

# 2017-2018 Undergraduate Calendar

The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2017-2018 academic year, including the Summer Semester 2017, the Fall Semester 2017 and the Winter Semester 2018.

For your convenience the Undergraduate Calendar is available in PDF format.

If you wish to link to the Undergraduate Calendar please refer to the Linking Guidelines.

The University is a full member of:

- The Association of Universities Canada

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UNIVERSITY  
of GUELPH

CHANGING LIVES  
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# Disclaimer

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## University of Guelph 2017

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The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2017-2018 academic year, including the Summer Semester 2017, the Fall Semester 2017 and the Winter Semester 2018.

The University reserves the right to change without notice any information contained in this calendar, including fees, any rule or regulation pertaining to the standards for admission to, the requirements for the continuation of study in, and the requirements for the granting of degrees or diplomas in any or all of its programs. The publication of information in this calendar does not bind the University to the provision of courses, programs, schedules of studies, or facilities as listed herein.

The University will not be liable for any interruption in, or cancellation of, any academic activities as set forth in this calendar and related information where such interruption is caused by fire, strike, lock-out, inability to procure materials or trades, restrictive laws or governmental regulations, actions taken by faculty, staff or students of the University or by others, civil unrest or disobedience, public health emergencies, or any other cause of any kind beyond the reasonable control of the University.

In the event of a discrepancy between a print version (downloaded) and the Web version, the Web version will apply.

Published by: Enrolment Services

## Introduction

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### Collection, Use and Disclosure of Personal Information

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Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes. Certain personal information is disclosed to external agencies, including the Ontario Universities Application Centre, the Ministry of Advanced Education and Skills Development, and Statistics Canada, for statistical and planning purposes, and is disclosed to other individuals or organizations in accordance with the Office of Registrarial Services Departmental Policy on the Release of Student Information. For details on the use and disclosure of this information call the Office of Registrarial Services at the University at (519) 824-4120 or see <http://www.uoguelph.ca/registrar/registrar/index.cfm?index>.

### Disclosure of Personal Information to the Ontario Ministry of Advanced Education and Skills Development

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The University of Guelph is required to disclose personal information such as characteristics and educational outcomes to the Minister of Training, Colleges and Universities under s. 15 of the Ministry of Advanced Education and Skills Development Act, R.S.O. 1990, Chapter M.19, as amended. The Ministry collects this data for purposes including but not limited to planning, allocating and administering public funding to colleges, universities and other post-secondary educational and training institutions.

Amendments made to the Ministry of Advanced Education and Skills Development Act, authorizing the collection and use of personal information from colleges and universities by the Minister of Training Colleges and Universities, which were set out in Schedule 5 of the Childcare Modernization Act, 2014, came into force on March 31, 2015.

The amendments strengthen the ability of the Minister to directly or indirectly collect and use personal information about students as required to conduct research and analysis, including longitudinal studies, and statistical activities conducted by or on behalf of the Ministry for purposes that relate to post-secondary education and training, including,

- i. understanding the transition of students from secondary school to post-secondary education and training,
- ii. understanding student participation and progress, mobility and learning and employment outcomes,
- iii. understanding linkages among universities, colleges, secondary schools and other educational and training institutions prescribed by regulation,
- iv. understanding trends in post-secondary education or training program choices made by students,
- v. understanding sources and patterns of student financial resources, including financial assistance and supports provided by government and post-secondary educational and training institutions,
- vi. planning to enhance the affordability and accessibility of post-secondary education and training and the quality and effectiveness of the post-secondary sector,
- vii. identifying conditions or barriers that inhibit student participation, progress, completion and transition to employment or future post-secondary educational or training opportunities, and
- viii. developing key performance indicators.

Information that the University is required to provide includes but is not limited to: first, middle and last name, Ontario Educational Number, citizenship, date of birth, gender, first three digits of a student's postal code, mother tongue, degree program and major(s) in which the student is enrolled, year of study and whether the student has transferred from another institution.

Further information on the collection and use of student-level enrolment-related data can be obtained from the Ministry of Training Colleges and Universities website: <https://www.ontario.ca/page/ministry-advanced-education-and-skills-development> (English) or <https://www.ontario.ca/fr/page/ministere-de-lenseignement-superieur-et-de-la-formation-professionnelle> (French) or by writing to the Director, Postsecondary Finance and Information Management Branch, Postsecondary Education Division, 7th Floor, Mowat Block, 900 Bay Street, Toronto, ON M7A 1L2.

An update on Institutional and Ministry of Advanced Education and Skills Development Act Notice of Disclosure Activities is posted at <https://www.ontario.ca/page/ministry-advanced-education-and-skills-development>

Frequently Asked Questions related to the Ministry's enrolment and OEN data activities are also posted at: <http://www.tcu.gov.on.ca/peps/publications/NoticeOfCollection.pdf>

#### Authority to Disclose Personal Information to Statistics Canada

The Ministry of Advanced Education and Skills Development discloses student-level enrolment-related data it collects from the colleges and universities as required by Statistics Canada in accordance with Section 13 of the Federal Statistics Act. This gives Ministry of Advanced Education and Skills Development Act authority to disclose personal information in accordance with s. 42(1) (e) of FIPPA

### Notification of Disclosure of Personal Information to Statistics Canada

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For further information, please see the Statistics Canada's web site at <http://www.statcan.ca> and Section XIV Statistics Canada.

### Address for University Communication

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Depending on the nature and timing of the communication, the University may use one of these addresses to communicate with students. Students are, therefore, responsible for checking all of the following on a regular basis:

#### Email Address

The University issued email address is considered an official means of communication with the student and will be used for correspondence from the University. Students are responsible for monitoring their University-issued email account regularly. See Section I--Statement of Students' Academic Responsibilities for more information.

#### Home Address

Students are responsible for maintaining a current mailing address with the University. Address changes can be made, in writing, through Enrolment Services.

### Name Changes

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The University of Guelph is committed to the integrity of its student records, therefore, each student is required to provide either on application for admission or on personal data forms required for registration, his/her complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution or addition, must be accompanied by appropriate supporting documentation.

### Student Confidentiality and Release of Student Information Policy Excerpt

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The University undertakes to protect the privacy of each student and the confidentiality of his or her record. To this end the University shall refuse to disclose personal information to any person other than the individual to whom the information relates where disclosure would constitute an unjustified invasion of the personal privacy of that person or of any other individual. All members of the University community must respect the confidential nature of the student information which they acquire in the course of their work.

Complete policy at <https://uoguelph.civicweb.net/document/68892/ORSInfoReleasePolicy060610.pdf?handle=FF982F8A9AEA4076BE4F3D88147172B8>.

# Learning Outcomes

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On December 5, 2012, the University of Guelph Senate approved five University-wide Learning Outcomes as the basis from which to guide the development of undergraduate degree programs, specializations and courses:

1. Critical and Creative Thinking
2. Literacy
3. Global Understanding
4. Communicating
5. Professional and Ethical Behaviour

These learning outcomes are also intended to serve as a framework through which our educational expectations are clear to students and the broader public; and to inform the process of outcomes assessment through the quality assurance process (regular reviews) of programs and departments.

An on-line guide to the learning outcomes, links to the associated skills, and detailed rubrics designed to support the development and assessment of additional program and discipline-specific outcomes, are available for reference on the [Learning Outcomes website](#).

## 1. Critical and Creative Thinking

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Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems in with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome show evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome.

In addition, **Critical and Creative Thinking** includes, but is not limited to, the following outcomes: **Inquiry and Analysis; Problem Solving; Creativity; and Depth and Breadth of Understanding.**

## 2. Literacy

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Literacy is the ability to extract information from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.

In addition, **Literacy** includes, but is not limited to, the following outcomes: **Information Literacy, Quantitative Literacy, Technological Literacy, and Visual Literacy.**

## 3. Global Understanding:

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Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.

In addition, **Global Understanding** includes, but is not limited to, the following outcomes: **Global Understanding, Sense of Historical Development, Civic Knowledge and Engagement, and Intercultural Competence.**

## 4. Communicating

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Communicating is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communicating also comprises attentiveness and listening, as well as reading comprehension. It includes the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.

