2015-2016 Undergraduate Calendar

The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2015-2016 academic year, including the Summer Semester 2015, the Fall Semester 2015 and the Winter Semester 2016.

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 and Colleges of Canada

Contact Information:

University of Guelph
Guelph, Ontario, Canada
N1G 2W1
519-824-4120
http://www.uoguelph.ca

Revision Information:

Date	Description
February 3, 2015	Initial Publication
May 22, 2015	2nd Publication
July 20, 2015	3rd Publication
October 9, 2015	4th Publication
May 11, 2016	5th Publication

Disclaimer

University of Guelph 2015

The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2015-2016 academic year, including the Summer Semester 2015, the Fall Semester 2015 and the Winter Semester 2016.

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

Collection, Use and Disclosure of Personal Information

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 Training, Colleges and Universities, 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.

Statistics Canada - Notification of Disclosure

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

Address for University Communication

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

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

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

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

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

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:

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

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

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**

Table of Contents

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

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

One of:

BOT*2100	[0.50]	Life Strategies of Plants
ZOO*3200	[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

2.00 electives or restricted electives

Note: For students considering graduate research programs in Ecology, ENVS*4001/2 may be substituted by an independent research course (1.00 credits minimum) with approval from the Ecology Faculty Advisor. Course options include: (BIOL*4110, ENVS*4410, ENVS*4420, ENVS*4430), (IBIO*4500 and IBIO*4510), IBIO*4521/2.

Semester 8

ENVS*4002	[0.50]	Project in Environmental Sciences

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 5.

Winter Semester

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

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*3200 [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.

Note: For students considering graduate research programs in Ecology, ENVS*4001/2 may be substituted by an independent research course (1.00 credits minimum) with approval from the Ecology Faculty Advisor. Course options include: (BIOL*4110, ENVS*4410, ENVS*4420, ENVS*4430), (IBIO*4500 and IBIO*4510), IBIO*4521/2 If BIOL*4110 is chosen, it must be taken in Semester 8.

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 provides a foundation in the life and physical sciences, combined with economic, legal and policy aspects of environmental issues. Students gain understanding of environmental processes at the surface of the Earth, where complex interactions involving soils, rocks, water, air and living organisms regulate ecosystems and provide life-sustaining resources. Beginning in the second year, students are able to choose from a range of courses that tailor learning to their individual interests. This major presents opportunities for hands-on experiential learning in both lab and field, as well as independent research and study courses. It provides a solid background in the environmental sciences setting the stage for careers in environmental protection and resource management 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*2230	[0.50]	Communications in Environmental Science
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity

One of:

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

0.50 electives or restricted electives from List A

Note: ENVS*2230 may be taken in either Semester 3 or 4.

Note: 1.00 credits from: (ENVS*2310, ENVS*2320, ENVS*2330, ENVS*2340) must be taken by the end of Semester 4. ENVS*2310 and/or ENVS*2330 may be substituted for ENVS*2320 and/or ENVS*2340, which would be taken in Semester 4.

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

Semester 4

ENVS*2230	[0.50]	Communications in Environmental Science
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
STAT*2040	[0.50]	Statistics I

0.50 electives or electives from List A

Note: ENVS*2230 is taken in Semester 4 if not already taken in Semester 3.

Note: 1.00 credits from: (ENVS*2310, ENVS*2320, ENVS*2330, ENVS*2340) must be taken by the end of Semester 4. ENVS*2320 and/or ENVS*2340 may be substituted for ENVS*2310 and/or ENVS*2330, which would be taken in Semester 3.

Semester 5

2.50 electives or restricted electives from List A

Semester 6

2.50 electives or restricted electives from List A

Semester 7

ENVS*4001	[0.50]	Project in Environmental Sciences *

2.00 electives or restricted electives from List A

Semester 8

ENVS*4002	[0.50]	Project in Environmental Sciences *

2.00 electives or restricted electives from List A

***** An Independent Research course may be substituted for ENVS*4001/2.

Restricted Electives

Students are required to choose a minimum of 8.00 credits from the following list, including at least 1.00 credit at the 4000-level. The list has been divided into sections however students may choose courses from any of the sections provided that they have the necessary prerequisites for the upper level courses they plan to take. Students are encouraged to seek advice on their choices from their faculty advisor and are reminded that 6.00 credits of the B.Sc.(Env.) degree must be at the 3000-4000 level.

