



FOR APPROVAL

PUBLIC

OPEN SESSION

TO: UTSC Academic Affairs Committee

SPONSOR: Prof. William Gough, Vice-Principal Academic and Dean
CONTACT INFO: 416-208-7027, vpdean@utsc.utoronto.ca

PRESENTER: Prof. Mark Schmuckler, Vice-Dean Undergraduate
CONTACT INFO: 416-208-2978, vicedean@utsc.utoronto.ca

DATE: Wednesday, January 25, 2017

AGENDA ITEM: 3

ITEM IDENTIFICATION:

Major modifications to introduce a new freestanding Minor in Natural Sciences and Environmental Management (Science)

JURISDICTIONAL INFORMATION:

University of Toronto Scarborough Academic Affairs Committee (AAC) “is concerned with matters affecting the teaching, learning and research functions of the Campus” (*AAC Terms of Reference, Section 4*). Under section 5.6 of its terms of reference, the Committee is responsible for approval of “Major and minor modifications to existing degree programs.” The AAC has responsibility for the approval of Major and Minor modifications to existing programs as defined by the University of Toronto Quality Assurance Process (*UTQAP, Section 3.1*).

GOVERNANCE PATH:

- 1. UTSC Academic Affairs Committee [For Approval] (January 25, 2017)**

PREVIOUS ACTION TAKEN:

No previous action in governance has been taken on this item.

HIGHLIGHTS:

The Department of Physical and Environmental Sciences (DPES) at the University of Toronto Scarborough (UTSC) is proposing to introduce a new freestanding Minor in Natural Sciences and Environmental Management (Science).

There is a clear societal need for graduates with the skills necessary to address applied questions in environmental and natural resources management, and also an increasing societal demand for ‘greener’ and environmentally sustainable economies around the world. Students completing the proposed Minor will gain a multidisciplinary education in the natural history of the Earth, human-environment systems, environmental management, and decision-analysis techniques, and also the requisite level of science literacy required to enable them to meet this societal need and demand. Thus, the Minor in Natural Sciences and Environmental Management will fill an existing gap in the cross-disciplinary approach to environmental science education by establishing a coherent academic connection between Science and the Arts. It will also help UTSC meet the increasing demand for science-based education in the management and economic sectors.

The proposed Minor will meet the needs of a growing number of undergraduates who prefer to diversify their education by combining Majors and Minors from various disciplines. The proposed Minor is distinct in that it is designed to appeal to students from a broad range of disciplines, including: Economics for Management Studies, Management, and the Social Sciences, many of whom may find themselves in careers that will demand a basic understanding of natural sciences and environmental management.

The proposed Minor will be distinguished from the existing Minor in Environmental Science (Science) by its cross-disciplinary approach to education. It is worth noting that enrolment in the Minor in Environmental Science has grown steadily over the last five years, from 90 students in 2011-12 to 125 students in 2015-16, which suggests there is strong student demand for programs focused on the Environment.

There has been extensive consultation in the Department of Physical and Environmental Sciences. The proposal has the approval of the Department Chair, the Environmental Science and Environmental Studies Groups, the Teaching and Curriculum Committee, and the DPES Council. Finally, the proposal has been reviewed by the Dean’s Office, the Decanal Undergraduate Curriculum Committee and the Provost’s Office.

FINANCIAL IMPLICATIONS:

There are no net financial implications to the campus operating budget.

RECOMMENDATION:

Be It Resolved,

THAT the major modifications to introduce a new freestanding Minor in Natural Sciences and Environmental Management (Science), as described in the proposal dated December 2, 2016 and recommended by the Vice-Principal Academic and Dean, Professor William Gough, be approved effective April 1, 2017 for the academic year 2017-18.

DOCUMENTATION PROVIDED:

1. Major Modification to introduce a new freestanding Minor in Natural Sciences and Environmental Management (Science) dated December 2, 2016.



**University of Toronto
Major Modification Proposal:
New Freestanding Minor where there is no Existing
Specialist or Major**

What is being proposed:	New Freestanding Minor in Natural Sciences and Environmental Management (Science)
Department / Unit where the program will be housed:	DPES
Start date of the program:	April 1, 2017
Faculty / Academic Division:	University of Toronto Scarborough
Faculty / Academic Division Contact:	Annette Knott, Academic Programs Officer aknott@utsc.utoronto.ca
Department/Unit Contact:	Lana Mikhaylichenko
Date of this version of the proposal:	December 2, 2016

1 Summary

This is a proposal to introduce a new freestanding Minor in Natural Sciences and Environmental Management (Science), which will be housed in the Department of Physical and Environmental Sciences (DPES) at the University of Toronto Scarborough (UTSC). DPES offers Specialist, Major and Minor programs in Environmental Science, as well as a Major in Environmental Studies (shared with the Department of Political Science); however, there are no existing Specialist or Major programs in Natural Sciences and Environmental Management housed at UTSC.