In addition, **Communicating** includes, but is not limited to, the following outcomes: **Oral Communication, Written Communication, Reading Comprehension, and Integrative Communication.**

## 5. Professional and Ethical Behaviour

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Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organizational and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome.

In addition, **Professional and Ethical Behaviour** includes, but is not limited to, the following outcomes: **Teamwork, Ethical Reasoning, Leadership, and Personal Organization and Time Management**

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# Bachelor of Science in Environmental Sciences

## [B.Sc.(Env.)]

### Program Information

#### Objectives of the Program

The Environmental Sciences program is designed to provide a strong interdisciplinary grounding in specific environmental sciences including the socioeconomic context in which environmental issues are resolved.

There is an emphasis on management and decision-making skills for the application of scientific knowledge to environmental problems, and the evaluation of appropriate environmental policies. A practical perspective based on defining and resolving problems is central to the program, and this is often done in the context of group work.

Substantial emphasis is placed on communication skills, including the development of competence in both written and oral presentations. These skills will be progressively developed in core courses from the first to the fourth year. Students in the final year of their program will be expected to take part in more intensive communication skill development. Graduates will seek employment in a range of fields, from government agencies to private industry and research.

#### Academic Counselling

General information on the degree program is available from the Program Counsellor. Advising for each major is available through the assigned faculty advisor responsible for the major. Students are encouraged to seek the advice of the faculty advisors when choosing restricted electives and planning course selections.

#### Degree

The degree granted for the successful completion of this honours program will be the Bachelor of Science in Environmental Sciences--B.Sc.(Env.).

#### Continuation of Study

Students are advised to consult the regulations for Continuation of Study in Section VIII--Undergraduate Degree Regulations and Procedures of this Calendar.

#### Conditions for Graduation

In order to graduate from the B.Sc.(Env.) program, students must successfully complete a minimum of 20.00 credits including all the stated course requirements for the program. As well, students must achieve a cumulative average of 60% or higher over all course attempts.

#### Environmental Sciences (Co-op)

A 5-year Honours Program in Environmental Sciences is offered as a Co-operative Education Program. This option is offered within the B.Sc. (Env.) degree and is available to all majors. The course requirements are the same as those listed for the regular B.Sc. (Env.) program, by the Co-operative Education Program and as outlined in the Continuation of Study policy (Section VIII--Undergraduate Degree Regulations & Procedures).

3 co-op work terms (COOP\*1000, COOP\*2000, COOP\*3000) are required. An optional 4th co-op work term (COOP\*4000) is available. COOP\*1100 must be completed during semester 2.

#### Environmental Sciences Co-op Work Term Schedule

Year	Fall	Winter	Summer
1	Academic Term 1	Academic Term 2	Off
2	Academic Term 3	COOP*1000	Academic Term 4
3	COOP*2000	Academic Term 5	COOP*3000
4	Academic Term 6	Academic Term 7	COOP*4000 (Optional)
5	Academic Term 8	N/A	N/A

Since some of the course requirements in the degree program (core or major) are not offered each semester, careful planning and program consultation with the Faculty Co-op Advisor is essential. In particular, students are encouraged to seek advice when choosing for their Summer academic semester.

#### The Environmental Sciences Program

The degree in Environmental Sciences consists of a minimum of 20.00 credits, as follows:

1. 7.00 Environmental Sciences Core
2. 8.50 - 11.00 Environmental Sciences prescribed and restricted electives according to major.
3. free electives\*

Within these courses, students must include at least 6.00 credits at the 3000 or 4000 level, and no program may include more than 7.00 credits at the 1000 level.

\* There are not specific subject requirements for the elective courses, however, you may NOT select the following: BIOL\*1500, BOT\*1200, CHEM\*1100, CIS\*1000, ENVS\*1060, GEOL\*1100, MICR\*1020, MBG\*1000, PHYS\*1600.

Please note that not all courses in the "One of:" options are available each semester (F, W, S). Students are encouraged to seek advice from the appropriate advisor when selecting and scheduling courses.

#### First Year Curriculum

The first year courses have been selected to provide students with sufficient background and knowledge to enter any one of the Environmental Sciences majors.

##### Semester 1

BIOL*1070	[0.50]	Discovering Biodiversity
CHEM*1040	[0.50]	General Chemistry I
ENVS*1030	[1.00]	Introduction to Environmental Sciences
MATH*1080	[0.50]	Elements of Calculus I

##### Semester 2

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
FARE*1040	[1.00]	Intro to Environmental Economics, Law & Policy
GEOG*1300	[0.50]	Introduction to the Biophysical Environment

**Note:** Co-op students must select COOP\*1100 Introduction to Co-operative Education

#### Environmental Sciences Core

In addition to the common first year curriculum, students are required to take the following core Environmental Sciences courses in the semesters recommended in the schedule of studies:

ENVS*4001	[0.50]	Project in Environmental Sciences
ENVS*4002	[0.50]	Project in Environmental Sciences

One of:

ECON*2100	[0.50]	Economic Growth and Environmental Quality
FARE*2700	[0.50]	Survey of Natural Resource Economics
GEOG*3210	[0.50]	Management of the Biophysical Environment

A required statistics course is prescribed by the student's choice of major.

#### Environmental Sciences Majors

Ecology

Environment and Resource Management

Environmental Economics and Policy

Environmental Sciences

Requirements for each of these majors are described in the detailed schedules of studies below.

#### Ecology (ECOL)

##### Department of Integrative Biology, College of Biological Science

This program provides a solid foundation in the principles of ecology, training in both pure and applied aspects of ecology and an introduction to economic, legal and policy issues related to the management of the environment. From the 2nd year on, students increasingly augment the core in ecology and policy with extensive restricted electives choices that allow the student to tailor the program to their interests. The major provides a sound science background for careers in conservation, resource management, ecological consulting, or nature interpretation used in teaching, government, non-government or the private sector; or for further post-graduate training in fundamental ecology, environmental biology and environmental management or policy.

#### Major

##### Semester 1

BIOL*1070	[0.50]	Discovering Biodiversity
CHEM*1040	[0.50]	General Chemistry I
ENVS*1030	[1.00]	Introduction to Environmental Sciences
MATH*1080	[0.50]	Elements of Calculus I

##### Semester 2

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
FARE*1040	[1.00]	Intro to Environmental Economics, Law & Policy
GEOG*1300	[0.50]	Introduction to the Biophysical Environment

##### Semester 3

BIOL*2060	[0.50]	Ecology
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One of:

PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1300	[0.50]	Fundamentals of Physics

One of:

ECON*2100	[0.50]	Economic Growth and Environmental Quality
FARE*2700	[0.50]	Survey of Natural Resource Economics

1.00 electives or restricted electives

**Note:** Students lacking 4U physics or equivalent must take PHYS\*1300. Students with 4U physics or equivalent must take PHYS\*1080. PHYS\*1130 may be substituted for PHYS\*1080 and would be taken in a Winter semester.

**Note:** GEOG\*3210 may be substituted for ECON\*2100 or FARE\*2700 and would be taken in semester 5.

**Semester 4**

BIOC*2580	[0.50]	Introduction to Biochemistry
BIOL*2400	[0.50]	Evolution
MBG*2040	[0.50]	Foundations in Molecular Biology and Genetics
STAT*2230	[0.50]	Biostatistics for Integrative Biology

0.50 electives or restricted electives

**Semester 5**

BIOL*3010	[0.50]	Laboratory and Field Work in Ecology
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One of:

BOT*2100	[0.50]	Life Strategies of Plants
ZOO*3600	[0.50]	Comparative Animal Physiology I

One of:

BOT*3410	[0.50]	Plant Anatomy
ZOO*2090	[0.50]	Vertebrate Structure and Function

1.00 electives or restricted electives

**Note:** ZOO\*2700 may be substituted for BOT\*3410 or ZOO\*2090 and would be taken in semester 6.**Semester 6**

BIOL*3060	[0.50]	Populations, Communities & Ecosystems
BIOL*3130	[0.50]	Conservation Biology

1.50 electives or restricted electives

**Semester 7**

ENVS*4001	[0.50]	Project in Environmental Sciences
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2.00 electives or restricted electives

**Semester 8**

ENVS*4002	[0.50]	Project in Environmental Sciences
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2.00 electives or restricted electives

**Note:** See note in semester 7.**Restricted Electives**

Students are required to take 5.50 restricted credits in Ecology as noted below. Of these, at least 1.00 credits must be at the 4000 level.

