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www.sfu.ca/vpacademic**MEMORANDUM**

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<b>ATTENTION</b>	Senate	<b>DATE</b>	December 11, 2013
<b>FROM</b>	Jon Driver, Vice-President, Academic and Provost, and Chair, SCUP	<b>PAGES</b>	1/1
<b>RE:</b>	Faculty of Environment: Full Program Proposal for a Global Environmental Systems Major (SCUP 13-65)		

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At its November 20, 2013 meeting, SCUP reviewed and approved the Full Program Proposal for a Global Environmental Systems Major within the Faculty of Environment, effective Fall 2014.

**Motion:**

That Senate approve and recommend to the Board of Governors the Full Program Proposal for a Global Environmental Systems Major within the Faculty of Environment, effective Fall 2014.

c: A. Clapp  
D. Burns

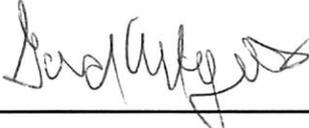
A handwritten signature in blue ink, appearing to read "Jon Driver".



OFFICE OF THE ASSOCIATE VICE-PRESIDENT, ACADEMIC

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**MEMORANDUM**

<b>ATTENTION</b>	Senate Committee on University Priorities	<b>DATE</b>	November 8, 2013
<b>FROM</b>	Gordon Myers, Chair Senate Committee on Undergraduate Studies	<b>PAGES</b>	1/1
<b>RE:</b>	Faculty of Environment (SCUS 13-48f)		

Action undertaken by the Senate Committee on Undergraduate Studies at its meeting of November 7, 2013, gives rise to the following recommendations:

## Motion

That SCUP approve and recommend to Senate the Full Program Proposal for the Global Environmental Systems Major within the Faculty of Environment.

The relevant documentation for review by SCUP is attached.

**FULL PROGRAM PROPOSAL**  
**Global Environmental Systems Major**  
**Faculty of Environment (FENV)**  
**Simon Fraser University**  
**December 10, 2013**

**Executive Summary**

This document contains a proposal for a new major in Global Environmental Systems (GES) under a new credential, a Bachelor of Environment (BEnv). It accompanies separate proposals for the BEnv credential, a BEnv Major in Environmental Resource Management, and a BBA/BEnv Joint Major in Business and Environment. The content of this proposal is the result of three years of consultation with faculty within and beyond the Faculty of Environment, as well as with staff, students, alumni and prospective employers. Four previous documents, each more refined, were distributed for comment and discussion, and the educational goals and curriculum were developed and revised by a design committee composed of faculty from multiple FENV units. The program is proposed to begin September 2014.

Global environmental change and the issues it presents for society are complex and interdisciplinary in nature. The major in Global Environmental Systems would produce graduates who are able to support environmental decision-making with an understanding of environmental systems at the global scale. Students will have a basic understanding of analytical methods, tools and models, and the ability to communicate the information gained thereby. Based on educational goals for the BEnv credential and the GES major, the program would include an interdisciplinary core in the social and natural sciences vital to understanding environmental issues; foundational courses introducing methods needed to work in complex environmental systems; and three advanced courses in each of biophysical systems, socio-economic systems, and data analysis and modeling.

This major would take advantage of the expertise existing across FENV units (Archaeology, Development & Sustainability, Environmental Science, Geography, Resource & Environmental Management and Sustainability Community Development). It is a high strategic priority for FENV and is in line with other FENV and SFU priorities. Mounting the GES major can be carried out at a relatively low cost by using primarily unfilled seats in existing FENV and non-FENV courses, increasing class sizes where appropriate, and taking advantage of existing administrative capacity in FENV units and the FENV Dean's Office. Five new courses are being proposed to accompany this program proposal, and additional sections of existing courses may be required.

Recruitment will focus on four potential sources of students: direct entry from secondary schools, transfers from colleges, international students, and undecided SFU students. We hope to admit 10 students in the first year, building to 20 students after 5 years. Assuming modest attrition, this would translate to a steady enrolment of approximately 75 students in the GES program once it has matured.