There is a clear societal need for graduates with the skills necessary to address applied questions in environmental and natural resources management, and also an increasing societal demand for ‘greener’ and environmentally sustainable economies around the world. Students completing the proposed Minor will gain a multidisciplinary education in the natural history of the Earth, human-environment systems, environmental management, and decision-analysis techniques, and also the requisite level of science literacy required to enable them to meet this societal need and demand.

The proposed Minor also will meet the needs of a growing number of undergraduates who prefer to diversify their education by combining Majors and Minors from various disciplines. The proposed Minor is distinct in that it is designed to appeal to students from a broad range of disciplines, including: Economics for Management Studies, Management, and the Social Sciences, many of whom may find themselves in careers that will demand a basic understanding of natural sciences and environmental management.

The proposed Minor will be distinguished from the existing Minor in Environmental Science (Science) by its cross-disciplinary approach to education. It is worth noting that enrolment in the Minor in Environmental Science has grown steadily over the last five years, from 90 students in 2011-12 to 125 students in 2015-16, which suggests there is strong student demand for programs focused on the Environment.

2 Academic Rationale

This is a proposal to introduce a new freestanding Minor in Natural Sciences and Environmental Management (Science), which will be housed in the Department of Physical and Environmental Sciences (DPES) at the University of Toronto Scarborough (UTSC). DPES offers Specialist, Major and Minor programs in Environmental Science, as well as a Major in Environmental Studies (shared with the Department of Political Science); however, there are no existing Specialist or Major programs in Natural Sciences and Environmental Management housed at UTSC.

The proposed Minor will provide students with the opportunity to explore the world around them through essential courses in planetary sciences, environmental science, and environmental studies. It takes an innovative approach to cross-disciplinary education by including courses in natural sciences in the first two years, followed by courses in environmental studies that extend

the human-environment interface in the third year.

The Minor in Natural Sciences and Environmental Management will fill an existing gap in the cross-disciplinary approach to environmental science education by establishing a coherent academic connection between Science and the Arts. It will also help UTSC meet the increasing demand for science-based education in the management and economic sectors.

The proposed Minor is designed to appeal to a broad range of students, by integrating knowledge from economics, management, and social sciences. Its applied focus will allow students to gain a better understanding of the natural sciences, environmental issues, and the management challenges we face today.

Mode of Delivery

The formal mode of delivery for the proposed Minor will be designated as “In Class”, however three of the first-year courses (EESA06H3, EESA09H3, and EESA10H3) will all include a web-option during fall/winter semesters, thereby proffering students greater convenience and flexibility in completing the program.

Context

There is great need, both nationally and internationally, for educated professionals who understand how terrestrial systems function and respond to human activities. Yet, many economic and policy decisions are being made by graduates who may not have a strong foundation in physical sciences. The proposed Minor, which is aimed at scientists and non-scientists, will provide students with the foundational knowledge needed to make informed judgements about environmental issues within the broader social, political, and economic aspects of environmental management. Pedagogically, the creation and support of the program is well maintained by the multidisciplinary strength of the DPES faculty.

The proposed Minor is consistent with both the wider University mission, and with the UTSC and DPES academic plans and priorities. The program is designed to:

- Achieve cross-disciplinary learning by combining foundational courses in natural sciences and environmental management through structured methodology that is inherently integrative in field of environmental sciences (i.e., incorporating various subjects that are normally taught separately through our various disciplines;
- Attract national and international students with diverse academic backgrounds;
- Fill the knowledge gap in natural sciences and career expectations of science and non-science graduates; and
- Enrich student experience through life-long learning and career development.

Distinctiveness

The proposed Minor has been designed to provide students with an education in natural history of the Earth, human-environment systems, environmental management, and decision-analysis techniques. It focuses on the cross-disciplinary proficiencies necessary to meet the challenges of

the growing ‘green’ and resource-based economies.