1. A minimum of 0.50 credits from:

BIOL*4150	[0.50]	Wildlife Conservation and Management
CIS*1500	[0.50]	Introduction to Programming
GEOG*2420	[0.50]	The Earth From Space
GEOG*2480	[0.50]	Mapping and GIS
GEOG*3420	[0.50]	Remote Sensing of the Environment *
GEOG*3480	[0.50]	GIS and Spatial Analysis *
GEOG*4480	[1.00]	Applied Geomatics *

\* Additional prerequisites are required.

2. Students in the Ecology Major are required to take an additional 5.00 restricted elective credits from the following lists. Some courses may require other courses from the list as prerequisites.

Ecology

ANSC*3180	[0.50]	Wildlife Nutrition
BIOL*3450	[0.50]	Introduction to Aquatic Environments
BOT*3050	[0.50]	Plant Functional Ecology
ENVS*2030	[0.50]	Meteorology and Climatology
ENVS*3010	[0.50]	Climate Change Biology
ENVS*3270	[0.50]	Forest Biodiversity
ENVS*3290	[0.50]	Waterborne Disease Ecology
ENVS*4350	[0.50]	Forest Ecology
GEOG*2000	[0.50]	Geomorphology
GEOG*2110	[0.50]	Climate and the Biophysical Environment
GEOG*3000	[0.50]	Fluvial Processes
GEOG*3610	[0.50]	Environmental Hydrology
NUTR*3210	[0.50]	Fundamentals of Nutrition
ZOO*4570	[0.50]	Marine Ecological Processes

Conservation

BIOL*4120	[0.50]	Evolutionary Ecology
BIOL*4150	[0.50]	Wildlife Conservation and Management
BIOL*4350	[0.50]	Limnology of Natural and Polluted Waters
ENVS*2040	[0.50]	Plant Health and the Environment
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3000	[0.50]	Nature Interpretation
ENVS*3010	[0.50]	Climate Change Biology
GEOG*2480	[0.50]	Mapping and GIS
GEOG*3020	[0.50]	Global Environmental Change
GEOG*3110	[0.50]	Biotic and Natural Resources
GEOG*3210	[0.50]	Management of the Biophysical Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis
GEOG*4110	[1.00]	Environmental Systems Analysis
GEOG*4230	[0.50]	Environmental Impact Assessment
GEOG*4480	[1.00]	Applied Geomatics

## Policy, Law and Management

BIOL*4500	[0.50]	Natural Resource Policy Analysis
ECON*2100	[0.50]	Economic Growth and Environmental Quality
FARE*2700	[0.50]	Survey of Natural Resource Economics
GEOG*2210	[0.50]	Environment and Resources
GEOG*4210	[0.50]	Environmental Governance
GEOG*4220	[0.50]	Local Environmental Management
PHIL*2070	[0.50]	Philosophy of the Environment
POLS*3370	[0.50]	Environmental Politics and Governance
Independent Research and Field Courses		
BIOL*4410	[0.75]	Field Ecology
BIOL*4700	[0.50]	Field Biology
BIOL*4710	[0.25]	Field Biology
BIOL*4800	[0.50]	Field Biology
BIOL*4810	[0.25]	Field Biology
ENVS*3410	[0.50]	Independent Research I
ENVS*3420	[0.50]	Independent Research II
ENVS*3430	[1.00]	Independent Research
IBIO*4500	[0.75]	Research in Integrative Biology I
IBIO*4510	[0.75]	Research in Integrative Biology II
IBIO*4521	[1.00]	Thesis in Integrative Biology
IBIO*4522	[1.00]	Thesis in Integrative Biology
ZOO*4300	[0.75]	Marine Biology and Oceanography

**Credit Summary (20.00 Total Credits)**

7.00 credits - Environmental Sciences core

5.00 credits - Ecology Required courses

5.50 credits - Ecology Restricted electives

2.50 credits - Free electives

Students are reminded that 6.00 credits of their B.Sc. (Env.) degree must be at the 3000-4000 level.

Students are encouraged to seek advice on their choices from their faculty advisor. With prior approval, students may be able to use courses not on these lists towards their Ecology restrictive electives.

**Ecology (ECOL:C)****Department of Integrative Biology, College of Biological Science**

This program provides a solid foundation in the principles of ecology, training in both pure and applied aspects of ecology and an introduction to economic, legal and policy issues related to the management of the environment. From the 2nd year on, students increasingly augment the core in ecology and policy with extensive restricted electives choices that allow the student to tailor the program to their interests. The major provides a sound science background for careers in conservation, resource management, ecological consulting, or nature interpretation used in teaching, government, non-government or the private sector; or for further post-graduate training in fundamental ecology, environmental biology and environmental management or policy.

**Major****Semester 1 - Fall**

BIOL*1070	[0.50]	Discovering Biodiversity
CHEM*1040	[0.50]	General Chemistry I
ENVS*1030	[1.00]	Introduction to Environmental Sciences
MATH*1080	[0.50]	Elements of Calculus I

**Semester 2 - Winter**

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
FARE*1040	[1.00]	Intro to Environmental Economics, Law & Policy
GEOG*1300	[0.50]	Introduction to the Biophysical Environment

**Semester 3 - Fall**

BIOL*2060	[0.50]	Ecology
One of:		
PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1300	[0.50]	Fundamentals of Physics
One of:		
ECON*2100	[0.50]	Economic Growth and Environmental Quality
FARE*2700	[0.50]	Survey of Natural Resource Economics

1.00 electives or restricted electives

**Note:** Students lacking 4U physics or equivalent must take PHYS\*1300. Students with 4U physics or equivalent must take PHYS\*1080. PHYS\*1130 may be substituted for PHYS\*1080 and would be taken in a Winter semester.**Note:** GEOG\*3210 may be substituted for ECON\*2100 or FARE\*2700 and would be taken in semester 6.**Winter Semester**

COOP*1000	[0.00]	Co-op Work Term I
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**Semester 4 - Summer**

BIOC\*2580 [0.50] Introduction to Biochemistry  
2.00 electives or restricted electives

**Fall Semester**

COOP\*2000 [0.00] Co-op Work Term II

**Semester 5 - Winter**

BIOL\*2400 [0.50] Evolution  
MBG\*2040 [0.50] Foundations in Molecular Biology and Genetics  
STAT\*2230 [0.50] Biostatistics for Integrative Biology  
1.00 electives or restricted electives

**Summer Semester**

COOP\*3000 [0.00] Co-op Work Term III

**Semester 6 - Fall**

BIOL\*3010 [0.50] Laboratory and Field Work in Ecology  
ENVS\*4001 [0.50] Project in Environmental Sciences

One of:

BOT\*2100 [0.50] Life Strategies of Plants  
ZOO\*3600 [0.50] Comparative Animal Physiology I

One of:

BOT\*3410 [0.50] Plant Anatomy  
ZOO\*2090 [0.50] Vertebrate Structure and Function

0.50 electives or restricted electives

**Note:** ZOO\*2700 may be substituted for BOT\*3410 or ZOO\*2090 and would be taken in semester 7.

**Semester 7 - Winter**

BIOL\*3060 [0.50] Populations, Communities & Ecosystems  
BIOL\*3130 [0.50] Conservation Biology  
ENVS\*4002 [0.50] Project in Environmental Sciences

1.00 electives or restricted electives

**Note:** See note in semester 6.

**Summer Semester (Optional)**

COOP\*4000 [0.00] Co-op Work Term IV

**Semester 8- Fall**

2.50 electives or restricted electives

**Restricted Electives**

Students are required to take 5.50 restricted credits in Ecology as noted below. Of these, at least 1.00 credits must be at the 4000 level.

1. A minimum of 0.50 credits from:

BIOL*4150	[0.50]	Wildlife Conservation and Management
CIS*1500	[0.50]	Introduction to Programming
GEOG*2420	[0.50]	The Earth From Space
GEOG*2480	[0.50]	Mapping and GIS
GEOG*3420	[0.50]	Remote Sensing of the Environment *
GEOG*3480	[0.50]	GIS and Spatial Analysis *
GEOG*4480	[1.00]	Applied Geomatics

\* Additional prerequisites are required.

