# SC 329

# Fundamentals of Restoration Ecology

**3 Credits**


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# Fundamentals of Restoration Ecology

## Calendar Description

This course focuses on the foundations of restoration ecology and introduces techniques used to restore native plant communities in grassland, forest, parkland, and wetland habitats. It examines the causes and consequences of ecological degradation and emphasizes approaches to restoring and maintaining ecological characteristics and processes. Special consideration is given to species at risk and the conservation of plant and animal populations. Field trips and field labs provide students with the opportunity to observe or participate in restoration activities in a variety of habitat types.

## Rationale

This is a required course for students enrolled in the Environmental Sciences Diploma: Conservation & Restoration Ecology Major. Natural areas are becoming increasingly susceptible to the ecological pressures associated with agriculture, forestry, industry, urbanization, and recreational activities. One approach to managing degraded wildlands for biodiversity is to apply the principles and practices of ecological restoration. Ecological restoration is a process-oriented approach to reestablishing functioning ecosystems in riparian, wetland, and terrestrial upland habitat where ecosystem processes no longer operate at desired levels. Conserving and restoring soil resources, hydrological attributes, and native plant communities are fundamental to effective restoration programs. Of equal importance to successful restoration activities are land-use planning, site assessment, project evaluation, and collaboration

## Prerequisites

BI 110 and BO 120

## Co-Requisites

None

## Course Learning Outcomes

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

1. assess the physical and biological components and processes in degraded riparian, wetland, aquatic, forest, and grassland ecosystems.
2. collect baseline ecological data from reference ecosystems to identify essential ecological processes and the composition of native communities.
3. relate ecological restoration to other habitat conservation initiatives.
4. identify and mitigate human-caused and natural sources of disruption to functioning ecosystems.
5. assess damage to soil resources, hydrological features, and other primary processes operating in functioning ecosystems, and apply specialized techniques to mitigate that damage.
6. select appropriate planting materials to reestablish native plant communities by formulating species mixtures that ensure species and genetic diversity.
7. apply principles of functional diversity, functional redundancy, and community assembly.
8. utilize effective approaches to site preparation, seedbed management, and the various planting strategies and practices associated with reestablishing native plant communities.
9. ensure local site conditions facilitate the germination, growth and establishment of restored plant communities.
10. plan and carry out restoration activities in degraded natural areas and evaluate project success with respect to stated goals and objectives.

## 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*:**

Smreciu, A., H. Sinton, D. Walder, and J. Bietz. 2003. Establishing native plant communities. Alberta Agriculture, Food and Rural Development, Edmonton, AB.

Gramineae Services Ltd. 2013. Recovery strategies for industrial development in native prairie for the dry mixed grass natural subregion of Alberta. Alberta Environment and Sustainable Resource Development, Edmonton, AB. (pdf available online)

Neville, M., J. Lancaster, B. Adams and P. Desserud. 2014. Recovery strategies for industrial development in native prairie for the mixed grass natural subregion of Alberta. Alberta Environment and Sustainable Resource Development, Edmonton, AB. (pdf available online)

Lancaster, J., M. Neville, P. Desserud, V. Craig, R. Adams, B. Adams and J. Woosaree. 2014. Long-term revegetation success of industry reclamation techniques for native grassland for the northern fescue natural subregion. Petroleum Technology Alliance Canada, Calgary, AB. (pdf available online)

***Recommended Texts:***

Gerling, H.S., M.G. Willoughby, A. Schoepf, K.E. Tannas, and C.A. Tannas. 1996. A guide to using native plants on disturbed lands. Agriculture, Food and Rural Development and Alberta Environmental Protection, Edmonton, AB.

***Reference Texts:***

Alberta Land Conservation and Reclamation Council Report No. RRTAC 89-4 p. 436. 1989. Manual of plant species suitability for reclamation in Alberta. 2nd ed. Hardy BBT Limited, Edmonton, AB.

Falk, D.A., M.A. Palmer, and J.B. Zedler. 2006. Foundations of Restoration Ecology. Island Press. Washington, D.C.