The proposed Minor is different from the existing Minor in Environmental Science (Science) in that it goes beyond environmental sciences by requiring students to extend their knowledge of natural and environmental sciences to decision making analysis for solutions to local and global scale environmental challenges.

There are no other programs similar to the proposed Minor offered at the wider University of Toronto. Similar offerings at other universities include: the [Minor in Resource and Environmental Management](#) offered by Simon Fraser University. However, this Minor makes a greater attempt to integrate natural and social systems concepts into resource management through applied topics and contemporary resource management issues.

3 Need and Demand

There is a growing need for science literacy among students with economic, management, and social sciences backgrounds whose careers may demand an understanding of natural sciences. The proposed Minor will provide a multidisciplinary education in the natural history of the Earth, human-environment systems, environmental management, and decision-analysis techniques required to address this need for enhanced science literacy.

There is also evidence that a growing number of undergraduates prefer to diversify their education by combining Majors and Minors from various disciplines, and also for cross-disciplinary Minors. It should be noted that enrolment in the Minor in Environmental Science has grown steadily over the last five years, from 90 students in 2011-12 to 125 students in 2015-16, which further suggests there is demand for the proposed Minor.

Table 1: Undergraduate Enrolment Projections

Level of study	Academic year 2017-18	Academic year 2018-19	Academic year 2019-20	Academic year 2020-21	Academic year 2021-22	Academic year 2022-23	Academic year 2023-24*
1 st year	20	30	40	50	60	60	60
2 nd year	0	18	27	36	45	55	55
3 rd year	0	0	18	27	36	45	55
4 th year							
Total enrolment	20	50	85	113	141	160	170

*Offering reaches steady-state.

4 Admission / Eligibility Requirements

No special enrolment requirements will be applied. Enrolment will be unlimited, and the offering will be open to students from all disciplines.

5 Program Requirements

Complete Program Description and Proposed Calendar copy:

MINOR PROGRAM IN NATURAL SCIENCES AND ENVIRONMENTAL MANAGEMENT (SCIENCE)

This Minor is designed to provide students with a multidisciplinary education encompassing the origin and natural history of the Earth, environmental science and environmental management, with emphasis on how these branches of study relate to one another. Building on foundational courses in natural and environmental science, students will develop decision-analysis techniques and a broad perspective on human impact on the environment. In upper years, knowledge of natural, environmental and social sciences is implemented in analyses of real-world issues through integrative environmental studies courses. The program is well suited to complement degree programs in Management, Economics for Management Studies and the Social Sciences. First year students are strongly advised to check prerequisites for B- and C-level courses before choosing their A-level courses.

Note: The Minor in Natural Sciences and Environmental Management cannot be combined with the Major in Environmental Science (Science), the Major Environmental Studies (Arts) or the Minor in Environmental Science (Science).

Program Requirements

Students must complete a total of 4.0 credits as follows:

First Year:

1.0 credit from the following:

- ASTA01H3 Introduction to Astronomy and Astrophysics I: The Sun and Planets
- ASTA02H3 Introduction to Astronomy and Astrophysics II: Beyond the Sun and Planets
- EESA06H3 Introduction to Planet Earth
- EESA09H3 Wind
- EESA10H3 Human Health and the Environment
- EESA11H3 Environmental Pollution
- ESTB01H3 Introduction to Environmental Studies

Second/Third Year:

1.5 credits from the following:

- ASTB03H3 Great Moments in Astronomy*
- EESB05H3 Principles of Soil Science**
- EESB15H3 Earth History**
- EESB16H3 Feeding Humans - The Cost to the Planet***
- EESB18H3 Natural Hazards

EESC13H3 Environmental Impact Assessment and Auditing
EESC34H3 Sustainability in Practice

Third/Fourth Year:

1.5 credits from the following:

ESTC35H3 Environmental Science and Technology in Society
ESTC36H3 Knowledge, Ethics and Environmental Decision-Making
POLC53H3 Canadian Environmental Policy
ESTD16H3 Project Management in Environmental Studies
ESTD17Y3 Cohort Capstone Course in Environmental Studies
PSCD02H3 Current Questions in Mathematics and Science
PSCD11H3 Communicating Science: Film, Media, Journalism, and Society

Notes:

- *ASTB03H3 cannot be taken in combination with any other AST course in the program.
- **Students in the Minor in Natural Sciences and Environmental Management must take EESA06H3 as the prerequisite for these courses.
- ***The prerequisites for this course are BIOA01H3 and BIOA02H3, which are not included in the requirements for the Minor.