2. Students in the Ecology Major are required to take an additional 5.00 restricted elective credits from the following lists. Some courses may require other courses from the list as prerequisites.

Ecology

ANSC*3180	[0.50]	Wildlife Nutrition
BIOL*3450	[0.50]	Introduction to Aquatic Environments
BOT*3050	[0.50]	Plant Functional Ecology
ENVS*2030	[0.50]	Meteorology and Climatology
ENVS*3010	[0.50]	Climate Change Biology
ENVS*3270	[0.50]	Forest Biodiversity
ENVS*3290	[0.50]	Waterborne Disease Ecology
ENVS*4350	[0.50]	Forest Ecology
GEOG*2000	[0.50]	Geomorphology
GEOG*2110	[0.50]	Climate and the Biophysical Environment
GEOG*3000	[0.50]	Fluvial Processes
GEOG*3610	[0.50]	Environmental Hydrology
NUTR*3210	[0.50]	Fundamentals of Nutrition
ZOO*4570	[0.50]	Marine Ecological Processes

Conservation

BIOL*4120	[0.50]	Evolutionary Ecology
BIOL*4150	[0.50]	Wildlife Conservation and Management
BIOL*4350	[0.50]	Limnology of Natural and Polluted Waters
ENVS*2040	[0.50]	Plant Health and the Environment
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3000	[0.50]	Nature Interpretation
ENVS*3010	[0.50]	Climate Change Biology
GEOG*2480	[0.50]	Mapping and GIS

GEOG*3020	[0.50]	Global Environmental Change
GEOG*3110	[0.50]	Biotic and Natural Resources
GEOG*3210	[0.50]	Management of the Biophysical Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis
GEOG*4110	[1.00]	Environmental Systems Analysis
GEOG*4230	[0.50]	Environmental Impact Assessment
GEOG*4480	[1.00]	Applied Geomatics

Policy, Law and Management

BIOL*4500	[0.50]	Natural Resource Policy Analysis
ECON*2100	[0.50]	Economic Growth and Environmental Quality
FARE*2700	[0.50]	Survey of Natural Resource Economics
GEOG*2210	[0.50]	Environment and Resources
GEOG*4210	[0.50]	Environmental Governance
GEOG*4220	[0.50]	Local Environmental Management
PHIL*2070	[0.50]	Philosophy of the Environment
POLS*3370	[0.50]	Environmental Politics and Governance

Independent Research and Field Courses

BIOL*4410	[0.75]	Field Ecology
BIOL*4700	[0.50]	Field Biology
BIOL*4710	[0.25]	Field Biology
BIOL*4800	[0.50]	Field Biology
BIOL*4810	[0.25]	Field Biology
ENVS*3410	[0.50]	Independent Research I
ENVS*3420	[0.50]	Independent Research II
ENVS*3430	[1.00]	Independent Research
IBIO*4500	[0.75]	Research in Integrative Biology I
IBIO*4510	[0.75]	Research in Integrative Biology II
IBIO*4521	[1.00]	Thesis in Integrative Biology
IBIO*4522	[1.00]	Thesis in Integrative Biology
ZOO*4300	[0.75]	Marine Biology and Oceanography

**Credit Summary (20.00 Total Credits)**

7.00 credits - Environmental Sciences core

5.00 credits - Ecology Required courses

5.50 credits - Ecology Restricted electives

2.50 credits - Free electives

Students are reminded that 6.00 credits of their B.Sc. (Env.) degree must be at the 3000-4000 level.

Students are encouraged to seek advice on their choices from their faculty advisor. With prior approval, students may be able to use courses not on these lists towards their Ecology restrictive electives.

**Environmental Sciences (ENVS)****School of Environmental Sciences, Ontario Agricultural College**

This major combines a foundation in the breadth of environmental science while giving students practical experience in integrating the basic science in environmental problem solving. The integration of biophysical sciences with real-world applications provides students with a unique skill set for engaging with current and future environmental issues. The many opportunities in the major for experiential learning and independent research give students an ability to collect, analyze and interpret environmental data, and propose solutions that account for both the biophysical science and the socio-economic context. The second year core curriculum develops a cross-disciplinary understanding of the biophysical environment, while the third and fourth years allow students to engage more deeply with issues of interest to them. Students will graduate from this major ready to address diverse problems such as pollinator conservation, soil and water conservation, greenhouse gas mitigation, plant disease management and chemical movement in the environment. It provides a solid background for careers in environmental protection, resource management and research, in both the public and private sectors.

**Major****Semester 1**

BIOL*1070	[0.50]	Discovering Biodiversity
CHEM*1040	[0.50]	General Chemistry I
ENVS*1030	[1.00]	Introduction to Environmental Sciences
MATH*1080	[0.50]	Elements of Calculus I

**Semester 2**

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
FARE*1040	[1.00]	Intro to Environmental Economics, Law & Policy
GEOG*1300	[0.50]	Introduction to the Biophysical Environment

**Semester 3**

ENVS*2030	[0.50]	Meteorology and Climatology
ENVS*2060	[0.50]	Soil Science
ENVS*2240	[0.50]	Fundamentals of Environmental Geology
ENVS*2310	[0.50]	Earth Surface Processes

0.50 restricted electives from List A or B



**Semester 4**

BIOL*2060	[0.50]	Ecology
ENVS*2080	[0.50]	Introduction to Environmental Microbiology
STAT*2040	[0.50]	Statistics I

0.50 restricted electives from List A or B

0.50 electives or restricted electives

**Semester 5**

One of:

ECON*2100	[0.50]	Economic Growth and Environmental Quality
FARE*2700	[0.50]	Survey of Natural Resource Economics
GEOG*3210	[0.50]	Management of the Biophysical Environment

2.00 electives or restricted electives

Students wishing to register in BIOL\*4350 must substitute BIOL\*3450 in Semester 5 for ENVS\*3150 in Semester 6.

**Semester 6**

ENVS*3150	[0.50]	Aquatic Systems
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2.00 electives or restricted electives

**Semester 7**

ENVS*4001	[0.50]	Project in Environmental Sciences
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2.00 electives or restricted electives

**Semester 8**

ENVS*4002	[0.50]	Project in Environmental Sciences
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2.00 electives or restricted electives

**Restricted Electives**

Students must take a total of 6.50 restricted elective credits as prescribed by the following lists.

Students must take 0.50 credits from each of List A & B

**List A**

One of:

ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Management

**List B**

One of:

PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1130	[0.50]	Physics with Applications
PHYS*1300	[0.50]	Fundamentals of Physics

Students lacking 4U Physics or equivalent must take PHYS\*1300.

Students are required to choose a minimum of 5.50 credits from Lists C, D, E, and F. Students must take a minimum of 1.50 credits from List C, a minimum of 1.00 credits from List D, and students may not count more than 1.00 credits from List F towards their restricted electives. Students should note that many restricted electives, particularly in List D, require other courses as prerequisites. Students should consult the most recent Undergraduate Calendar for specific requirements.

**List C**

Students must take a minimum of 1.50 credits from the following list:

BIOL*3130	[0.50]	Conservation Biology
CHEM*3360	[0.50]	Environmental Chemistry and Toxicology
ENVS*2040	[0.50]	Plant Health and the Environment
ENVS*2120	[0.50]	Introduction to Environmental Stewardship
ENVS*2210	[0.50]	Apiculture and Honey Bee Biology
ENVS*2230	[0.50]	Communications in Environmental Science
ENVS*3000	[0.50]	Nature Interpretation
ENVS*3010	[0.50]	Climate Change Biology
ENVS*3020	[0.50]	Pesticides and the Environment
ENVS*3030	[0.50]	Conservation Field Course
ENVS*3040	[0.50]	Natural Chemicals in the Environment
ENVS*3050	[0.50]	Microclimatology
ENVS*3060	[0.50]	Groundwater
ENVS*3080	[0.50]	Soil and Water Conservation
ENVS*3090	[0.50]	Insect Diversity and Biology
ENVS*3180	[0.50]	Sedimentary Environments
ENVS*3210	[0.50]	Plant Pathology
ENVS*3220	[0.50]	Terrestrial Chemistry
ENVS*3230	[0.50]	Agroforestry Systems
ENVS*3250	[0.50]	Forest Health and Disease
ENVS*3270	[0.50]	Forest Biodiversity
ENVS*3290	[0.50]	Waterborne Disease Ecology
ENVS*3310	[0.50]	Soil Biodiversity and Ecosystem Function
ENVS*3340	[0.50]	Use and Management of Environmental Data
ENVS*3370	[0.50]	Terrestrial Ecosystem Ecology
MICR*3220	[0.50]	Plant Microbiology
TOX*2000	[0.50]	Principles of Toxicology