Note: Students should note that many restricted electives require other courses as prerequisites. Students should consult the most recent Undergraduate Calendar for specific requirements.

List A

The following courses have as prerequisites courses from the first-year curriculum and/or courses within the list. Students are responsible for ensuring that they have the necessary pre-requisites for courses they wish to take.

Aquatic Science:

BIOL*3450	[0.50]	Introduction to Aquatic Environments
BIOL*4350	[0.50]	Limnology of Natural and Polluted Waters
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3150	[0.50]	Aquatic Systems
ENVS*3190	[0.50]	Environmental Water Chemistry
ENVS*3290	[0.50]	Waterborne Disease Ecology

Atmospheric Science:

ENVS*2030	[0.50]	Meteorology and Climatology
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*3050	[0.50]	Microclimatology
ENVS*4110	[0.50]	Physical Meteorology
ENVS*4210	[1.00]	Meteorological and Environmental Instrumentation
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1130	[0.50]	Physics with Applications

Ecological and Environmental Toxicology:

BIOC*2580	[0.50]	Introduction to Biochemistry
CHEM*3360	[0.50]	Environmental Chemistry and Toxicology
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3020	[0.50]	Pesticides and the Environment
ENVS*3040	[0.50]	Natural Chemicals in the Environment
ENVS*4130	[0.50]	Chemical Ecology: Principles & Practice
MICR*3220	[0.50]	Plant Microbiology
MICR*4180	[0.50]	Microbial Processes in Environmental Management
PBIO*4530	[0.50]	Plants and Environmental Pollution
TOX*2000	[0.50]	Principles of Toxicology

Ecosystem Sciences and Biodiversity:

BIOL*2060	[0.50]	Ecology
ENVS*2210	[0.50]	Apiculture and Honey Bee Biology
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3000	[0.50]	Nature Interpretation
ENVS*3010	[0.50]	Climate Change Biology
ENVS*3090	[0.50]	Insect Diversity and Biology
ENVS*3150	[0.50]	Aquatic Systems
ENVS*3210	[0.50]	Plant Pathology
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*3370	[0.50]	Terrestrial Ecosystem Ecology
ENVS*4040	[0.50]	Behaviour of Insects
ENVS*4230	[0.50]	Biology of Aquatic Insects
ENVS*4260	[0.50]	Field Entomology
ENVS*4350	[0.50]	Forest Ecology

Geoscience:

ENVS*1050	[0.50]	Geology and the Environment
ENVS*2060	[0.50]	Soil Science
ENVS*2200	[0.50]	Glacial Geology
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2400	[0.50]	Sedimentary Environments
ENVS*3060	[0.50]	Groundwater
ENVS*3260	[0.50]	Field Methods in Geosciences
ENVS*4280	[0.50]	Geomicrobiology
GEOG*2000	[0.50]	Geomorphology
GEOG*3420	[0.50]	Remote Sensing of the Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis
GEOG*3610	[0.50]	Environmental Hydrology
GEOG*4150	[0.50]	Catchment Processes
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1130	[0.50]	Physics with Applications

Plant Health and Pathology:

ENVB*4070	[0.50]	Biological and Cultural Control of Plant Diseases
ENVS*2040	[0.50]	Plant Health and the Environment
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*3140	[0.50]	Management of Turfgrass Diseases
ENVS*3210	[0.50]	Plant Pathology
ENVS*3250	[0.50]	Forest Health and Disease
ENVS*4100	[0.50]	Integrated Management of Invasive Insect Pests
ENVS*4180	[0.50]	Insecticide Biological Activity and Resistance
ENVS*4190	[0.50]	Biological Activity of Herbicides
MICR*3220	[0.50]	Plant Microbiology
PBIO*4000	[0.50]	Molecular and Cellular Aspects of Plant-Microbe Interactions

Soil Science:

ENVS*2060	[0.50]	Soil Science
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
ENVS*3080	[0.50]	Soil and Water Conservation
ENVS*3310	[0.50]	Soil Biodiversity and Ecosystem Function
ENVS*4090	[0.50]	Soil Management
ENVS*4160	[0.50]	Soil and Nutrient Management
ENVS*4320	[1.00]	Laboratory and Field Methods in Soil Biodiversity
ENVS*4390	[1.00]	Soil Variability and Land Evaluation

Stewardship:

BIOL*3130	[0.50]	Conservation Biology
BIOL*4150	[0.50]	Wildlife Conservation and Management
ENVS*2120	[0.50]	Introduction to Environmental Stewardship
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
ENVS*3030	[0.50]	Conservation Field Course
ENVS*3080	[0.50]	Soil and Water Conservation
ENVS*3140	[0.50]	Management of Turfgrass Diseases
ENVS*4390	[1.00]	Soil Variability and Land Evaluation

The following courses are guided independent study courses. The semester prior to enrolling in one of these courses the student must arrange for a faculty supervisor and develop a course proposal in consultation with that supervisor.

