UNIVERSITY OF CALGARY | FACULTY OF SCIENCE

BSc in ECOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

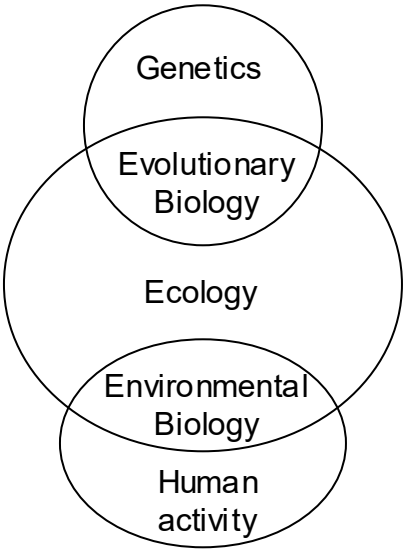
EXECUTIVE SUMMARY
DECEMBER 2016

Overview and Context of the Ecology Program

The diversity of life is one of the most remarkable features of Earth. Over 3,000,000 species have been described, although many scientists agree that number represents just a fraction of the total biodiversity of the plan. Some species (e.g., humans and ferns) occupy much of the planet, but most species have limited ranges. Even so, no species lives in isolation, but instead provides other species with a resource, a competitor, a parasite, a predator, a helper. Evidence is accumulating that biodiversity loss has a significant impact on humanity.

The diversity of life raises a number of questions. How and why do species multiply, or become extinct? How do we explain the remarkable fits observed between organisms and their environment? What happens when that environment changes? How do we explain the rapid rise of antibiotic-resistant germs that the United Nations has stated represents a fundamental threat to global health and safety?

The disciplines of ecology and evolutionary biology provide scientific approaches to answering these questions. *Ecology* seeks to explain how organisms respond to all aspects of their environment, including physical and chemical conditions, and other individuals of the same or different species. In contrast, evolutionary biology considers how ecological responses cause genetic change in the characteristics of species, and the number and variety of species.



The Ecology program teaches students about the ecological and evolutionary principles that apply generally to many organisms in different circumstances. These principles incorporate ideas from many disciplines, including mathematics, chemistry, physics, economics, psychology, and geography. Based on these concepts, ecologists find solutions to specific ecological, evolutionary and environmental problems, regardless of whether they involve a single species or an entire ecosystem. For these reasons, the Ecology program courses are often subscribed by other students in the Biological Sciences and in other areas of Arts (e.g., Anthropology/Primatology), Kinesiology, and Science (Mathematics, Geosciences). Our students graduate with an appreciation of variation as a feature of nature and with a skill set that enables them to isolate and understand the variation associated with ecological and evolutionary processes. This skill set includes knowing how the techniques of mathematics, experimental design, and statistics can be applied to analyze ecological and evolutionary questions.

Students pursuing a degree in Ecology have the option of pursuing an Honours degree or a Co-Op degree. All Ecology majors take nine courses which build a foundation of modern concepts and techniques in all aspects of ecology (including environmental biology) and evolutionary biology. Five of these courses consider the breadth of ecology and evolutionary biology, including the ecological interactions of individual organisms (Ecol. 429), populations (Ecol. 439) and aquatic and terrestrial communities and ecosystems (Ecol. 417 and 419), the evolutionary processes responsible for biological diversity (Biol. 401), and genomic methods that can test predictions associated with this theory (Ecol. 529). Ecology students investigate these perspectives in a natural context during a field course (Ecol. 413 or an MRSC equivalent at the BMSC). During two additional courses (Biol. 315, Ecol. 425) students

learn to apply mathematical and statistical techniques to formulate mathematical models of nature, design studies and analyze numerical results. Students have the option to complete the required portion of their Ecology program with a class-project course (Ecol. 501) that allows them to apply their understanding of ecological and evolutionary concepts and their analytical skills to investigate selected ecological and evolutionary problems in detail. The second objective of the Ecology program is to allow each student to develop the perspective on ecology and evolutionary biology that best serves their own objectives. Available options from the field include courses that focus on specific organisms or environments and courses that provide individual research experience. In addition, students can use their non-science options to broaden their view of the interaction between human activity and nature (e.g., Economics, Geography, Philosophy).

