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Ecological Restoration Professional Specialization Certificate

(offered jointly by the School of Environmental Studies in the Faculty of Social Sciences and the Division of Continuing Studies)

ER 502: Ecosystem Design through Propagation of Native Plants Course Outline

Course Description:

This is an advanced course on ecosystem design that considers the ecology and reproductive biology of plants when restoring ecosystems. It examines the principles and ethics of native plant selection, harvesting and propagation to meet site-specific design objectives such as which species need to be closely matched genetically (geographically) for the propagated stock.

Other course topics include pollinators, peripheral populations, dispersal agents and hybridization. Implications for green or living roofs and the impact of climate change are also explored. The course includes an overview of the goals and foundations of ecological restoration and how restoration nurseries grow appropriate restoration species.

Course Goals:

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

- demonstrate an understanding of the principles and concepts of ecological design for restoration or habitat creation;
- describe the objectives and expectations of different types of ecological design and the role of native plant propagation in such projects (from ecosystem restoration and green infrastructure projects to backyard habitat and living roofs);
- demonstrate an understanding of the role of appropriate plant species selection and propagation in ecological design;
- explain the interdependency of ecological factors related to plant survival: micro-climate, pollinators and pollenizers, seed dispersal, competition;
- analyze natural ecological processes in relation to human design values;
- develop integrated strategies for creating regionally appropriate ecological planting designs;
- analyze designs for ecosystem functions: water retention, bio-filtration, biodiversity, connectivity;

- identify suitable plants and plant selection criteria for different landscape design scenarios: forest, wetland, meadow, roof; and
- prepare a planting design and management/maintenance plan.

Learning Outcomes:

The following learning outcomes provide further detail regarding how the course goals will be accomplished:

Course Unit	Learning Outcomes
Unit 1: Definitions and Fundamentals Review	Upon completing this unit, students will have a working understanding of: • the language, definitions, and fundamentals of ecosystem restoration and ecological landscape design; and • native plant uses, their advantages and issues in design, and scientific/ethical principles for their collection, propagation and use.
Unit 2: Biodiversity: Policy, Legislation & Rules	Upon completing this unit, students will be able to: • explain the overarching international conventions and obligations that guide ecosystem restoration and ecological design; • list the policy, legislation and rules that provide guidance for ecosystem restoration and ecological landscape design; and • describe how these high level instruments connect to local projects.
Unit 3: Species at Risk, Ecosystems at Risk, Invasive Species	Upon completing this unit, students will be able to: • locate information about species at risk; • locate information about ecosystems at risk; • locate information about invasive species; and • read recovery strategies and management plans for species and ecosystems at risk as guidance for restoration design.
Unit 4: Ecological Design Principles	Upon completing this unit, students will be able to: • discuss the principles and concepts of ecological design for restoration or habitat creation; • determine the right plant for the right place, including when cultivars and non-natives are appropriate;

	• describe the principles of biodiversity as they relate to ecological design: resilience, regeneration, ecosystem health, adaptation, novel ecosystems, biomimicry, climate change; and • demonstrate how to move from an idea to a working design.
Unit 5: Integrating Design with Scientific Restoration Objectives	Upon completing this unit, students will be able to: • discuss landscape dynamics and scale as they relate to design: matrix, corridors, patches, edges, and boundaries (ecotones); • integrate ecosystem restoration design with urban green infrastructure objectives, including: sewage and stormwater management, open space, transportation corridors, rain gardens, low impact development (LID); • apply the landscape design process, including: site selection, inventory & analysis, design concept, site design, planting plans, costing, construction, maintenance, adaptive management, monitoring, stewardship; and • reconcile different agency/stakeholder goals and objectives for a site, including competing and conflicting issues with more than one species at risk • explain how a design charette works.
Unit 6: Plant Reproduction Strategies	Upon completing this unit, students will have a working understanding of: • fundamental requirements for integrating "whole ecosystem" thinking into ecological planning and design as they affect plant growth & survival: open/closed systems, soils, micro-climates, eco-niches, habitat, mycorrhizal associations, plant-plant, plant-animal and plant-insect associations; • *phenology*: how climate change is affecting ecotypes and selection of plant material from nurseries, missing pollinators through out-of-sync flowering; • vegetative (asexual) reproduction types, cultivars, loss of genetic diversity by using clones; • seeds and sexual reproduction; • microhabitat, microsites, suitable sites for germination; • generalists vs specialists; • inoculants – protecting local soil flora by using native soil to inoculate instead of importing generic AM -