**Credential to be awarded:**

Bachelor of Environment (BEnv) in Global Environmental Systems

**Location of program:**

SFU Burnaby, Harbour Centre and Surrey campuses

**Faculty offering the new degree program**

Faculty of Environment

**Anticipated program start date:**

September 2014

**Description of the proposed program: Aims, goals and objectives**

Building upon the consultation carried out by FENV over the past 3 years on BEnv design, this document proposes the establishment of a Global Environmental Systems major under a proposed new Bachelor of Environment credential.

Environmental issues facing society are complex and interdisciplinary in nature. The major in Global Environmental Systems would produce graduates knowledgeable of climate change, carbon cycles and other dimensions of global environmental change, and able to support environmental decision making with an understanding of the complexity of and interplay between socio-economic and biophysical systems at the global scale. Students will have a basic understanding of modeling, geospatial, and other analytical methods and tools, and the ability to communicate the information gained thereby. Building upon a core in both the social and natural sciences, students will have a solid grounding in earth systems, the global scale, and quantitative analysis. They will have the abilities to support decision-making involving multiple systems, and to communicate scientific and technical information to a variety of audiences. The GES major is designed to provide a foundation for post-graduate education in a range of environmental disciplines that use and interpret models for understanding and prediction of global environmental change.

This major would take full advantage of the expertise existing across FENV units and include the core requirements, both lower division and upper division, characteristic of all BEnv majors. It requires an interdisciplinary core of courses from the social and natural sciences and foundational knowledge of quantitative and geospatial methods. Students seeking the GES major will be required to complete more advanced methodology courses as well as six upper-division courses in environmental systems, both social and biophysical, and a capstone course that brings these streams together.

**Linkages between the educational goals and the curriculum**

The Global Environmental Systems major is designed with reference to both BEnv program-level educational goals (see BEnv Credential FPP) and the Global Environmental Systems educational goals.

**BEnv program-level educational goals:**

- **Natural Sciences – earth systems, ecology and biology.**
- **Social Sciences – human role in nature, social and built environments, stewardship and governance, and the global scale.**
- **Methodology, Practice and Communication – quantitative and geospatial analysis, models, environmental communication, and collaboration and fieldwork.**
- **Integration – sustainability, systems, complexity and decision-making and demonstration through a capstone course.**

**In addition to the BEnv educational goals, the educational goals for the Global Environmental Systems major are:**

**Graduates of the GES major will have an understanding of the interplay between biophysical and socio-economic systems that produce global environmental change and will be able to use analytical and communication skills to support decision-making. Students will acquire the abilities to:**

- **Understand and depict the global dimensions of key biophysical and socio-economic systems and their interactions, employing narratives, inventories, databases, maps and simple models.**
- **Apply basic geospatial and statistical techniques to evaluate environmental change at the global scale in support of risk assessment, negotiation, and decision-making.**
- **Acquire and interpret global scale data, and understand the range, applications and limitations of models used to reconstruct past and predict future changes in global environmental systems.**
- **Recognize and explain how international institutions and agreements address environmental issues and how policy interventions can modify human impacts on environmental systems.**
- **Analyze how policy change affects a specific global system.**
- **Communicate the dynamics, uncertainties, and risks of global environmental change to a variety of audiences using different communication tools and strategies.**

**These educational goals are described at a level of abstraction appropriate for future evolution of the program as new dimensions of global environmental change become apparent. SFU's current curriculum resources address five major global environmental systems:**

- **Climate dynamics and climate change;**
- **Natural and anthropogenic effects on carbon and other biogeochemical cycles;**
- **Energy sources, uses, technologies and transitions;**
- **Land use and land cover; and**
- **Resource use, scarcity and abundance.**

**An accompanying course proposal expands the resources of the Faculty of Environment to include Ocean Resources and Management.**

## **Distinctive characteristics of the Bachelor of Environment in Global Environmental Systems:**

- The major provides a SFU program of study that directly addresses climate change from both the social and natural science perspectives, and provides undergraduate students the theories and methods needed to undertake graduate programs in global environmental change, adaptation and mitigation.
- The major builds upon a foundation in the social and natural sciences;
- Knowledge integration, communication and practice are built into the program design;
- Students learn methods needed to analyze and represent complex systems and the interactions among those systems; and
- The major builds upon the resources of all FENV units and multiple faculties beyond FENV.