Complete List of Courses Associated With the Program, Including Full Calendar Copy:

ASTA01H3 Introduction to Astronomy and Astrophysics I: The Sun and Planets

The solar neighbourhood provides examples of astronomical bodies that can be studied by both ground-based and space vehicle based-observational instruments. The astronomical bodies studied range from cold and rocky planets and asteroids to extremely hot and massive bodies, as represented by the sun. This course considers astronomical bodies and their evolution, as well as basic parts of physics, chemistry, etc., required to observe them and understand their structure. The course is suitable for both science and non-science students.

Exclusion: AST101H

Breadth Requirement: Natural Sciences

ASTA02H3 Introduction to Astronomy and Astrophysics II: Beyond the Sun and Planets

The structure and evolution of stars and galaxies is considered, with our own galaxy, the Milky Way, providing the opportunity for detailed study of a well-observed system. Even this system challenges us with many unanswered questions, and the number of questions increases with further study of the universe and its large-scale character. Current models and methods of study of the universe will be considered. The course is suitable for both science and non-science students.

Exclusion: AST121H, AST201H

Breadth Requirement: Natural Sciences

ASTB03H3 Great Moments in Astronomy

An examination of the people, the background and the events associated with some major advances in astronomy.

Emphasis is given to the role of a few key individuals and to how their ideas have revolutionized

our understanding of nature and the Universe. The perspective gained is used to assess current astronomical research and its impact on society.

Prerequisite: 4.0 full credits

Exclusion: AST210H

Breadth Requirement: Natural Sciences

EESA06H3 Introduction to Planet Earth

This general interest course explores the composition, structure and origin of the Earth and the tectonic, chemical and biological processes that have evolved over the last 4.5 billion years. It explains how planet "works" as a complex system. It provides a fundamental basis for understanding many of the environmental challenges faced by human societies especially natural hazards, water shortages, and climate change, and the importance of natural resources to our economy.

Exclusion: GGR100Y, GLG110H

Breadth Requirement: Natural Sciences

EESA09H3 Wind

A survey of the science, history and applications of wind. Topics include storms including hurricanes, tornadoes and mid-latitude cyclones, global circulation, local circulations, measurement of winds, impact of winds on land surfaces, wind power, winds and pollution, historical and literary winds, and contemporary wind research. No prior knowledge of environmental science is required.

Breadth Requirement: Natural Sciences

EESA10H3 Human Health and the Environment

Because of pollution, our surroundings are becoming increasingly hazardous to our health. The past century has seen intense industrialization characterized by the widespread production and use of chemicals and the intentional and unintentional disposal of a wide range of waste materials. This course explores the relationship between the incidence of disease in human populations and the environmental pollution. Emphasis will be placed on understanding where and what pollutants are produced, how they are taken up by humans and their long term effects on health; the role of naturally-occurring carcinogens will also be examined. The course will include a view of risk assessment and toxicology using case studies. No prior knowledge of environmental or medical science is required.

Breadth Requirement: Natural Sciences

EESA11H3 Environmental Pollution

This course illustrates the environmental effects of urban expansion, changing methods of agriculture, industrialization, recreation, resource extraction, energy needs and the devastation of war. Drawing on information from a wide spectrum of topics - such as waste disposal, tourism, the arctic, tropical forests and fisheries - it demonstrates what we know about how pollutants are produced, the pathways they take through the global environment and how we can measure them. The course will conclude with an examination of the state of health of Canada's environments highlighting areas where environmental contamination is the subject of public discussion and concern. No prior knowledge of environmental science is required.

Breadth Requirement: Natural Sciences

EESB05H3 Principles of Soil Science

A study of the processes of pedogenesis and the development of diverse soil profiles, their field relationships and their response to changing environmental conditions.

An examination of the fundamental soil properties of importance in soil management. An introduction to the techniques of soil examination in the field, soil analysis in the laboratory and the basic principles of soil classification.

Prerequisite: [EESA01H3](#) or [EESA06H3](#)

Exclusion: GGR205H

Breadth Requirement: Natural Sciences

EESB15H3 Earth History

Planet Earth is at least 4,400 million years old and a geological record exists for at least the last 3,900 million years in the form of igneous, metamorphic and sedimentary rocks. The changing dynamics of convection deep within the Earth's mantle and associated super-continent assembly and breakup along with meteorite impacts, are now recognized as the major controls on development of the planet's atmosphere, oceans, biology, climate and geo-chemical cycles. This course reviews this long history and the methods and techniques used by geologists to identify ancient environments.