	Arbuscular Mycorrhizae or other mycorrhizae; and • fertilizer management after planting to propagate in the best growing medium.
Unit 7: Plant Suitability for Ecological Planting Designs	Upon completing this unit, students will be able to: • analyze natural processes in relation to human and social values; • understand natural succession; • review role of volunteer plants and weed species in enhancing design; • explore regional plant communities and develop strategies for creating design diversity; • investigate the Garry Oak (savannah woodlands), Coastal Bluffs, Grasslands /Prairie, Desert and Sub-alpine Ecosystems in detail, find key native species for propagation by ecological zone; • examine habitat requirements, plant associations & ecosystem functions; • investigate plant canopy complexity and cover, eco-niches and individual plants; • review basic and complex species mixes; • determine plant availability for projects: timing for commercial propagations, provenance stratification, scarification, lead time to reach planting day; and • evaluate design and plant survivorship.
Unit 8: Turning a Green Roof into a Living Roof	Upon completing this unit, students will be able to: • explain the difference between a green roof and a living roof; • describe the integrated design process (IDP) and the role an ecosystem restoration specialist might play in designing and building a roof ecosystem that complements restoration on ground; • demonstrate an understanding of green roof systems, including: intensive, extensive, & hybrid; the materials they are constructed from; the limitations of each system type in terms of supporting plant life; • determine environmental factors that influence design and plant selection; • describe the limitations and opportunities for designing habitat for an extensive green roof system; • understand how to design, modify, and amend the growing medium to create the best soil environments for selected plant species; • create surrogate rooftop habitat for ground nesting

	species, invertebrates, and plant species at risk; and • discuss the fundamentals of green façade and living wall systems and how through planting design they can increase biodiversity and complement restoration on ground.
Unit 9: Preparing Planting Plans	Upon completing this unit, students will be able to: • create a planting design that demonstrates knowledge of individual plant species ecology and community ecology – right plant right place; • determine when simple vs complex planting designs are more appropriate; • create a planting design that understands plant composition by addressing habitat relationships; • create a planting design that demonstrates functional and aesthetic values; and • describe how to get from concept to a design that works.
Unit 10: Implementing Design: Construction & Planting	Upon completing this unit, students will have a working understanding of: • sourcing plant material from commercial nurseries: What if you need 500,000 seedling plugs for a project? How far afield do you go for plant material? Who/where are the reputable growers?; • CFIA - certified/ inspected plants; • seed mixes: off-the shelf selection, custom blends, seed grading, industry standards for seeds; • outsourcing propagation of hand-collected seed to a commercial grower, provenances, substitutions, timing; • site preparation, soil amendments such as mycorrhizal fungi inoculation, pH adjustment, fertilizer, biochar, hydrogels; • how to select from the different approaches to plant size (seed, plug, container, trays, mats) in order to implement design in an economically viable way; • terraseeding & hydroseeding; and • training a work crew to prepare the site and plant for successful establishment.
Unit 11: Plant Specifications, Planting Techniques & Cost Evaluation	Upon completing this unit, students will have a working understanding of: • industry standards for high quality nursery grown

	material – when to use them and when not; • how to develop a detailed project spreadsheet that links to the planting plan and allows for evaluation for different plant establishment methods (e.g. seed vs container plants); • the parameters of plant establishment methods; • how to calculate area and number of plants required for different establishment methods (seed, plugs, containers); and • how to use a cost comparative spreadsheet for each establishment method including labour.
Unit 12: Good Practices	Upon completing this unit, students will be able to: • understand the difference between "best" and "good" practices; • evaluate plant establishment methods; • demonstrate an understanding of site maintenance and management; • understand the essentials for preparing maintenance and management plans; • determine monitoring needs for both short term establishment & long-term stewardship; • develop a record keeping system to document plant accession information and field-monitoring of plant and design success at sites; and • know when to "let go" of your design and let nature take over – self-seeding, spontaneous colonization, etc.

Course Format:

Online Moodle-based format over a 14-week period, requiring 8-10 hours of weekly coursework.

Course Materials:

Course materials consist of one textbook (*Principles of Ecological Landscape Design* by Travis Beck) and online readings available on the course website and through the Uvic library reserve system.