## **Content and Summary of Requirements for Graduation**

All students undertaking the GES major would require lower division preparation in earth systems, ecology and biology; and in human roles in nature, social & built environments, stewardship & governance, and the global scale. Quantitative and geospatial methodology courses are also included in the lower division core requirements. Upper division courses focusing on modeling, communication and integration are also required. Both these upper and lower division course requirements, with minor variation, would be common to all BEnv majors.

In addition to the above requirements, the GES major requires 3 upper division courses on biophysical systems, 3 on socio-economic systems, 3 courses on data acquisition, analysis and modeling, 1 course on communication, and 1 capstone course.

### **GES Major Summary:**

#### **BEnv Core:**

- Lower Division 10 courses (= 30-31 credits)

#### **GES Major Requirements:**

- Upper Division 11 courses (= 36-45 credits)

**TOTAL: 66-76 credits**

### **Lower Division Requirements (10 courses)**

Complete all of:

- ENV 221-3 Systems Thinking (new)
- GEOG 100-3 Society, Space, Environment: Introducing Human Geography
- GEOG 111-3 Earth Systems
- GEOG 214-3 Weather and Climate
- GEOG 255-3 Geographical Information Science I
- REM 100-3 Global Change

Choose 1 of:

- GEOG 251-3 Quantitative Geography
- STAT 101-3 Introduction to Statistics
- STAT 201-3 Statistics for the Life Sciences
- STAT 203-3 Introduction to Statistics for the Social Sciences (3)
- STAT 270-3 Introduction to Probability and Statistics

Choose 1 of:

- ARCH 131-3 Human Origins
- BISC 101-4 General Biology
- BISC 102-4 General Biology
- HSCI 100-3 Human Biology

Choose 1 of:

- BISC 204-3 Introduction to Ecology
- EVSC 100-3 Introduction to Environmental Sciences
- GEOG 215-3 Biogeography

Choose 1 of:

- ARCH 286-3 Cultural Heritage Stewardship in Global Context (new course)
- ENV 222-3 Environmental Controversy
- GEOG 221-3 Economic Geography
- GEOG 241-3 Social Geography
- GEOG 261-3 Introduction to Urban Geography

### **Upper Division Requirements (11 courses)**

#### **Biophysical Systems (choose 3)**

- ARCH 438-5 Geoarchaeology
- GEOG 213-3 Geomorphology
- GEOG 311-4 Hydrology
- GEOG 312-4 Natural Hazards
- GEOG 313-4 River Geomorphology
- GEOG 314-4 The Climate System
- GEOG 315-4 World Ecosystems
- GEOG 316-4 Global Biogeochemical and Water Cycles
- GEOG 317-4 Soil Science
- GEOG 319-4 Landscape Ecology
- REM 370-3 Global Resource Issues in Oceanography (new course)
- REM 471-3 Forest Ecosystem Management

#### **Socio-economic Systems (choose 3)**

- ARCH 363-3 Landscape Archaeology (new course)
- ARCH 365-3 Archaeological Perspectives on Human Ecology

- DEVS 401-4 Issues, Concepts and Cases in Development and Sustainability
- ENV 321-3 Ecological Economics
- GEOG 321-4 Geographies of Global Capitalism
- GEOG 322W-4 World Resources
- GEOG 382-4 Population Geography
- GEOG 389W-4 Nature and Society
- GEOG 428-4 World Forests
- POL 346-4 International Organization
- POL 452-4 Energy Policy
- REM 350-3 Management and Policy for Sustainable Energy and Materials
- REM 356-3 Institutional Arrangements for Sustainable Development
- SA 371-4 The Environment and Society

**Data Acquisition, Analysis and Modeling (choose 3)**

- ARCH 285-3 Archaeological Science (new course)
- GEOG 253-3 Remote Sensing
- GEOG 352-4 Spatial Analysis
- GEOG 353-4 Advanced Remote Sensing
- GEOG 414-4 Climate Change
- GEOG 451-4 Spatial Modeling
- GEOG 453-4 Remote Sensing of Environment
- REM 311-3 Applied Ecology
- REM 412-3 Environmental Modeling