Jordan, W.R., M.E. Gilpin, and Aber, J.D. 1987. Restoration Ecology: A synthetic approach to ecological research. Cambridge University Press, Cambridge, United Kingdom.

Tannas K. 2001. Common plants of the western rangelands. Volume I and II. Alberta Agriculture, Food, and Rural Development. Edmonton, AB.

Wruck, G., and A. Hammermeister. 2003. Prairie roots: A handbook for native prairie restoration. Native Plant Society of Saskatchewan Inc., Saskatoon, SK.

Whisenant, S.G. 1999. Reparing damaged wildlands: A process-oriented, landscape-scale approach. Cambridge University Press. Cambridge, United Kingdom.

## Conduct of Course

This course consists of approximately 42 hours of lecture and 28 hours of lab.

The lecture is a formalized classroom situation where the instructor discusses pertinent topics and students normally take notes. Students are encouraged to participate in class discussion and to ask questions to clarify subject areas.

The laboratory component focuses on field trips, field tours, and field exercises that practically apply the theory discussed in lecture. Assignments are made for each laboratory activity.

## Evaluation Procedures

The final grade for the course is weighted according to the following schedule:

| | |
|---|---|
| Exam I | 25% |
| Exam II | 30% |
| Term Assignments | 20% |
| Laboratory Assignments | 25% |
| Total | 100% |

To obtain credit for this course:

- All projects and assignments must be completed and handed in.
- All lab activities must be attended in the required time slot. An absence, excused or unexcused will result in a zero for the absence lab.
- Students who are absent during in-class assignments, quizzes and labs will not typically be allowed to make up these exercises for marks, but may be required to complete them for learning practice.
- A minimum grade of D (50%) is required.
- Late assignments and projects are not graded and a mark of 0 is assigned.

All exams, reports, projects and assignments 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 based on the college grade strip.

Exam II is a cumulative exam including all material covered in the course including that covered on Exam I.

# 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/Goals 1-10; Final/ Goals 1-10; Lab Exercises/ Goals 1-10 |
| **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 3, 4, 9, 10 |
| **A3. by using libraries, Internet, technical publications, journals and other sources to find pertinent information** |
| **Evaluation(s)/Goal(s):** Assignments/ Goals 1-10 |

### 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):** Assignments / Goals 6, 8, 9, 10 |
| **B2. by using interpersonal skills to resolve conflict, relate to others, and assist others** |
| **Evaluation(s)/Goal(s):** NA |
| **B3. by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and identifies resources and timelines** |
| **Evaluation(s)/Goal(s):** Assignments / Goals 3, 6, 8, 9, 10 |
| **B4. by treating other members of the group open-mindedly and fairly** |
| **Evaluation(s)/Goal(s):** NA |
| **B5. by developing tactics/strategies to accomplish tasks** |
| **Evaluation(s)/Goal(s):** Assignments / Goals 8, 9, 10 |

### C. Critical Thinking Skills

| |
|---|
| **C1. by seeing critical thinking as a lifelong process of self-assessment** |
| **Evaluation(s)/Goal(s):** Midterm/Goals 1-10; Final/ Goals 1-10; Lab Exercises/ Goals 1-10 |
| **C2. by examining problems closely** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 1-10; Final / Goals 1-10; Lab Exercises / Goals 1-10 |
| **C3. by examining beliefs, assumptions, and opinions, and weigh them against the facts** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 3, 4, 10; Final / Goals 3,4,10; Lab Exercises / Goals 3, 4, 10 |
| **C4. by seeking out the truth** |
| **Evaluation(s)/Goal(s):** NA |
| **C5. by finding solutions; make decisions** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 1-10; Final / Goals 1-10; Lab Exercises / Goals 1-10 |
| **C6. by incorporating new ideas that may not necessarily agree with previous thought on the topic** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 3, 4, 5, 8, 9, 10; Final / Goals 3, 4, 5, 8, 9, 10; Lab Exercises / Goals 3, 4, 5, 8, 9, 10 |
| **C7. by seeing connections between topics and use knowledge from other disciplines to enhance reading and learning experiences** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 1-10; Final / Goals 1-10; Lab Exercises / Goals 1-10 |