**List D**

Students must take a minimum of 1.00 credits from the following list:

BIOL*4350	[0.50]	Limnology of Natural and Polluted Waters
ENVS*4070	[0.50]	Pollinator Conservation
ENVS*4090	[0.50]	Soil Management
ENVS*4100	[0.50]	Integrated Management of Invasive Insect Pests
ENVS*4160	[0.50]	Soil and Nutrient Management
ENVS*4180	[0.50]	Insecticide Biological Activity and Resistance
ENVS*4190	[0.50]	Biological Activity of Herbicides
ENVS*4210	[0.50]	Meteorological and Environmental Instrumentation
ENVS*4230	[0.50]	Biology of Aquatic Insects
ENVS*4260	[0.50]	Field Entomology
ENVS*4320	[1.00]	Laboratory and Field Methods in Soil Biodiversity
ENVS*4350	[0.50]	Forest Ecology
ENVS*4360	[0.50]	Glacial Environments
ENVS*4370	[0.50]	Environmental Organic Chemistry
ENVS*4390	[1.00]	Soil Variability and Land Evaluation
PBIO*4530	[0.50]	Plants and Environmental Pollution

**List E**

ENVS*3100	[0.50]	Internship/Externship in Environmental Sciences
ENVS*3410	[0.50]	Independent Research I
ENVS*3420	[0.50]	Independent Research II
ENVS*3430	[1.00]	Independent Research
ENVS*3510	[0.50]	Independent Study I
ENVS*3520	[0.50]	Independent Study II
ENVS*3530	[1.00]	Independent Study
ENVS*4410	[1.00]	Advanced Independent Research I
ENVS*4420	[1.00]	Advanced Independent Research II
ENVS*4430	[2.00]	Advanced Independent Research
ENVS*4510	[0.50]	Advanced Independent Study I
ENVS*4520	[0.50]	Advanced Independent Study II
ENVS*4530	[1.00]	Advanced Independent Study

**List F**

Students may count up to 1.00 credits from the following list towards their 6.50 credit restricted electives.

GEOG*2420	[0.50]	The Earth From Space
GEOG*2480	[0.50]	Mapping and GIS
GEOG*3420	[0.50]	Remote Sensing of the Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis

**Credit Summary (20.00 Total Credits)**

7.00 credits - Environmental Sciences core

4.50 credits - Required Courses for the Major

5.50 credits - Restricted Electives

3.00 credits - Free electives

Students are encouraged to seek advice from their faculty advisor and are reminded that 6.00 credits of their B.Sc.(Env.) degree must be at the 3000-4000 level. With prior approval, students may be able to use courses not on Lists C, D, E, or F toward their restricted electives

**Environmental Sciences (ENVS:C)****School of Environmental Sciences, Ontario Agricultural College**

This major combines a foundation in the breadth of environmental science while giving students practical experience in integrating the basic science in environmental problem solving. The integration of biophysical sciences with real-world applications provides students with a unique skill set for engaging with current and future environmental issues. The many opportunities in the major for experiential learning and independent research give students an ability to collect, analyze and interpret environmental data, and propose solutions that account for both the biophysical science and the socio-economic context. The second year core curriculum develops a cross-disciplinary understanding of the biophysical environment, while the third and fourth years allow students to engage more deeply with issues of interest to them. Students will graduate from this major ready to address diverse problems such as pollinator conservation, soil and water conservation, greenhouse gas mitigation, plant disease management and chemical movement in the environment. It provides a solid background for careers in environmental protection, resource management and research, in both the public and private sectors.

**Major****Semester 1 - Fall**

BIOL*1070	[0.50]	Discovering Biodiversity
CHEM*1040	[0.50]	General Chemistry I
ENVS*1030	[1.00]	Introduction to Environmental Sciences
MATH*1080	[0.50]	Elements of Calculus I

**Semester 2 - Winter**

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education

FARE*1040	[1.00]	Intro to Environmental Economics, Law & Policy
GEOG*1300	[0.50]	Introduction to the Biophysical Environment

**Semester 3 - Fall**

ENVS*2030	[0.50]	Meteorology and Climatology
ENVS*2060	[0.50]	Soil Science
ENVS*2240	[0.50]	Fundamentals of Environmental Geology
ENVS*2310	[0.50]	Earth Surface Processes

0.50 restricted electives from List A or B

**Winter Semester**

COOP*1000	[0.00]	Co-op Work Term I
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**Semester 4 - Summer**

STAT*2040	[0.50]	Statistics I
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2.00 electives or restricted electives

**Fall Semester**

COOP*2000	[0.00]	Co-op Work Term II
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**Semester 5 - Winter**

BIOL*2060	[0.50]	Ecology
ENVS*2080	[0.50]	Introduction to Environmental Microbiology

0.50 restricted electives from List A or B

1.00 electives or restricted electives

**Summer Semester**

COOP*3000	[0.00]	Co-op Work Term III
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**Semester 6 - Fall**

ENVS*4001	[0.50]	Project in Environmental Sciences
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One of:

ECON*2100	[0.50]	Economic Growth and Environmental Quality
FARE*2700	[0.50]	Survey of Natural Resource Economics
GEOG*3210	[0.50]	Management of the Biophysical Environment

1.50 electives or restricted electives

Students wishing to register in BIOL\*4350 must substitute BIOL\*3450 in Semester 6 for ENVS\*3150 in Semester 7.

**Semester 7 - Winter**

ENVS*3150	[0.50]	Aquatic Systems
ENVS*4002	[0.50]	Project in Environmental Sciences

1.50 electives or restricted electives

**Summer Semester - (Optional)**

COOP*4000	[0.00]	Co-op Work Term IV
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**Semester 8 - Fall**

2.50 electives or restricted electives

**Restricted Electives**

Students must take a total of 6.50 restricted elective credits as prescribed by the following lists.

Students must take 0.50 credits from each of List A & B

**List A**

One of:

ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Management

**List B**

One of:

PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1130	[0.50]	Physics with Applications
PHYS*1300	[0.50]	Fundamentals of Physics

Students lacking 4U Physics or equivalent must take PHYS\*1300.

Students are required to choose a minimum of 5.50 credits from Lists C, D, E, and F. Students must take a minimum of 1.50 credits from List C, a minimum of 1.00 credits from List D, and students may not count more than 1.00 credits from List F towards their restricted electives. Students should note that many restricted electives, particularly in List D, require other courses as prerequisites. Students should consult the most recent Undergraduate Calendar for specific requirements.

**List C**

Students must take a minimum of 1.50 credits from the following list:

BIOL*3130	[0.50]	Conservation Biology
CHEM*3360	[0.50]	Environmental Chemistry and Toxicology
ENVS*2040	[0.50]	Plant Health and the Environment
ENVS*2120	[0.50]	Introduction to Environmental Stewardship
ENVS*2210	[0.50]	Apiculture and Honey Bee Biology
ENVS*2230	[0.50]	Communications in Environmental Science
ENVS*3000	[0.50]	Nature Interpretation
ENVS*3010	[0.50]	Climate Change Biology
ENVS*3020	[0.50]	Pesticides and the Environment
ENVS*3030	[0.50]	Conservation Field Course

ENVS*3040	[0.50]	Natural Chemicals in the Environment
ENVS*3050	[0.50]	Microclimatology
ENVS*3060	[0.50]	Groundwater
ENVS*3080	[0.50]	Soil and Water Conservation
ENVS*3090	[0.50]	Insect Diversity and Biology
ENVS*3180	[0.50]	Sedimentary Environments
ENVS*3210	[0.50]	Plant Pathology
ENVS*3220	[0.50]	Terrestrial Chemistry
ENVS*3230	[0.50]	Agroforestry Systems
ENVS*3250	[0.50]	Forest Health and Disease
ENVS*3270	[0.50]	Forest Biodiversity
ENVS*3290	[0.50]	Waterborne Disease Ecology
ENVS*3310	[0.50]	Soil Biodiversity and Ecosystem Function
ENVS*3340	[0.50]	Use and Management of Environmental Data
ENVS*3370	[0.50]	Terrestrial Ecosystem Ecology
MICR*3220	[0.50]	Plant Microbiology
TOX*2000	[0.50]	Principles of Toxicology