**Communication (choose 1)**

- CMNS 342-4 Science and Public Policy: Risk Communication
- CMNS 349-4 Environment, Media and Communication
- GEOG 351-4 Multimedia Cartography
- GEOG 356-4 3D Geovisualization

**Capstone (choose 1)**

- ENV 495-4 Environmental Capstone (new)

In special cases, the Director may approve substitutes for the capstone, such as ENV 491 (Directed Study in Environment). Three lower division courses (ARCH 285, GEOG 213 and GEOG 253 can be used to satisfy some of upper division requirements of this major, but do not count towards the graduation requirement of 45 upper division units. Additional courses may be required to satisfy WQB requirements, but an interdisciplinary major such as Global Environmental Systems already includes numerous courses that meet Quantitative requirements.

**Target Audience**

The GES major would be targeted towards students wishing to understand global environmental change, and seeking careers in the understanding and mitigation of climate change and its consequences. GES content and pedagogy are intended to meet the knowledge and skill

requirements of careers that require: an understanding of biophysical and social system function; familiarity with methodologies used to understand their dynamics and interplay; the capacity to support decision making involving multiple systems; and the ability to communicate scientific and technical information to a variety of audiences. The GES major is designed to prepare graduates for these fields or to continue their studies in graduate programs.

Recruitment for the GES major will focus on four potential target groups:

- Direct entry from secondary schools;
- Transfers from colleges;
- International students; and
- Undecided SFU students.

**Delivery Methods:** Face-to-face courses are the primary delivery method, but some distance education courses may be included.

**Anticipated completion time in semesters:** The BEnv may be completed in 8 semesters of full time study.

### **Enrolment plan for the length of the program**

Full Program Proposals for the BEnv credential and GES major will be introduced in fall 2013, with the target of getting approval from Senate and the Board of Governors by January 2014. Allowing two months for the Ministry approval process, we hope that prospective students will be able to apply for admission to the GES major in spring 2014, beginning their studies in September 2014. We hope to admit 10 students in the first year, building to 20 students after 5 years. Allowing for attrition, this would translate to a steady enrolment of approximately 75 students in the Global Environmental Systems program once it has matured.

New students will be admitted directly into this major; they will be required to have a Math 12 equivalent for admission. Existing SFU students can transfer internally if they have completed at least 15 units of required work in the major.

**Student Evaluation** will proceed according to the general regulations of Simon Fraser University, the Faculty of Environment and the Department of Geography, the FENV unit that will administer the program.

### **Anticipated Contribution to the Faculty of Environment Mandate and Strategic Plan**

See BEnv Credential FPP for details.

### **Program Design, Governance and Assessment**

A design committee developed and refined the GES major NOI into this Full Program Proposal, including the educational goals, structure, lower-division core and specific upper-division courses. The committee was composed of faculty members from FENV units; the educational goals were reviewed by experts in the major area within and beyond FENV. The design

committee reviewed the GES major in terms of overlap with existing programming, and recommended that the GES major be proposed under the BEnv credential and housed within the Department of Geography for the purposes of student advising and program administration.

The GES major would be directed by a Steering Committee with representatives from all FENV units who desire it. A Director will be responsible for approving course substitutions and other day-to-day operations, and consulting with the steering committee on major changes. The Director should be appointed by the Dean from among interested FENV faculty members, with consideration given to the unit offering the most courses in the major. If no member accepts the appointment, the Associate Dean (Undergraduate) will take on the role. The FENV Undergraduate Curriculum Committee would be responsible for approval of any GES major curricular changes.

The GES major would be assessed according to SFU regulations. Programs administered by individual units within FENV will be reviewed as part of the normal external review process, so the GES major will be reviewed when Geography is reviewed. In addition, the BEnv and its majors will be reviewed externally after five years. Assuming that the program begins in 2014, review is envisioned for 2019-2020.

### **Level of Support and Recognition from other Post-Secondary Institutions**

As per SFU's transfer credit procedures, students may transfer from BC colleges or universities to enroll into BEnv programs. FENV Dean's Office will work with Lower Mainland colleges on preparing their students for transfer into the GES program. The GES major has been developed primarily from courses in the Faculty of Environment, most of which have already been articulated with the various post secondary institutions in British Columbia. Students majoring in GES can transfer the courses to Environment, Geography or Science programs in other post secondary institutions.