**D. Adaptability Skills**

| |
|---|
| **D1. by working independently or as part of team** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 1, 2, 5, 6, 8, 9, 10; Final / Goals 1, 2, 5, 6, 8, 9, 10; Lab Exercises / Goals 1-10 |
| **D2. by carrying out multiple tasks or projects** |
| **Evaluation(s)/Goal(s):** Assignments / Goals 1-10 |
| **D3. by being innovative and resourceful: identify and suggest alternative ways to get the job done** |
| **Evaluation(s)/Goal(s):** Assignments / Goal 7, 8, 9, 10 |
| **D4. by being open and respond constructively to change and uncertainty** |
| **Evaluation(s)/Goal(s):** Assignments / Goal 4, 8, 9, 10 |

**E. Positive Attitude and Behavioural Skills**

| |
|---|
| **E1. by dealing with people, problems, and situations with honesty, integrity, and personal ethics** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 4, 9, 10; Final / Goals 4,9,10; Lab Exercises / Goals 4, 9, 10 |
| **E2. by showing interest, initiative, and effort** |
| **Evaluation(s)/Goal(s):** Midterm / Goals 1-10; Final / Goals 1-10; Lab Exercises / Goals 1-10 |
| **E3. by affirming the need for positive solutions and encourage positive interaction and feedback** |
| **Evaluation(s)/Goal(s):** Lab Exercises / Goal 10 |
| **E4. by balancing personal and family activities with job-related activities** |
| **Evaluation(s)/Goal(s):** NA |

## 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:

1. Overview of ecological restoration
    - ecosystem characteristics and components
    - processes of ecosystem formation
    - identifying ecosystem function and function indices
    - defining restoration
2. Understanding disturbance
    - differences between natural and human impacts
    - characteristics of disturbances- industrial and natural
    - characteristics of degraded landscapes
3. Pre-Disturbance Planning
    - conducting site evaluations
        - ecological components including abiotic and biotic features
        - socioeconomical components including land owners, communities and societal values

- understanding regulations and restoration
    - Provincial regulations, codes of practice and guidelines applicable in restoration
    - Regional and municipal regulations applicable in restoration
- determining end land use objectives
    - establishing distinct measureable goals and objectives to achieve successful restoration

4. Site and element conservation
    - minimum disturbance planning and use
        - what is minimal disturbance, when and where can it be used
    - salvaging native materials
        - native plant salvage and handling
        - soil salvage and handling
5. Site preparation characteristics and management
    - assessing physical, chemical and biological properties of interest following disturbance removal
    - ensuring site stability and planting potential
    - assessing invasive plant pathways of entry and prevention
6. Introduction to establishing native communities
    - using native plants and seed mixes
    - designing seed mixes and vegetation communities
    - seeding and planting techniques
    - timing of vegetation collection and establishment
    - role of keystone species plant and wildlife
7. Managing and monitoring the establishment of plant communities
    - decision making for what to manage and monitor
    - techniques for monitoring and management
    - how to evaluate success

Laboratory:

The labs in this course emphasize field tours and exercises. As such, changes in scheduling may occur due to inclement weather, changes to the schedule of the host, restrictions to site access, availability of specific projects on any given year, etc. The actual lab tours and exercises are not restricted but may include the following:

1. Inventory of reference ecosystems
2. Detailed Site Assessment and Rare Species Inventory
3. Invasive species inventories, mapping and control
4. Monitoring and evaluation of restoration projects
5. Calculating seed mixes and purchasing plant material
6. Native seed collection and planting techniques
7. Large and hand held field equipment use and calibration
8. Native grassland restoration
9. Habitat restoration for rare and threatened species
10. Restoration of wetland and riparian habitats
11. Restoration of oil and gas development
12. Restoration of mined landscapes


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