (e.g. timetable conflicts, work-related issues) must be approved in writing by the Department Chair prior to the beginning of the course.

It is the students' responsibility to know their own absentee record.

Normal hours are 8:30 a.m. to 6:30 p.m., with potential for evening courses, exams or extended field trips. Students are expected to be available for classes during these times.

Course Units/Topics

Lecture Content:

Lecture content order and delivery may vary based on field trip and lab activities that compliment lecture content.

Unit 1. Weeds and Vegetation Management

1. Weeds as Pests
 - a. Terminology
 - b. Plants as pests
 - c. Origin and Pathways
 - d. Harm and Impact
2. Vegetation Management in Alberta and Saskatchewan
 - a. Situations Requiring Vegetation Management
 - b. The Integrated Vegetation (Pest) Management Approach - IPM
 - c. Legislation Governing Prevention, Control and Eradication of Weeds and Invasive Plants

Unit 2. Biology and Physiology of Weeds and Other Invasive Plants

1. Plant Identification
2. Biological and Physiological Strategies for Success
3. Interference for Success: Competition and Allelopathy
4. The Role of Succession in Success

Unit 3. Non-chemical Control Techniques for Herbaceous and Woody Vegetation for Industrial and Natural Resource Activities

1. Prevention Techniques
2. Cultural Practices
3. Manual Control
4. Mechanical and Physical Removal of Woody and Herbaceous Vegetation (special emphasis on industrial control)
5. Special topic: Aquatic Environments

Unit 4. Chemical Control: Pesticide Legislation and Safe use

1. Federal and Provincial Legislation
2. Pesticide Formulations and Classification
3. Personal and Environmental Health
4. Integrated Pest Management
5. Pesticide Personal Safety and Safe Use Handling

Unit 5. Chemical Control: Herbicide Activity in the Plant and the Environment

1. History and Use of Pesticides
2. Herbicide Classification
3. Soil Processes Related to Herbicide Activities
4. Factors Affecting Herbicide Effectiveness
5. Environmentally Sensitive Areas
6. Symptoms of Herbicide Injury

Unit 6. Industrial Vegetation Management Techniques

1. Industrial Vegetation Control
2. Industrial Vegetation Management Categories
3. Controlling Woody Vegetation with Chemical Control

Unit 7. Biological Control

1. Value of Biological Controls
2. Vegetation Control Using Livestock Grazing
3. Biological Control Using Natural Pests

Unit 8. Fire Techniques for Vegetation Control

1. Prescribed Fire
2. Environmental Effects
3. Effectiveness of Fire in Controlling Vegetation

Unit 9. Integrated Vegetation Management Case Studies

Laboratory Content: The following topics will be covered in the lab although based on timetables and student conferences, order and/or emphasis may vary.

1. Weed identification introduction
2. Morphology review
3. Plant families and Species Identification
4. Mature and juvenile plant identification
5. Cotyledon identification
6. Seed identification
7. Case studies
8. Keying
9. Lecture content related to the homestudy unit of the Authorized Assistant Pesticide Certification and related practise questions
10. Field lab for weed identification (weather and site dependent)

Laboratory content and order of delivery varies depending on available materials for study.



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