Letters requesting support are being sent to BC universities and colleges 1) whose students might transfer to SFU into the proposed GES major, 2) with graduate programs that are likely to appeal to graduates of this major, and 3) that have degree program(s) similar to this major.

### **Evidence of Student Interest and Labour Market Demand**

Seeking input from SFU students has been an important part of the BEnv consultation process. Students were involved in both BEnv forums (November 2010 and June 2012). Sustainable SFU, a SFU student organization, ran two focus groups (Burnaby and Harbour Centre campuses) in November 2012 seeking input on the BEnv as described in this document. In all these sessions students expressed strong support for the BEnv credential and its interdisciplinary content, structure and experiential components. In the 2011 SFU Undergraduate Student Survey, of the over 5000 students responding, approximately 8% were very interested in a possible Bachelor of Environment.

In recent years, Canadian employment in environmentally related jobs has been continually increasing. According to Environmental Careers Organization (ECO), between 2007 and 2010,

the total number of Canadian workers who spend at least 50% of their time on environmental activities increased from 3.2% to 4%, bring the total number of such workers in 2010 to 682,000. ECO also stated that environmental employment has remained relatively strong during the recent economic downturn, and attributed difficulties in hiring to the lack of workers possessing appropriate levels of education and experience. ECO estimates that demand for environmental workers should continue to be strong into the future. Over the next decade over 100,000 environmental employees (14% of the environmental workforce) will reach retirement age (Profile of Canadian Environmental Employment: Labour Market Research Study, ECO, 2010).

U.S. environmental job market data is also encouraging. In 2013 Georgetown University published data on unemployment rates of college graduates in 15 sectors. The agriculture/natural resource category ranked third lowest with rates of 6.1/3.4/2.3 percent for recent graduates/experienced graduates/graduate degree holders. This compares with rates as high as 12.8/9.3/6.9 for architecture ([Hard Times 2013](#): College majors, unemployment and earnings. Georgetown Public Policy Institute, May 2013).

Also in fall 2011, the FENV Faculty Advisory Board, made up of highly experienced representatives from business, government, First Nations and academia\*, met and provided guidance on development of the BEnv and its majors, stressing the importance of interdisciplinarity, experiential learning, and communication of technical information to non-specialist audiences.

Two surveys, targeted at environmental professionals, were implemented to gather input on the BEnv credential (December 2011 – March 2012) and its proposed majors (June – August 2013). Seventy-three responses were received. The average years of experience of respondents were approximately 15. Approximately 67% of respondents strongly agreed or agreed with the statement “A Bachelor of Environment will be well perceived by potential employer”. Respondents also provided input on job demand for graduates in each of the proposed majors in the next 5–15 years. On a scale of 5 to 1 (5-very high, 4-high, 3-medium, 2-low, 1-very low) results were as follows:

	Mean	Very High=5	High=4	Medium=3	Low=2	Very Low=1	N
Global Environmental Systems	3.4	2	13	10	4	0	29

**Summary of Resources Required and Available to Implement the Program**

The GES major can be mounted at a relatively low cost by providing students with the flexibility to satisfy graduation requirements using existing courses from FENV, and in some cases non-FENV, units. This is part of FENV’s goal of taking advantage of the synergy within newly joined FENV units. Required and elective courses are drawn mainly from existing courses. Nevertheless, we propose five new courses (Systems Thinking; Ocean Resources and Management; Archaeological Science; Landscape Archaeology and Environmental Capstone) to mount the GES major. Those courses will serve both Global Environmental Systems and the accompanying BEnv degrees in Environmental Resource Management and Sustainable Business. The courses will be offered as enrolments grow and demand requires.

We hope to reduce the resources necessary to mount the GES program by using unfilled seats in existing FENV and non-FENV courses, increasing class sizes where appropriate, and taking advantage of existing administrative capacity in the Department of Geography and the FENV Dean's Office. However, the new courses and possible increases in offerings of existing courses will require additional faculty resources and teaching assistantships, and additional support to the Department of Geography may be needed to support this new administrative load.

The increased demand for GIS courses is likely to require additional laboratory space and computational resources within a few years. Furthermore, additional faculty resources will be needed to mount the capstone courses when the first cohorts of GES (and other BEnv) majors reach the culmination of their programs. Those resources should be outweighed by increased AFTEs and resulting revenues to the Faculty.