Prerequisite: ~~EESA01H3~~ and [EESA06H3](#)

Breadth Requirement: Natural Sciences

NOTE: Note: Priority will be given to students in Specialist programs in Environmental Geoscience and Environmental Chemistry.

EESB16H3 Feeding Humans - The Cost to the Planet

Examines the origins and systems of production of the major plants and animals on which we depend for food. Interactions between those species and systems and the local ecology will be examined, looking at issues of over harvesting, genetic erosion, soil erosion, pesticide use, and impacts of genetically modified strains.

Prerequisite: [BIOA01H3](#) & [BIOA02H3](#)

Breadth Requirement: Natural Sciences

EESB18H3 Natural Hazards

This course is an investigation of the geological background and possible solutions to major hazards in the environment.

Environmental hazards to be studied include: landslides, erosion, earthquakes, volcanic eruptions, asteroid impacts, flooding, glaciation, future climate change, subsidence, and the disposal of toxic wastes. This may be of interest to a wide range of students in the life, social, and physical sciences; an opportunity for the non-specialist to understand headline-making geological events of topical interest. No prior knowledge of the Earth Sciences is required.

Exclusion: (EESA05H3), GLG103H

Breadth Requirement: Natural Sciences

EESC13H3 Environmental Impact Assessment and Auditing

To familiarize students with the relevant legislation, qualitative and quantitative approaches and applications for environmental impact assessments and environmental auditing. The focus will

be on the assessment of impacts to the natural environment, however, socio-economic impacts will also be discussed. Environmental auditing and environmental certification systems will be discussed in detail. Examples and case studies from forestry, wildlife biology and land use will be used to illustrate the principles and techniques presented in the course. Students will acquire "hands-on" experience in impact assessment and environmental auditing through case studies.

Prerequisite: ~~2.5~~ **1.0** full-credits in of EES courses

Corequisite: **0.5 credit in EES courses**

Exclusion: GGR393H

Breadth Requirement: Natural Sciences

EESC34H3 Sustainability in Practice

This course is intended for students who would like to apply theoretical principles of environmental sustainability learned in other courses to real world problems. Students will identify a problem of interest related either to campus sustainability, a local NGO, or municipal, provincial, or federal government. Class meetings will consist of group discussions investigating key issues, potential solutions, and logistical matters to be considered for implementation of proposed solutions. Students who choose campus issues will also have the potential to actually implement their solutions. Grades will be based on participation in class discussions, as well as a final report and presentation.

Same as ESTC34H3

Prerequisite: **EESA06H3** ~~Enrollment in the Environmental Studies major program~~ and 9.5 credits

Exclusion: ESTC34H3

Enrolment Limits: 20

Breadth Requirement: Natural Sciences

ESTB01H3 Introduction to Environmental Studies

This course introduces the Environmental Studies major and the interdisciplinary study of the environment through a team-teaching format. Students will explore both physical and social science perspectives on the environment, sustainability, environmental problems and their solutions. Emphasis will be on critical thinking, problem solving, and experiential learning.

Prerequisite: Enrolment in the Environmental Studies major program

Breadth Requirement: Social & Behavioural Sciences

[Note: course change proposal is pending]

ESTC36H3 Knowledge, Ethics and Environmental Decision-Making

Most environmental issues have many sides including scientific, social, cultural, ethical, political, and economic. Current national, regional and local problems will be discussed in class to help students critically analyze the roots of the problems and possible approaches to decision-making in a context of pluralism and complexity.

Prerequisite: ESTB01H3

Enrolment Limits: 60

Breadth Requirement: Social & Behavioural Sciences

NOTE: Priority will be given to students enrolled in the Environmental Studies Program.

Additional students will be admitted as space permits.

ESTD16H3 Project Management in Environmental Studies

Students will select a research problem in an area of special interest. Supervision will be provided by a faculty member with active research in geography, ecology, natural resource management, environmental biology, or geosciences as represented within the departments. Project implementation, project monitoring and evaluation will form the core elements for this course.