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

Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core

1.50 credits - Required Courses for the Major

8.00 credits - Restricted Electives (List A)

3.50 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 List A toward their restricted electives

Environmental Sciences (ENVS:C)

School of Environmental Sciences, Ontario Agricultural College

This major provides a foundation in the life and physical sciences, combined with economic, legal and policy aspects of environmental issues. Students gain understanding of environmental processes at the surface of the Earth, where complex interactions involving soils, rocks, water, air and living organisms regulate ecosystems and provide life-sustaining resources. Beginning in the second year, students are able to choose from a range of courses that tailor learning to their individual interests. This major presents opportunities for hands-on experiential learning in both lab and field, as well as independent research and study courses. It provides a solid background in the environmental sciences setting the stage for careers in environmental protection and resource management 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*2230	[0.50]	Communications in Environmental Science
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity

One of:

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

0.50 electives or restricted electives from List A

Note: ENVS*2230 may be taken in either Semester 3 or 5.

Note: 1.00 credits from: (ENVS*2310, ENVS*2320, ENVS*2330, ENVS*2340) must be taken by the end of Semester 5. ENVS*2310 and/or ENVS*2330 may be substituted for ENVS*2320 and/or ENVS*2340, which would be taken in Semester 5.

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

Semester 4 - Summer

STAT*2040	[0.50]	Statistics I

2.00 electives or restricted electives from List A

Fall Semester

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

Semester 5 - Winter

ENVS*2230	[0.50]	Communications in Environmental Science
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt

1.00 electives or restricted electives from List A

Note: ENVS*2230 is taken in Semester 5 if not already taken in Semester 3.

Note: 1.00 credits from: (ENVS*2310, ENVS*2320, ENVS*2330, ENVS*2340) must be taken by the end of Semester 5. ENVS*2320 and/or ENVS*2340 may be substituted for ENVS*2310 and/or ENVS*2330, which would be taken in Semester 3.

Summer Semester

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

Semester 6 - Fall

ENVS*4001	[0.50]	Project in Environmental Sciences *

2.00 electives or restricted electives from List A

Semester 7 - Winter

ENVS*4002	[0.50]	Project in Environmental Sciences *

2.00 electives or restricted electives from List A

Summer Semester - (Optional)

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

Semester 8 - Fall

2.50 electives or restricted electives from List A

* An Independent Research course may be substituted for ENVS*4001/2.

Restricted Electives

Students are required to choose a minimum of 8.00 credits from the following list, including at least 1.00 credit at the 4000-level. The list has been divided into sections however students may choose courses from any of the sections provided that they have the necessary prerequisites for the upper level courses they plan to take. Students are encouraged to seek advice on their choices from their faculty advisor and are reminded that 6.00 credits of the B.Sc.(Env.) degree must be at the 3000-4000 level.

Note: Students should note that many restricted electives require other courses as prerequisites. Students should consult the most recent Undergraduate Calendar for specific requirements.

List A

The following courses have as prerequisites courses from the first-year curriculum and/or courses within the list. Students are responsible for ensuring that they have the necessary pre-requisites for courses they wish to take.

Aquatic Science:

BIOL*3450	[0.50]	Introduction to Aquatic Environments
BIOL*4350	[0.50]	Limnology of Natural and Polluted Waters
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3150	[0.50]	Aquatic Systems
ENVS*3190	[0.50]	Environmental Water Chemistry
ENVS*3290	[0.50]	Waterborne Disease Ecology

Atmospheric Science:

ENVS*2030	[0.50]	Meteorology and Climatology
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*3050	[0.50]	Microclimatology
ENVS*4110	[0.50]	Physical Meteorology
ENVS*4210	[1.00]	Meteorological and Environmental Instrumentation
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1130	[0.50]	Physics with Applications

Ecological and Environmental Toxicology:

BIOC*2580	[0.50]	Introduction to Biochemistry
CHEM*3360	[0.50]	Environmental Chemistry and Toxicology
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3020	[0.50]	Pesticides and the Environment
ENVS*3040	[0.50]	Natural Chemicals in the Environment
ENVS*4130	[0.50]	Chemical Ecology: Principles & Practice
MICR*3220	[0.50]	Plant Microbiology
MICR*4180	[0.50]	Microbial Processes in Environmental Management
PBIO*4530	[0.50]	Plants and Environmental Pollution
TOX*2000	[0.50]	Principles of Toxicology

Ecosystem Sciences and Biodiversity:

BIOL*2060	[0.50]	Ecology
ENVS*2210	[0.50]	Apiculture and Honey Bee Biology
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*3000	[0.50]	Nature Interpretation
ENVS*3010	[0.50]	Climate Change Biology
ENVS*3090	[0.50]	Insect Diversity and Biology
ENVS*3150	[0.50]	Aquatic Systems
ENVS*3210	[0.50]	Plant Pathology
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*3370	[0.50]	Terrestrial Ecosystem Ecology
ENVS*4040	[0.50]	Behaviour of Insects
ENVS*4230	[0.50]	Biology of Aquatic Insects
ENVS*4260	[0.50]	Field Entomology
ENVS*4350	[0.50]	Forest Ecology

Geoscience:

ENVS*1050	[0.50]	Geology and the Environment
ENVS*2060	[0.50]	Soil Science
ENVS*2200	[0.50]	Glacial Geology
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2400	[0.50]	Sedimentary Environments
ENVS*3060	[0.50]	Groundwater
ENVS*3260	[0.50]	Field Methods in Geosciences
ENVS*4280	[0.50]	Geomicrobiology
GEOG*2000	[0.50]	Geomorphology
GEOG*3420	[0.50]	Remote Sensing of the Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis
GEOG*3610	[0.50]	Environmental Hydrology
GEOG*4150	[0.50]	Catchment Processes
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1130	[0.50]	Physics with Applications

Plant Health and Pathology:

ENVB*4070	[0.50]	Biological and Cultural Control of Plant Diseases
ENVS*2040	[0.50]	Plant Health and the Environment
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*3140	[0.50]	Management of Turfgrass Diseases
ENVS*3210	[0.50]	Plant Pathology
ENVS*3250	[0.50]	Forest Health and Disease
ENVS*4100	[0.50]	Integrated Management of Invasive Insect Pests
ENVS*4180	[0.50]	Insecticide Biological Activity and Resistance
ENVS*4190	[0.50]	Biological Activity of Herbicides
MICR*3220	[0.50]	Plant Microbiology
PBIO*4000	[0.50]	Molecular and Cellular Aspects of Plant-Microbe Interactions

Soil Science:

ENVS*2060	[0.50]	Soil Science
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
ENVS*3080	[0.50]	Soil and Water Conservation
ENVS*3310	[0.50]	Soil Biodiversity and Ecosystem Function
ENVS*4090	[0.50]	Soil Management
ENVS*4160	[0.50]	Soil and Nutrient Management
ENVS*4320	[1.00]	Laboratory and Field Methods in Soil Biodiversity
ENVS*4390	[1.00]	Soil Variability and Land Evaluation

Stewardship:

BIOL*3130	[0.50]	Conservation Biology
BIOL*4150	[0.50]	Wildlife Conservation and Management
ENVS*2120	[0.50]	Introduction to Environmental Stewardship
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
ENVS*3030	[0.50]	Conservation Field Course
ENVS*3080	[0.50]	Soil and Water Conservation
ENVS*3140	[0.50]	Management of Turfgrass Diseases
ENVS*4390	[1.00]	Soil Variability and Land Evaluation

The following courses are guided independent study courses. The semester prior to enrolling in one of these courses the student must arrange for a faculty supervisor and develop a course proposal in consultation with that supervisor.