### **Related programs at SFU or other British Columbia post-secondary institutions**

The following programs are related and particular attention has been paid to evaluating and avoiding duplication.

- B.A. Geography
- B.A. Geography Environmental Specialty
- B.Sc. Physical Geography

The BEnv in Global Environmental Systems is more interdisciplinary than the B.A. in Geography, more technical than the Environmental Specialty, and more concerned with social and economic impacts than the B.Sc. in Physical Geography. The GES major is also distinguished by the emphasis on the global scale and the equal weighting of biophysical, socio-economic and geospatial systems.

A scan of similar undergraduate programs dealing with environmental systems identified only a few related programs, mainly in the United States. UBC's Global Resource Systems seems to focus on land and food systems and does not emphasize geospatial modeling and analysis.

### **List of faculty members who will be teaching**

The GES major will be taught by faculty members from across FENV units and SFU.

#### **Proposed Program Contact Person:**

Alex Clapp, Associate Dean, FENV, 778-782-8827, [aclapp@sfu.ca](mailto:aclapp@sfu.ca)

Dan Burns, Manager, Curriculum and Planning, FENV, 778-782-9225, [dburns@sfu.ca](mailto:dburns@sfu.ca)

\* FENV Faculty Advisory Committee members are Frank Brown (Director, Land and Marine Stewardship, Coastal First Nations), the honourable David Anderson (former Minister of Environment, and of Fisheries and Oceans), Bob Elton (former President and CEO of BC Hydro), C.S. Holling (one of the founders of ecological economics), Leslie King (Director, Centre for Environmental Education, Royal Roads), Bruce Morgan (Director, Change

Management and Special Projects, Canadian Environmental Assessment Agency), Nancy Olewiler (Director, SFU School of Public Policy), and Barry Smit (Chair in Global Environmental Change, U. of Guelph).

# **Global Environmental Systems Major**

## **Bachelor of Environment**

### **Minimum Grades**

The minimum cumulative grade point average (CGPA) for continuation and graduation is 2.00.

### **Program Requirements**

Students complete 120 units, as specified below. Additional upper division units will be required to total a minimum of 45 upper division units.

Visit the [[link:program overview](#)] for a suggested course sequence.

### **Lower Division Requirements**

Complete all of:

ENV 221-3	Systems Thinking
GEOG 100-3	Society, Space, Environment: Introducing Human Geography
GEOG 111-3	Earth Systems
GEOG 214-3	Weather and Climate
GEOG 255-3	Geographical Information Science I
REM 100-3	Global Change

Choose one of:

GEOG 251-3	Quantitative Geography
STAT 101-3	Introduction to Statistics
STAT 201-3	Statistics for the Life Sciences
STAT 203-3	Introduction to Statistics for the Social Sciences
STAT 270-3	Introduction to Probability and Statistics

Choose one of:

ARCH 131-3	Human Origins
BISC 101-4	General Biology
BISC 102-4	General Biology

Choose one of:

BISC 204-3	Introduction to Ecology
EVSC 100-3	Introduction to Environmental Sciences
GEOG 215-3	Biogeography

Choose one of:

ARCH 286-3	Cultural Heritage Stewardship in Global Context
ENV 222-3	Environmental Controversy
GEOG 221-3	Economic Geography
GEOG 241-3	Social Geography
GEOG 261-3	Introduction to Urban Geography

## **Upper Division Requirements**

### **Biophysical Systems (choose three of:)**

ARCH 438-5	Geoarchaeology
GEOG 213-3	Geomorphology
GEOG 311-4	Hydrology
GEOG 312-4	Natural Hazards
GEOG 313-4	River Geomorphology
GEOG 314-4	The Climate System
GEOG 315-4	World Ecosystems
GEOG 316-4	Global Biogeochemical and Water Cycles
GEOG 317-4	Soil Science
GEOG 319-4	Landscape Ecology
REM 370-3	Global Resource Issues in Oceanography
REM 471-3	Forest Ecosystem Management