Same as [EESD16H3](#)

Prerequisite: ~~Enrolment in the Environmental Studies major program and~~ **At least** 14.5 credits

Exclusion: [EESD16H3](#)

Breadth Requirement: Natural Sciences

ESTD17Y3 Cohort Capstone Course in Environmental Studies

This course is designed to provide a strong interdisciplinary focus on specific environmental problems including the socioeconomic context in which environmental issues are resolved. The cohort capstone course is in 2 consecutive semesters, providing final year students the opportunity to work in a team, as environmental researchers and consultants, combining knowledge and skill-sets acquired in earlier courses. Group research to local environmental problems and exposure to critical environmental policy issues will be the focal point of the course. Students will attend preliminary meetings schedules in the Fall semester.

Same as [EESD17Y3](#)

Prerequisite: ~~Enrolment in the Environmental Studies major program and~~ **At least** 14.5 credits

Exclusion: [EESD17Y3](#)

Breadth Requirement: Natural Sciences

POLC53H3 Canadian Environmental Policy

This course examines the ideas and success of the environmental movement in Canada. The course focuses on how environmental policy in Canada is shaped by the ideas of environmentalists, economic and political interests, public opinion, and Canada's political-institutional framework. Combined lecture-seminar format.

Areas of Focus: Canadian Government and Politics; Public Policy

Prerequisite: [[POLB50Y3](#) or equivalent] or [ESTB01H3](#) or [1.5 credits at the B-level in CIT courses]

Breadth Requirement: Social & Behavioural Sciences

PSCD02H3 Current Questions in Mathematics and Science

Topics of current prominence arising in chemistry, computer science, earth sciences, mathematics and physics will be discussed, usually by faculty or outside guests who are close to the areas of prominence. Topics will vary from year to year as the subject areas evolve.

Prerequisite: Completion of at least 3.5 credits of a Physical Sciences program.

Corequisite: Continued participation in one of the Physical Sciences programs **or enrolment in the Minor Program in Natural Sciences and Environmental Management.**

Exclusion: PHY342H

Breadth Requirement: Natural Sciences

PSCA01H3 PSCD11H3 Communicating Science: Film, Media, Journalism, and Society

Communicating complex science issues to a wider audience remains a major challenge. This course will use film, media, journalism and science experts to explore the role of science and

scientists in society. Students will engage with media and academic experts to get an insight into the ‘behind the scenes’ world of filmmaking, media, journalism, and scientific reporting. The course will be of interest to all students of physical and environmental science, media, education, journalism and political science.

Breadth Requirement: ~~Natural Sciences~~ **Arts and Literature and Language**

6 Program Structure, Learning Outcomes, and Degree Level Expectations

Degree Level Expectations	Program Learning Outcomes – e.g. what students will know or be able to do at the completion of the program [Clearly describe how the Program Learning Outcomes will support the degree level expectations]	How the program design / structure supports the degree level expectations [Clearly describe how the program design/structure will support the degree level expectations]
<p>1. Depth and Breadth of Knowledge Depth of Knowledge: is attained through a progression of introductory, core and specialized courses. Specialized courses will normally be at the C and D levels. Breadth of Knowledge: students will gain an appreciation of the variety of modes of thinking, methods of inquiry and analysis, and ways of understanding the world that underpin different intellectual fields.</p>	<p>Depth and breadth of knowledge in the Minor in Natural Sciences and Environmental Management is reflected in students who are able to:</p> <ul style="list-style-type: none"> • Understand astronomical concepts, their evolution, as well as basic parts of physics, chemistry, etc.; • Understand models and methods of study of the universe; • Understand the composition and structure of the Earth • Apply knowledge to understand positive and negative environmental effects; • Understand physical and social science perspectives on the environment, sustainability, and environmental problems and solutions. 	<p>The program consists of three sections: 1) Introductory (ASTA01H3 Introduction to Astronomy and Astrophysics I: The Sun and Planets; ASTA02H3 Introduction to Astronomy and Astrophysics II: Beyond the Sun and Planets; ASTB03H3 Great Moments in Astronomy; EESA06H3 Introduction to Planet Earth; EESA09H3 Wind; EESA10H3 Human Health and the Environment; EESA11H3 Environmental Pollution; ESTB01H3 Introduction to Environmental Studies), 2) Fundamental and Advanced Knowledge (EESB05H3 Principles of Soil Science; EESB15H3 Earth History; EESB16H3 Feeding Humans - The Cost to the Planet; EESB18H3 Natural Hazards; EESC13H3 Environmental Impact Assessment and Auditing; EESC34H3 Sustainability in Practice), and 3) Environmental Studies/Management and communication including capstone and interdisciplinary courses (ESTC35H3 Environmental Science and Technology in Society; ESTC36H3 Knowledge, Ethics and Environmental Decision-Making; POLC53H3 Canadian Environmental Policy; ESTD16H3 Project Management in Environmental Studies; ESTD17Y3 Cohort Capstone Course in Environmental Studies;</p>