Guiding Questions

The following critical questions and concerns were used to guide the curriculum review process: Questions 1 and 2 were formulated by the Undergraduate Programs Curriculum Committee of the Biological Sciences Department, and approved by Department Council. Questions 3 and 4 are questions asked by all programs in the Faculty of Science.

1. How well do the BioCore courses prepare students for senior courses in each program?
(The BioCore courses refer to a common set of first- and second-year core courses completed by students in all programs).

2. In considering courses in each program outside of the BioCore courses: **Is course material properly scaffolded throughout the program to best prepare students to meet requirements?** (i.e., to what extent do the content and expectations of later courses build upon the content and expectations of earlier courses?) Are there gaps in the curriculum, in the order in which material is delivered or in the level of expectations as student progress from one course to another?

3. Are High Impact Practices being used regularly in each program?
High-Impact Practices (HIPs) share several traits: They generally demand considerable time and effort, facilitate learning outside of the classroom, require meaningful interactions between faculty and students, encourage collaboration with diverse others, and provide frequent and substantive feedback. Examples of HIPs include, but are not limited to:

- Learning community or some other formal program where groups of students take two or more classes together
- Courses that included a community-based project (service-learning)
- Work with a faculty member on a research project
- Internship, co-op, field experience, student teaching, or clinical placement
- Study abroad
- Culminating senior experience (capstone course, senior project or thesis, comprehensive exam, portfolio, etc.)

4. If HIPs are not being used regularly in each program, what is preventing these practices from being used?

Action Plan

To address the guiding questions, data were collected from academic staff s teaching in the Plant Biology program as well as from both current students and alumni. We also used data from the 2014 National Survey of Student Engagement, as well as data provided by the Office of Institutional Analysis, University of Calgary. The action plan below was developed based on information from those sources, and outlines how the Plant Biology program will address the findings of this review, to enhance student learning and strengthen the program in the interval between curriculum reviews.

The following chart outlines the recommendations, specific action items, the individual/team responsible, and the timeline for implementation.

Recommendation	Action Item	Who is Responsible?	Due Date
Redevelopment of the Ecology Curriculum	Develop a Curriculum that meets the needs of current and future Ecology students.	Ecology Program Chair and Ecology faculty	Short term (1-2 years)
	Consider strategies to improve access to courses in the upper levels of the Ecology program for students	Academic Coordinators & Associate Head (Undergraduate); Course Instructors	Short Term
	Improve program outcome for identifying and classifying local biota to explore natural history,	Ecology Program Chair, Ecology faculty.	Short Term
	Compare and evaluate mapping data from current “options from the field, including Marine Science, Medical Science, Geoscience, Plant Biology, Zoology, and certain 600 level courses” with our Ecology program level outcomes.	Department Head, Dean	Short term
	Consider development of a new upper level course in Calculus for Biologists considering the Ecology Program and BioSci outcomes of links between math and biology.	Ecology faculty, Department Head, Dean	Ongoing
	Advocate to hire additional faculty hires that will complement these	Ecology Faculty, Department Head, Dean	

	objectives and improve teaching in Ecology and Biosciences program		Ongoing
Expansion of experiential learning opportunities within the ECOL program curriculum	Advocate for a field experience	Biological Sciences Program Chair, Department Head, Dean	Long term, ongoing
	Advocate for modern lab equipment and spaces that promotes experiential learning, including the Ecological Reserve.	Biological Sciences Program Chair, Department Head, Dean	Long term, ongoing
Expansion of high-impact practices within the Ecology program curriculum	Provide additional support (teaching relief, TAs, etc.) for courses where high impact practices are currently occurring	Department Head, Dean	Long term, ongoing
	Evaluate constraints to implementation of HIPs	Department Head, Dean, Ecology Program Chair	Long term
	Advocate to hire additional faculty hires to help achieve these outcomes	Ecology faculty, Dept Head, Dean	Long term