### **Socio-economic Systems (choose three of:)**

ARCH 363-3	Landscape Archaeology
ARCH 365-3	Archaeological Perspectives on Human Ecology
DEVS 401-4	Issues, Concepts and Cases in Development and Sustainability
ENV 321-3	Ecological Economics
GEOG 321-4	Geographies of Global Capitalism
GEOG 322W-4	World Resources
GEOG 382-4	Population Geography
GEOG 389W-4	Nature and Society
GEOG 428-4	World Forests
POL 346-4	International Organization
POL 452-4	Energy Policy
REM 350-3	Management and Policy for Sustainable Energy and Materials
REM 356-3	Institutional Arrangements for Sustainable Development
SA 371-4	The Environment and Society

### **Data Acquisition, Analysis and Modeling (choose three of:)**

ARCH 285-3	Archaeological Science
GEOG 253-3	Remote Sensing
GEOG 352-4	Spatial Analysis
GEOG 353-4	Advanced Remote Sensing
GEOG 414-4	Climate Change
GEOG 451-4	Spatial Modeling
GEOG 453-4	Remote Sensing of Environment
REM 311-3	Applied Ecology
REM 412-3	Environmental Modeling

### **Communication (choose one of:)**

CMNS 342-4	Science and Public Policy: Risk Communication
CMNS 349-4	Environment, Media and Communication
GEOG 351-4	Multimedia Cartography
GEOG 356-4	3D Geovisualization

## Capstone (required)

ENV 495-4 Environmental Capstone

## Writing, Quantitative, and Breadth Requirements

Students admitted to Simon Fraser University beginning in the fall 2006 term must meet writing, quantitative and breadth requirements as part of any degree program they may undertake. See [Writing, Quantitative and Breadth Requirements] for university-wide information.

## WQB Graduation Requirements

A grade of C- or better is required to earn W, Q or B credit.

(INSERT WQB TABLE HERE)

## Residency Requirements and Transfer Credit

The University's residency requirement stipulates that, in most cases, total transfer and course challenge credit may not exceed 60 units, and may not include more than 15 as upper division work. In addition to the courses listed above, students should consult an academic advisor to plan the remaining required elective courses.

**NOTICE OF INTENT**  
**Global Environmental Systems Major**  
**Faculty of Environment (FENV)**  
**Simon Fraser University**  
**January 29, 2013**

**Executive Summary**

This document contains a proposal for a new major in Global Environmental Systems (GES) under a possible new credential, a Bachelor of Environment (BEnv). The program is proposed to begin September 2014. Separate NOIs are being proposed for the BEnv credential and two other majors under the BEnv (BBA/BEnv Joint Major in Sustainable Business and a BEnv Major in Environmental Resource Management).

Environmental issues facing society are complex and interdisciplinary in nature. The major in Global Environmental Systems would produce graduates who are able to support environmental decision-making with an understanding of environmental systems at the global scale. Students will have a basic ability to use analytical methods, tools and models, and the ability to communicate the information gained thereby.

The content of this NOI is the result of 3 years of consultation with faculty (FENV and non-FENV), staff, students, alumni and perspective employers. Three previous documents, each more refined, were distributed for comment and discussion. If this NOI is approved, a design committee, made up of faculty from difference FENV units, will propose the specifics of the GES major to be included in the FPP for FENV UCC approval.

This major would take full advantage of the expertise existing across FENV units (Archaeology, Development & Sustainability, Environmental Science, Geography, Resource & Environmental Management and Sustainability Community Development). It is a high strategic priority for FENV and is in line with other FENV and SFU priorities. The concept of a Global Environment Systems major has been highlighted in 3 previous documents presented to and discussed by FENV faculty, and this document has been reviewed and supported by all FENV units.

Based on draft program-level learning outcomes for the BEnv credential and the GES major, the program would include an interdisciplinary core in the social and natural sciences vital to understanding environmental issues, foundational courses introducing methodologies needed to work in complex environmental systems, advanced courses in environmental methodology and communication, and a minimum of 6 courses in environmental systems, both social and biophysical.

Recruitment will focus on four potential sources of students: direct entry from secondary schools, transfers from colleges, international students, and undecided SFU students. We hope to admit 10 students in the first year, building to 20 students after 5 years. This would translate to a steady enrolment of approximately 60-70 students in the GES program once it has matured.