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

Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core

1.50 credits - Required Courses for the Major

8.00 credits - Restricted Electives (List A)

3.50 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 List A 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 realities. 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 and private sectors. At the same time, the major fully prepares students to move onto 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
ECON*2100	[0.50]	Economic Growth and Environmental Quality
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
FARE*2700	[0.50]	Survey of Natural Resource Economics

One of:

BIOC*2580	[0.50]	Introduction to Biochemistry
BIOL*2060	[0.50]	Ecology
ENVS*1050	[0.50]	Geology and the Environment
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
GEOG*2480	[0.50]	Mapping and GIS
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1080	[0.50]	Physics for Life Sciences
TOX*2000	[0.50]	Principles of Toxicology

Semester 4

ECON*2310	[0.50]	Intermediate Microeconomics
ECON*2740	[0.50]	Economic Statistics
ECON*2770	[0.50]	Introductory Mathematical Economics
FARE*3170	[0.50]	Cost-Benefit Analysis

One of:

BIOC*2580	[0.50]	Introduction to Biochemistry
BIOL*2060	[0.50]	Ecology
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
GEOG*2110	[0.50]	Climate and the Biophysical Environment
GEOG*2480	[0.50]	Mapping and GIS
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1130	[0.50]	Physics with Applications

Note: STAT*2040 may be substituted for ECON*2740.

Semester 5

ECON*2410	[0.50]	Intermediate Macroeconomics
ECON*3710	[0.50]	Advanced Microeconomics
ECON*3740	[0.50]	Introduction to Econometrics
FARE*4290	[0.50]	Land Economics

0.50 electives or restricted electives

Note: Students who wish to pursue graduate studies in Economics should take the following courses: ECON*3810, ECON*4710, ECON*4810 and ECON*4640.

Semester 6

2.50 electives or restricted electives

Semester 7

ENVS*4001	[0.50]	Project in Environmental Sciences

2.00 electives or restricted electives

Semester 8

ECON*4930	[0.50]	Environmental Economics
ENVS*4002	[0.50]	Project in Environmental Sciences
FARE*4310	[0.50]	Resource Economics

1.00 restricted electives or electives

Restricted Electives

Students in the Environmental Economics and Policy major are required to choose 2.50 additional credits from Food, Agricultural and Resource Economics (FARE*XXXX) or Economics (ECON*XXXX) at the 3000 or 4000 level. Students must also take 5.00 additional credits in science courses. A list of acceptable science courses (which includes some ECON and FARE courses to simultaneously meet the additional FARE and ECON restricted electives), is available at http://www.bsc.uoguelph.ca/Approved_electives.shtml.

Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core

6.00 credits - Environmental Economics and Policy required courses

5.00 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.

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 Environmental Economics and Policy restrictive electives.

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 realities. 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 and private sectors. At the same time, the major fully prepares students to move onto 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
ECON*2100	[0.50]	Economic Growth and Environmental Quality
ENVS*2330	[0.50]	Current Issues in Ecosystem Science and Biodiversity
FARE*2700	[0.50]	Survey of Natural Resource Economics

One of:

BIOC*2580	[0.50]	Introduction to Biochemistry
BIOL*2060	[0.50]	Ecology
ENVS*1050	[0.50]	Geology and the Environment
ENVS*2310	[0.50]	Current Issues in Earth Surface Processes
GEOG*2480	[0.50]	Mapping and GIS
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1080	[0.50]	Physics for Life Sciences
TOX*2000	[0.50]	Principles of Toxicology

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
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives

Note: ECON*2740 may be substituted for STAT*2040.

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

One of:

BIOC*2580	[0.50]	Introduction to Biochemistry
BIOL*2060	[0.50]	Ecology
ENVS*2320	[0.50]	Current Issues in Microbial and Molecular Science
ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
ENVS*3150	[0.50]	Aquatic Systems
GEOG*2110	[0.50]	Climate and the Biophysical Environment
GEOG*2480	[0.50]	Mapping and GIS
PHYS*1070	[0.50]	Physics for Life Sciences II
PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1130	[0.50]	Physics with Applications

1.00 electives or restricted electives

Note: Students who wish to pursue graduate studies in Economics should take the following courses: ECON*3810, ECON*4710, ECON*4810 and ECON*4640.

Summer Semester

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

Semester 6 - Fall

ECON*3710	[0.50]	Advanced Microeconomics
ENVS*4001	[0.50]	Project in Environmental Sciences
FARE*4290	[0.50]	Land Economics

1.00 electives or restricted electives

Semester 7 - Winter

ECON*4930	[0.50]	Environmental Economics
ENVS*4002	[0.50]	Project in Environmental Sciences
FARE*4310	[0.50]	Resource Economics

1.00 electives or restricted electives

Summer Semester (Optional)

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

Semester 8 - Fall

2.50 electives or restricted electives

Restricted Electives

Students in the Environmental Economics and Policy major are required to choose 2.50 additional credits from Food, Agricultural and Resource Economics (FARE*XXXX) or Economics (ECON*XXXX) at the 3000 or 4000 level. Students must also take 5.00 additional credits in science courses. A list of acceptable science courses, which includes ECON and FARE courses to simultaneously meet the additional FARE and ECON restricted electives, is available at http://www.bsc.uoguelph.ca/Approved_electives.shtml.

Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core

6.00 credits - Environmental Economics and Policy required courses

5.00 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.

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 Environmental Economics and Policy restrictive electives.

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

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

GEOG*2000	[0.50]	Geomorphology
GEOG*2460	[0.50]	Analysis in Geography

One of:

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

1.00 electives

Semester 4

ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
GEOG*2110	[0.50]	Climate and the Biophysical Environment
GEOG*2210	[0.50]	Environment and Resources
GEOG*2480	[0.50]	Mapping and GIS

0.50 electives or restricted electives

Note: ENVS*2120 may be substituted for ENVS*2340 and could be taken in Semester 5.

Semester 5

GEOG*3000	[0.50]	Fluvial Processes
GEOG*3110	[0.50]	Biotic and Natural Resources
GEOG*3210	[0.50]	Management of the Biophysical Environment

1.00 electives or restricted electives

Note: GEOG*3610 may be substituted for GEOG*3000 and would be taken in Semester 6.

Semester 6

GEOG*3480	[0.50]	GIS and Spatial Analysis

2.00 electives or restricted electives

Semester 7

ENVS*4001	[0.50]	Project in Environmental Sciences
GEOG*4110	[1.00]	Environmental Systems Analysis
GEOG*4210	[0.50]	Environmental Governance

0.50 electives or restricted electives

Semester 8

ENVS*4002	[0.50]	Project in Environmental Sciences

2.00 electives or restricted electives

Restricted Electives

1. A minimum of 1.00 credits from:

1. A minimum of 2 courses from:

ENVS*4390	[1.00]	Soil Variability and Land Evaluation
GEOG*4220	[0.50]	Local Environmental Management
GEOG*4230	[0.50]	Environmental Impact Assessment

2. An additional 1.00 credits in Geography (GEOG) at the 3000 level or higher.

Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core

6.00 credits - Environment and Resource Management Required courses

2.00 - 2.50 credits - Environment and Resource Management Restricted electives, depending on course selection

4.00 - 4.50 credits - Free electives, depending on course selection

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.

Environment and Resource Management (ERM:C)

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 - 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

GEOG*2000	[0.50]	Geomorphology
GEOG*2480	[0.50]	Mapping and GIS

Note: 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.

Note: ENVS*2120 may be substituted for ENVS*2340 and could be taken in Semester 3 or 6.

1.50 electives or restricted electives

Winter Semester

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

Semester 4 - Summer

ECON*2100	[0.50]	Economic Growth and Environmental Quality
GEOG*2210	[0.50]	Environment and Resources
STAT*2040	[0.50]	Statistics I

1.00 electives or restricted electives

Fall Semester

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

Semester 5 - Winter

ENVS*2340	[0.50]	Current Issues in Agriculture and Landscape Mgmt
GEOG*2110	[0.50]	Climate and the Biophysical Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis

1.00 electives or restricted electives

Summer Semester

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

Semester 6 - Fall

ENVS*4001	[0.50]	Project in Environmental Sciences
GEOG*3000	[0.50]	Fluvial Processes
GEOG*3110	[0.50]	Biotic and Natural Resources
GEOG*3210	[0.50]	Management of the Biophysical Environment

0.50 electives or restricted electives

Note: GEOG*3610 may be substituted for GEOG*3000 and would be taken in Semester 6.

Semester 7 - Winter

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

Semester 8 - Fall

GEOG*4110	[1.00]	Environmental Systems Analysis
GEOG*4210	[0.50]	Environmental Governance

1.00 electives or restricted electives

Restricted Electives

1. A minimum of 2 of the following courses:

ENVS*4390	[1.00]	Soil Variability and Land Evaluation
GEOG*4220	[0.50]	Local Environmental Management
GEOG*4230	[0.50]	Environmental Impact Assessment

2. An additional 1.00 credits in Geography (GEOG) at the 3000 level or higher.

Credit Summary (20.00 Total Credits)

7.00 credits - Environmental Sciences core

6.00 credits - Environment and Resource Management Required courses

2.00 - 2.50 credits - Environment and Resource Management Restricted electives, depending on course selection

4.00 - 4.50 credits - Free electives, depending on course selection

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.