		PSCD02H3 Current Questions in Mathematics and Science; PSCD11H3 Communicating Science: Film, Media, Journalism, and Society). In addition, the proposed Minor integrates courses across various disciplines including: astronomy, environmental studies, environmental science, and political science - aiming to offer broad knowledge and cultivate the ability of students to deal with environmental management problems.
<p>2. Knowledge of Methodologies Students have a working knowledge of different methodologies and approaches relevant to their area of study. They are able to evaluate the efficacy of different methodologies in addressing questions that arise in their area of study.</p>	<p>Students completing the proposed Minor will develop an understanding of a variety of methodologies and approaches (classroom, lab and field for studying terrestrial systems, environmental issues, and environmental assessment. Some of the methodologies include:</p> <ul style="list-style-type: none"> - current physical and chemical models and methods of study of the universe; - approaches to environmental risk assessment; - various federal and provincial approaches to environmental assessment (Environmental Assessment Acts); - field and lab techniques in soil analysis; - geological methods used to distinguish ancient Earth environments; - current methods to better understand and construct the social and political systems in environmental management; - use of film, media and journalism to better understand the role of science and effective communication of science in society 	<p>Students will gain working knowledge of scientific methodology through B and C-level courses in natural sciences (i.e., ASTB03H3; EESB05H3; EESB15H3; ESB18H3; EESC13H3; EESC34H3).</p>
3. Application of	Students completing the	Many opportunities will be offered in

<p>Knowledge Students are able to frame relevant questions for further inquiry. They are familiar with, or will be able to seek the tools with which, they can address such questions effectively.</p>	<p>proposed Minor will be able to address complex questions with regards to environmental sustainability, risk, and decision making. For example, students in the 3rd and 4th years of the program will be able to use their knowledge of Earth and environmental processes to evaluate impacts on natural and social systems that can be brought on by proposed developments (EESC13H3 Environmental Impact Assessment and Auditing; ESTD16H3 Project Management in Environmental Studies). They will also be able to communicate their findings in the form of proposals, research and technical papers, and oral presentations (EESC13 Environmental Impact Assessment and Auditing; ESTD17H3 Cohort Capstone Course in Environmental Studies; PSCD11H3 Communicating Science: Film, Media, Journalism, and Society. Special emphasis will also be given in the introduction of uncertainty, natural variability, and knowledge gaps with the environmental management decision making process (ESTD16H3 Project Management in Environmental Studies)</p>	<p>capstone courses in third and fourth years of the program that will allow students to apply their knowledge of various methods and approaches learned in second and third years (i.e., EESC13H3; ESTD16H3; ESTD17Y3).</p>
<p>4. Awareness of Limits of Knowledge Students gain an understanding of the limits of their own knowledge and an appreciation of the uncertainty, ambiguity, and limits to our</p>	<p>Students completing the proposed Minor will be able to question their understanding of the subject matter as well as the established understanding of the science. The fundamental understanding of the Earth and environmental processes</p>	<p>Students will gain an appreciation for the limits of the science and their own understanding through more advanced courses such as EESC34H3 Sustainability in Practice, EESC13H3 Environmental Assessment and Auditing, ESTD16H3 Project Management in Environmental Studies, and PSCD02H3 Current Questions in mathematics and Society.</p>