**List D**

Students must take a minimum of 1.00 credits from the following list:

BIOL*4350	[0.50]	Limnology of Natural and Polluted Waters
ENVS*4070	[0.50]	Pollinator Conservation
ENVS*4090	[0.50]	Soil Management
ENVS*4100	[0.50]	Integrated Management of Invasive Insect Pests
ENVS*4160	[0.50]	Soil and Nutrient Management
ENVS*4180	[0.50]	Insecticide Biological Activity and Resistance
ENVS*4190	[0.50]	Biological Activity of Herbicides
ENVS*4210	[0.50]	Meteorological and Environmental Instrumentation
ENVS*4230	[0.50]	Biology of Aquatic Insects
ENVS*4260	[0.50]	Field Entomology
ENVS*4320	[1.00]	Laboratory and Field Methods in Soil Biodiversity
ENVS*4350	[0.50]	Forest Ecology
ENVS*4360	[0.50]	Glacial Environments
ENVS*4370	[0.50]	Environmental Organic Chemistry
ENVS*4390	[1.00]	Soil Variability and Land Evaluation
PBIO*4530	[0.50]	Plants and Environmental Pollution

**List E**

ENVS*3100	[0.50]	Internship/Externship in Environmental Sciences
ENVS*3410	[0.50]	Independent Research I
ENVS*3420	[0.50]	Independent Research II
ENVS*3430	[1.00]	Independent Research
ENVS*3510	[0.50]	Independent Study I
ENVS*3520	[0.50]	Independent Study II
ENVS*3530	[1.00]	Independent Study
ENVS*4410	[1.00]	Advanced Independent Research I
ENVS*4420	[1.00]	Advanced Independent Research II
ENVS*4430	[2.00]	Advanced Independent Research
ENVS*4510	[0.50]	Advanced Independent Study I
ENVS*4520	[0.50]	Advanced Independent Study II
ENVS*4530	[1.00]	Advanced Independent Study

**List F**

Students may count up to 1.00 credits from the following list towards their 6.50 credit restricted electives.

GEOG*2420	[0.50]	The Earth From Space
GEOG*2480	[0.50]	Mapping and GIS
GEOG*3420	[0.50]	Remote Sensing of the Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis

**Credit Summary (20.00 Total Credits)**

7.00 credits - Environmental Sciences core
4.50 credits - Required Courses for the Major
5.50 credits - Restricted Electives
3.00 credits - Free electives

Students are encouraged to seek advice from their faculty advisor and are reminded that 6.00 credits of their B.Sc.(Env.) degree must be at the 3000-4000 level. With prior approval, students may be able to use courses not on Lists C, D, E or F toward their restricted electives

**Environmental Economics and Policy (EEP)**

**Department of Food, Agricultural and Resource Economics, Ontario Agricultural College**

This major provides the foundation for applying science and economics to environmental issues to produce effective environmental policy. Students gain an understanding of the policy tools and market mechanisms for managing our natural resources effectively. Knowledge and skills learned in this major will enable students to identify, prioritize and solve environmental problems by integrating both scientific and economic theories and data. Equipped with the ability to look at current topics from the perspectives of economics, politics and environmental sciences, students have a number of interesting career opportunities in the public, private and NGO sectors. At the same time, the major fully prepares students to move onto professional and research graduate programs.

## Major

### Semester 1

BIOL*1070	[0.50]	Discovering Biodiversity
CHEM*1040	[0.50]	General Chemistry I
ENVS*1030	[1.00]	Introduction to Environmental Sciences
MATH*1080	[0.50]	Elements of Calculus I

### Semester 2

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
FARE*1040	[1.00]	Intro to Environmental Economics, Law & Policy
GEOG*1300	[0.50]	Introduction to the Biophysical Environment

### Semester 3

ECON*1100	[0.50]	Introductory Macroeconomics
FARE*2700	[0.50]	Survey of Natural Resource Economics

1.50 electives or restricted electives

### Semester 4

ECON*2310	[0.50]	Intermediate Microeconomics
ECON*2410	[0.50]	Intermediate Macroeconomics
ECON*2770	[0.50]	Introductory Mathematical Economics

One of:

ECON*2740	[0.50]	Economic Statistics
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives

**Note:** Students interested in the Statistics and Environmental Risk Assessment sequence in their restricted electives should choose STAT\*2040 to satisfy the statistics requirement in the ENVS core.

### Semester 5

ECON*2100	[0.50]	Economic Growth and Environmental Quality
ECON*3740	[0.50]	Introduction to Econometrics

1.50 electives or restricted electives

### Semester 6

FARE*3170	[0.50]	Cost-Benefit Analysis
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2.00 electives or restricted electives

### Semester 7

ECON*4930	[0.50]	Environmental Economics
ENVS*4001	[0.50]	Project in Environmental Sciences
FARE*4290	[0.50]	Land Economics

1.00 electives or restricted electives

### Semester 8

ENVS*4002	[0.50]	Project in Environmental Sciences
FARE*4310	[0.50]	Resource Economics

1.50 restricted electives or electives

### Restricted Electives

Students in the Environmental Economics and Policy major are required to complete 6.00 credits in restricted electives. 2.50 restricted elective credits must be in FARE or ECON courses at the 3000 or 4000 level.

Courses in the following lists may be taken to satisfy the restricted electives requirement. Courses are grouped to assist students select programs of study aimed at different educational and career paths.

#### List A

Students must select a minimum of 2.50 credits from the following lists:

##### 1. Quantitative Methods, Research and Graduate Studies

ECON*3100	[0.50]	Game Theory
ECON*3710	[0.50]	Advanced Microeconomics
ECON*4640	[0.50]	Applied Econometrics I
ECON*4700	[0.50]	Advanced Mathematical Economics
ECON*4710	[0.50]	Advanced Topics in Microeconomics
ECON*4750	[0.50]	Topics in Public Economics
ECON*4840	[0.50]	Applied Econometrics II
FARE*4500	[0.50]	Decision Science
FARE*4550	[0.50]	Independent Studies I
FARE*4560	[0.50]	Independent Studies II

##### 2. Policy Analysis

ECON*2650	[0.50]	Introductory Development Economics
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ECON*3500	[0.50]	Urban Economics
ECON*3580	[0.50]	Economics of Regulation
ECON*3610	[0.50]	Public Economics
ECON*3620	[0.50]	International Trade
ECON*4830	[0.50]	Economic Development
ECON*4880	[0.50]	Topics in International Economics
EDRD*2650	[0.50]	Introduction to Planning and Environmental Law
FARE*2410	[0.50]	Agri-food Markets and Policy
FARE*3250	[0.50]	Food and International Development
FARE*4000	[0.50]	Agricultural and Food Policy
FARE*4210	[0.50]	World Agriculture, Food Security and Economic Development
FARE*4550	[0.50]	Independent Studies I
FARE*4560	[0.50]	Independent Studies II
POLS*3370	[0.50]	Environmental Politics and Governance

#### List B

Students must select a minimum of 1.00 credits from the following lists:

##### 1. Remote Sensing, Geographical Information Systems and Spatial Analysis

GEOG*2420	[0.50]	The Earth From Space
GEOG*2480	[0.50]	Mapping and GIS
GEOG*3420	[0.50]	Remote Sensing of the Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis
GEOG*4480	[1.00]	Applied Geomatics

##### 2. Statistics and Environmental Risk Assessment

STAT*2050	[0.50]	Statistics II
STAT*3510	[0.50]	Environmental Risk Assessment

**Note:** Students interested in this sequence should take STAT\*2040 rather than ECON\*2740 to satisfy the statistics requirement in the ENVS core.

##### 3. Earth Sciences

ENVS*2030	[0.50]	Meteorology and Climatology
ENVS*2060	[0.50]	Soil Science
ENVS*2310	[0.50]	Earth Surface Processes
ENVS*3060	[0.50]	Groundwater

##### 4. Ecology and Conservation Biology

BIOL*2060	[0.50]	Ecology
BIOL*3060	[0.50]	Populations, Communities & Ecosystems
BIOL*3130	[0.50]	Conservation Biology
BIOL*4150	[0.50]	Wildlife Conservation and Management
BIOL*4500	[0.50]	Natural Resource Policy Analysis
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity

##### 5. Toxicology and Environmental Chemistry

ENVS*3020	[0.50]	Pesticides and the Environment
ENVS*3040	[0.50]	Natural Chemicals in the Environment
ENVS*3220	[0.50]	Terrestrial Chemistry
TOX*2000	[0.50]	Principles of Toxicology
TOX*3360	[0.50]	Environmental Chemistry and Toxicology

### Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core

5.00 credits - Environmental Economics and Policy required courses

6.00 credits - Environmental Economics and Policy restricted electives

2.00 credits - Free electives

Students are encouraged to seek advice on their choices from their faculty advisor. Students are reminded that 6.00 credits of their B.Sc. (Env.) degree must be at the 3000 or 4000 level.

## Environmental Economics and Policy (EEP:C)

### Department of Food, Agricultural and Resource Economics, Ontario Agricultural College

This major provides the foundation for applying science and economics to environmental issues to produce effective environmental policy. Students gain an understanding of the policy tools and market mechanisms for managing our natural resources effectively. Knowledge and skills learned in this major will enable students to identify, prioritize and solve environmental problems by integrating both scientific and economic theories and data. Equipped with the ability to look at current topics from the perspectives of economics, politics and environmental sciences, students have a number of interesting career opportunities in the public, private and NGO sectors. At the same time, the major fully prepares students to move onto professional and research graduate programs.

## Major

### Semester 1 - Fall

BIOL*1070	[0.50]	Discovering Biodiversity
CHEM*1040	[0.50]	General Chemistry I
ENVS*1030	[1.00]	Introduction to Environmental Sciences

MATH\*1080 [0.50] Elements of Calculus I

### Semester 2 - Winter

BIOL\*1090 [0.50] Introduction to Molecular and Cellular Biology  
 CHEM\*1050 [0.50] General Chemistry II  
 COOP\*1100 [0.00] Introduction to Co-operative Education  
 FARE\*1040 [1.00] Intro to Environmental Economics, Law & Policy  
 GEOG\*1300 [0.50] Introduction to the Biophysical Environment

### Semester 3 - Fall

ECON\*1100 [0.50] Introductory Macroeconomics  
 FARE\*2700 [0.50] Survey of Natural Resource Economics  
 1.50 electives or restricted electives

### Winter Semester

COOP\*1000 [0.00] Co-op Work Term I

### Semester 4 - Summer

ECON\*2310 [0.50] Intermediate Microeconomics  
 ECON\*2410 [0.50] Intermediate Macroeconomics  
 ECON\*2770 [0.50] Introductory Mathematical Economics

One of:

ECON\*2740 [0.50] Economic Statistics  
 STAT\*2040 [0.50] Statistics I

0.50 electives or restricted electives

**Note:** Students interested in the Statistics and Environmental Risk Assessment sequence in their restricted electives should choose STAT\*2040 to satisfy the statistics requirement in the ENVS core. ECON\*2740 may not be offered in the summer semester, so STAT\*2040 should be taken if students wish to satisfy this program requirement in the summer semester.

### Fall Semester

COOP\*2000 [0.00] Co-op Work Term II

### Semester 5 - Winter

ECON\*3740 [0.50] Introduction to Econometrics  
 FARE\*3170 [0.50] Cost-Benefit Analysis

1.50 electives or restricted electives

### Summer Semester

COOP\*3000 [0.00] Co-op Work Term III

### Semester 6 - Fall

ECON\*2100 [0.50] Economic Growth and Environmental Quality  
 ENVS\*4001 [0.50] Project in Environmental Sciences

1.50 electives or restricted electives

### Semester 7 - Winter

ENVS\*4002 [0.50] Project in Environmental Sciences  
 FARE\*4310 [0.50] Resource Economics

1.50 electives or restricted electives

### Summer Semester (Optional)

COOP\*4000 [0.00] Co-op Work Term IV

### Semester 8 - Fall

ECON\*4930 [0.50] Environmental Economics  
 FARE\*4290 [0.50] Land Economics

1.50 electives or restricted electives

### Restricted Electives

Students in the Environmental Economics and Policy major are required to complete 6.00 credits in restricted electives. 2.50 restricted elective credits must be in FARE or ECON courses at the 3000 or 4000 level.

Courses in the following lists may be taken to satisfy the restricted electives requirement. Courses are grouped to assist students select programs of study aimed at different educational and career paths.

#### List A

Students must select a minimum of 2.50 credits from the following lists:

#### 1. Quantitative Methods, Research and Graduate Studies

ECON\*3100 [0.50] Game Theory  
 ECON\*3710 [0.50] Advanced Microeconomics  
 ECON\*4640 [0.50] Applied Econometrics I  
 ECON\*4700 [0.50] Advanced Mathematical Economics  
 ECON\*4710 [0.50] Advanced Topics in Microeconomics  
 ECON\*4750 [0.50] Topics in Public Economics  
 ECON\*4840 [0.50] Applied Econometrics II  
 FARE\*4500 [0.50] Decision Science  
 FARE\*4550 [0.50] Independent Studies I  
 FARE\*4560 [0.50] Independent Studies II

#### 2. Policy Analysis

ECON\*2650 [0.50] Introductory Development Economics  
 ECON\*3500 [0.50] Urban Economics  
 ECON\*3580 [0.50] Economics of Regulation

ECON\*3610 [0.50] Public Economics  
 ECON\*3620 [0.50] International Trade  
 ECON\*4830 [0.50] Economic Development  
 ECON\*4880 [0.50] Topics in International Economics  
 EDRD\*2650 [0.50] Introduction to Planning and Environmental Law  
 FARE\*2410 [0.50] Agrifood Markets and Policy  
 FARE\*3250 [0.50] Food and International Development  
 FARE\*4000 [0.50] Agricultural and Food Policy  
 FARE\*4210 [0.50] World Agriculture, Food Security and Economic Development  
 FARE\*4550 [0.50] Independent Studies I  
 FARE\*4560 [0.50] Independent Studies II  
 POLS\*3370 [0.50] Environmental Politics and Governance

#### List B

Students must select a minimum of 1.00 credits from the following lists:

#### 1. Remote Sensing, Geographical Information Systems and Spatial Analysis

GEOG\*2420 [0.50] The Earth From Space  
 GEOG\*2480 [0.50] Mapping and GIS  
 GEOG\*3420 [0.50] Remote Sensing of the Environment  
 GEOG\*3480 [0.50] GIS and Spatial Analysis  
 GEOG\*4480 [1.00] Applied Geomatics

#### 2. Statistics and Environmental Risk Assessment

STAT\*2050 [0.50] Statistics II  
 STAT\*3510 [0.50] Environmental Risk Assessment

**Note:** Students interested in this sequence should take STAT\*2040 rather than ECON\*2740 to satisfy the statistics requirement in the ENVS core.

#### 3. Earth Sciences

ENVS\*2030 [0.50] Meteorology and Climatology  
 ENVS\*2060 [0.50] Soil Science  
 ENVS\*2310 [0.50] Earth Surface Processes  
 ENVS\*3060 [0.50] Groundwater

#### 4. Ecology and Conservation Biology

BIOL\*2060 [0.50] Ecology  
 BIOL\*3060 [0.50] Populations, Communities & Ecosystems  
 BIOL\*3130 [0.50] Conservation Biology  
 BIOL\*4150 [0.50] Wildlife Conservation and Management  
 BIOL\*4500 [0.50] Natural Resource Policy Analysis  
 ENVS\*2330 [0.50] Current Issues in Ecosystem Science and Biodiversity

#### 5. Toxicology and Environmental Chemistry

ENVS\*3020 [0.50] Pesticides and the Environment  
 ENVS\*3040 [0.50] Natural Chemicals in the Environment  
 ENVS\*3220 [0.50] Terrestrial Chemistry  
 TOX\*2000 [0.50] Principles of Toxicology  
 TOX\*3360 [0.50] Environmental Chemistry and Toxicology

#### Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core  
 5.00 credits - Environmental Economics and Policy required courses  
 6.00 credits - Environmental Economics and Policy restricted electives  
 2.00 credits - Free electives

Students are reminded that 6.00 credits of their B.Sc. (Env.) degree must be at the 3000-4000 level.