<p>collective knowledge and how these might influence analyses and interpretations.</p>	<p>will be accomplished in the 1st and 2nd year of the Minor and will provide the basis for the 3rd and 4th year courses, which establish the role of science within the social and political frameworks. Through the sequence of courses that develop depth within each of the core areas of study, students are exposed to the different limitations of each theory presented, as well as the prompts that motivate the development of a new theory or a modification to the existing one. This should translate, upon self-reflection, to awareness of the limits of the student's own knowledge. The need for different fields of study and the restrictions under which each field must work, further highlight the limits of knowledge.</p>	
<p>5. Communication Skills Students are able to communicate information, arguments, and analyses accurately and reliably, both orally and in writing. They learn to read and to listen critically.</p>	<p>Students completing the proposed Minor will be able practice and hone their communication skills in various C and D-level courses. Students will achieve these skills through writing of proposals, research and technical papers - and oral presentations (EESC13 Environmental Impact Assessment and Auditing; ESTD17H3 Cohort Capstone Course in Environmental Studies; PSCD11H3 Communicating Science: Film, Media, Journalism, and Society).</p>	<p>The program supports the communication skills expectation through C and D-level and capstone courses in environmental studies and science communication. Some specific examples include: EESD17H3 Cohort Capstone Course in Environmental Studies and PSCD11H3 Communicating Science: Film, Media, Journalism, and Society.</p>
<p>6. Autonomy and Professional Capacity The education students receive achieves the following broad goals:</p> <ul style="list-style-type: none"> • It gives students the 	<p>Students completing the proposed Minor will develop the knowledge and skills they need to better understand the world around them and the environmental issues and</p>	<p>The program is designed to cultivate an interest in natural sciences and provide skills and knowledge that students with diverse academic background can become lifelong learners. For example, A-level courses (ASTA01H3, ASTA02H3, ASTB03H3,</p>

<p>skills and knowledge they need to become informed, independent and creative thinkers</p> <ul style="list-style-type: none"> • It instils the awareness that knowledge and its applications are influenced by, and contribute to, society • It lays the foundation for learning as a life-long endeavour 	<p>challenges that face the society. Students with economic, management, and social sciences background whose careers may demand an understanding of natural sciences will be well served by the program. The program also lays the foundation of lifelong learning.</p>	<p>EESA06H3, EESA09H3, EESA10H3, EESA11H3, ESTB01H3) offer a journey into natural sciences and how they're intimately linked with all the major societal problems in our day to day lives. The courses in the later years (EESC13H3, EESC34H3, ESTC35H3, ESTC36H3, POLC53H3, ESTD17Y3, PSCD02H3, PSCD11H3) will sustain interest and further integrate the disciplines to help make students more informed to understand and manage environmental issues.</p>
--	--	---

7 Assessment of Teaching and Learning

The methods of assessment include final exams; lab and field work; written and oral assignments/papers. These methods of assessment are appropriate because they consider students' various learning styles and understanding of the subject matter while effectively assessing the learning objectives of the Minor Program.

8 Consultation

Consultation:

Approval of Department Chair (Prof. George Archontitsis)
 Environmental Science and Environmental Studies Groups (March 17, 2016)
 Teaching and Curriculum Committee (April 26 and May03, 2016)
 DPES Council

There are no expected impacts on other units/divisions.

9 Resources

Academic units should bear in mind that any additional resources needed must have been secured before the proposal can be moved into governance. The Vice-Dean will shepherd approval of these resources.

9.1 Faculty requirements

The program will be taught by existing DPES faculty, and no additional faculty resources are required. In the short term, we do not anticipate a need for additional TA support. However, if first-year enrolments increase significantly we may request additional TA support from the Dean's Office.

Experiential learning opportunities will be provided through fieldtrips (EESB15H3, EESC13H3) and capstone and project management courses (ESTD16H3, ESTD17H3).

Table 2: Detailed List of Committed Faculty

Faculty name and rank	Home unit	Area(s) of Specialization
Heidi Daxberger (Lecturer)	DPES	Earth Science
Nick Eyles (Professor)	DPES	Earth Science
Nicole Klenk (Assistant Professor)	DPES	Environmental Studies
Julian Lowman (Professor)	DPES	Physics and Astrophysics
Jim MacLellan (Lecturer)	DPES	Environmental Studies
Adam Martin (Assistant Professor)	DPES	Environmental Science
Mandy Meriano (Associate Professor, Teaching Stream)	DPES	Earth and Environmental Science
Tanzina Mohsin (Lecturer)	DPES	Physics and Climate Science
Silvija Stefanovic (Lecturer)	DPES	Environmental Science

9.2 Space/Infrastructure

- *Address any unique space/infrastructure requirements including information technology, laboratory space and equipment, etc.*

There are no additional space or infrastructure needs for the offering.

10 Governance Process

Levels of Approval Required	Dates
Departmental Curriculum Committee DPES Executive Committee	June 9, 2016 November 14, 2016
Forwarded to PO for Review/Sign-Off	December 6, 2016 Sign-off: December 14, 2016
Reviewed by DUCC (Undergraduate)	December 19, 2016
Decanal Sign-Off	Resources: September 30, 2016 Proposal: December 19, 2016
UTSC Academic Affairs Committee	
Submitted to Provost's Office	
Report to AP&P	
Report to Ontario Quality Council	