### Environment and Resource Management (ERM)

#### Department of Geography, College of Social and Applied Human Sciences

The major focuses on environmental interactions and problem solving by developing an integrated biophysical environment - human environment perspective. In ERM, students will gain knowledge across the natural sciences, an understanding of how they interact, the skills (tools and techniques) needed to support decision making, as well as the methods of management and governance that are critical for environmental decision making. Beginning in first year students learn in the classroom and through hands-on work in labs and in the field. Students are expected to design and conduct experiments and problem solve using state-of-the-art computing and analytical tools. This major provides the knowledge, skills and methods an environmental scientist requires as environmental consultant, environmental manager, environmental and/or resource planner, geographic information systems analyst or to facilitate future graduate work.

#### Major

##### Semester 1

BIOL\*1070 [0.50] Discovering Biodiversity  
 CHEM\*1040 [0.50] General Chemistry I  
 ENVS\*1030 [1.00] Introduction to Environmental Sciences  
 MATH\*1080 [0.50] Elements of Calculus I

<b>Semester 2</b>			MATH*1080 [0.50] Elements of Calculus I
BIOL*1090 [0.50]	Introduction to Molecular and Cellular Biology		<b>Semester 2 - Winter</b>
CHEM*1050 [0.50]	General Chemistry II		BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
FARE*1040 [1.00]	Intro to Environmental Economics, Law & Policy		CHEM*1050 [0.50] General Chemistry II
GEOG*1300 [0.50]	Introduction to the Biophysical Environment		COOP*1100 [0.00] Introduction to Co-operative Education
<b>Semester 3</b>			FARE*1040 [1.00] Intro to Environmental Economics, Law & Policy
GEOG*2000 [0.50]	Geomorphology		GEOG*1300 [0.50] Introduction to the Biophysical Environment
GEOG*2460 [0.50]	Analysis in Geography		<b>Semester 3 - Fall</b>
One of:			GEOG*2000 [0.50] Geomorphology
ECON*2100 [0.50]	Economic Growth and Environmental Quality		GEOG*2480 [0.50] Mapping and GIS
FARE*2700 [0.50]	Survey of Natural Resource Economics		1.50 electives or restricted electives
1.00 electives			<b>Note:</b> FARE*2700 may be substituted for ECON*2100 and may be taken in Semester 3 or 6, GEOG*2460 may be substituted for STAT*2040 and may be taken in Semester 3 or 6.
<b>Semester 4</b>			<b>Note:</b> ENVS*2120 may be substituted for ENVS*2340 and could be taken in Semester 3 or 6.
ENVS*2340 [0.50]	Current Issues in Agriculture and Landscape Management		<b>Winter Semester</b>
GEOG*2110 [0.50]	Climate and the Biophysical Environment		COOP*1000 [0.00] Co-op Work Term I
GEOG*2210 [0.50]	Environment and Resources		<b>Semester 4 - Summer</b>
GEOG*2480 [0.50]	Mapping and GIS		ECON*2100 [0.50] Economic Growth and Environmental Quality
0.50 electives or restricted electives			GEOG*2210 [0.50] Environment and Resources
<b>Note:</b> ENVS*2120 may be substituted for ENVS*2340 and could be taken in Semester 5.			STAT*2040 [0.50] Statistics I
<b>Semester 5</b>			1.00 electives or restricted electives
GEOG*3000 [0.50]	Fluvial Processes		<b>Fall Semester</b>
GEOG*3110 [0.50]	Biotic and Natural Resources		COOP*2000 [0.00] Co-op Work Term II
GEOG*3210 [0.50]	Management of the Biophysical Environment		<b>Semester 5 - Winter</b>
1.00 electives or restricted electives			ENVS*2340 [0.50] Current Issues in Agriculture and Landscape Management
<b>Note:</b> GEOG*3610 may be substituted for GEOG*3000 and would be taken in Semester 6.			GEOG*2110 [0.50] Climate and the Biophysical Environment
<b>Semester 6</b>			GEOG*3480 [0.50] GIS and Spatial Analysis
GEOG*3480 [0.50]	GIS and Spatial Analysis		1.00 electives or restricted electives
2.00 electives or restricted electives			<b>Summer Semester</b>
<b>Semester 7</b>			COOP*3000 [0.00] Co-op Work Term III
ENVS*4001 [0.50]	Project in Environmental Sciences		<b>Semester 6 - Fall</b>
GEOG*4110 [1.00]	Environmental Systems Analysis		ENVS*4001 [0.50] Project in Environmental Sciences
GEOG*4210 [0.50]	Environmental Governance		GEOG*3000 [0.50] Fluvial Processes
0.50 electives or restricted electives			GEOG*3110 [0.50] Biotic and Natural Resources
<b>Semester 8</b>			GEOG*3210 [0.50] Management of the Biophysical Environment
ENVS*4002 [0.50]	Project in Environmental Sciences		0.50 electives or restricted electives
2.00 electives or restricted electives			<b>Note:</b> GEOG*3610 may be substituted for GEOG*3000 and would be taken in Semester 6.
<b>Restricted Electives</b>			<b>Semester 7 - Winter</b>
1. A minimum of 2 of the following courses:			ENVS*4002 [0.50] Project in Environmental Sciences
ENVS*4390 [1.00] Soil Variability and Land Evaluation			2.00 electives or restricted electives
GEOG*4220 [0.50] Local Environmental Management			<b>Summer Semester (Optional)</b>
GEOG*4230 [0.50] Environmental Impact Assessment			COOP*4000 [0.00] Co-op Work Term IV
2. An additional 1.00 credits in Geography (GEOG) at the 3000 level or higher.			<b>Semester 8 - Fall</b>
<b>Credit Summary (20.00 Total Credits)</b>			GEOG*4110 [1.00] Environmental Systems Analysis
7.00 credits - Environmental Sciences core			GEOG*4210 [0.50] Environmental Governance
6.00 credits - Environment and Resource Management Required courses			1.00 electives or restricted electives
2.00 - 2.50 credits - Environment and Resource Management Restricted electives, depending on course selection			<b>Restricted Electives</b>
4.00 - 4.50 credits - Free electives, depending on course selection			1. A minimum of 2 of the following courses:
Students are reminded that 6.00 credits of their B.Sc. (Env.) degree must be at the 3000-4000 level.			ENVS*4390 [1.00] Soil Variability and Land Evaluation
Students are encouraged to seek advice on their choices from their faculty advisor.			GEOG*4220 [0.50] Local Environmental Management
<b>Environment and Resource Management (ERM:C)</b>			GEOG*4230 [0.50] Environmental Impact Assessment
<b>Department of Geography, College of Social and Applied Human Sciences</b>			2. An additional 1.00 credits in Geography (GEOG) at the 3000 level or higher.
The major focuses on environmental interactions and problem solving by developing an integrated biophysical environment - human environment perspective. In ERM, students will gain knowledge across the natural sciences, an understanding of how they interact, the skills (tools and techniques) needed to support decision making, as well as the methods of management and governance that are critical for environmental decision making. Beginning in first year students learn in the classroom and through hands-on work in labs and in the field. Students are expected to design and conduct experiments and problem solve using state-of-the-art computing and analytical tools. This major provides the knowledge, skills and methods an environmental scientist requires as environmental consultant, environmental manager, environmental and/or resource planner, geographic information systems analyst or to facilitate future graduate work.			<b>Credit Summary (20.00 Total Credits)</b>
<b>Major</b>			7.00 credits - Environmental Sciences core
<b>Semester 1 - Fall</b>			6.00 credits - Environment and Resource Management Required courses
BIOL*1070 [0.50] Discovering Biodiversity			2.00 - 2.50 credits - Environment and Resource Management Restricted electives, depending on course selection
CHEM*1040 [0.50] General Chemistry I			4.00 - 4.50 credits - Free electives, depending on course selection
ENVS*1030 [1.00] Introduction to Environmental Sciences			Students are reminded that 6.00 credits of their B.Sc. (Env.) degree must be at the 3000-4000 level.