Mounting the GES major can be carried out at a relatively low cost by using primarily unfilled seats in existing FENV and non-FENV courses, increasing class sizes where appropriate, and taking advantage of existing administrative capacity in FENV units and the FENV Dean's Office. 2-3 new courses would need to be developed and taught and additional sections of existing courses may be required.

**Credential to be awarded:**

Bachelor of Environment (BEnv) in Global Environmental Systems

**Location of program:**

SFU Burnaby, Harbour Centre and Surrey Campuses

**Faculty offering the new degree program**

Faculty of Environment

**Anticipated program start date:**

September 2014

**Description of the proposed program:**

Aims, Goals and Objectives

Building upon the consultation carried out by FENV over the past 3 years on BEnv design, this document proposes the establishment of a Global Environmental Systems major under a proposed new Bachelor of Environment credential.

Environmental issues facing society are complex and interdisciplinary in nature. The major in Global Environmental Systems would produce graduates who are able to understand climate change, carbon cycles and other dimensions of global environmental change, and to support environmental decision making with an understanding of the complexity of and interplay between social and biophysical systems at the global scale. Students will have a basic ability to use geospatial, modeling and other analytical methods and tools, and the ability to communicate the information gained thereby. Building upon a core in both the natural and social sciences, students will have a solid grounding in earth systems, the global scale, and quantitative analysis. They will be skilled at using geospatial models and integrating model results, and well prepared for post-graduate education in building models in a range of disciplines.

This major would take full advantage of the expertise existing across FENV units and include the core requirements, both lower division and upper division, characteristic of Bachelor of Environment majors. It would include an interdisciplinary core of courses from the environmental social and natural sciences. As with the other proposed BEnv majors, students will gain the ability to understand and use methods and tools needed to work on complex environmental systems (e.g., GIS, remote sensing, modeling, risk assessment). However, the students seeking the GES major will also be required to complete more advanced methodology courses as well as 6 upper-division courses in environmental systems, both social and biophysical.

Draft program level learning outcomes, provided in the BEnv Credential NOI appendices were developed as a result of consultation with faculty, staff, students, alumni and perspective employers. A faculty GES design committee, coordinated through the FENV Dean's Office, will finalize GES learning outcomes and course requirements at both the lower and upper division (see below development process details).

Anticipated Contribution to the Faculty of Environment Mandate and Strategic Plan

The contributions are described in detail in the accompanying NOI for the Bachelor of Environment credential.

### **Target Audience**

The GES major would be targeted towards students wishing to seek careers in environment, sustainability and climate change. GES content and pedagogy will be intended to meet the knowledge and skill requirements of careers that require; an understanding of biophysical and social system function, ability to use methodologies to understand their dynamics and interplay, familiarity with decision making processing involving multiple systems, and ability to communicate scientific and technical information to a variety of audiences. The GES major is designed to prepare graduates for these fields or to continue their studies in graduate programs.

Recruitment for GES major will focus on four potential target groups:

- Direct entry from secondary schools;
- Transfers from colleges;
- International students; and
- Undecided SFU students.

### **Content and Summary of Requirements for Graduation**

All students undertaking the GES major would require lower division preparation in biology, chemistry, earth systems, ecology, human roles in nature, social & built environments, stewardship & governance, and the global scale. Quantitative and geospatial methodology courses are also included in the lower division core requirements. Upper division courses focusing on modeling, communication and integration are also required. Both these upper and lower division course requirements, with minor variation, would be common to all BEnv majors.

In addition to the above requirements the GES major requires 6 courses focusing on social and natural systems and 3 courses in data/modeling and communication.

### **GES Major Summary:**

#### **BEnv Core:**

- Lower Division 13 courses (= 39 credits)
- Upper Division 3 courses (= 9 credits)

#### **GES Major Requirements:**

- Upper Division 9 courses (= 34-36 credits)

**TOTAL: 82-84 credits**

### **BEnv Core Lower Division Requirements (13 courses)**

The GES major would require students to complete approximately 13 courses, primarily lower division but including some upper division courses, in order to meet the BEnv core. Both a table of draft BEnv core requirements by major and a draft list of course the may satisfy these requirements are provided in the BEnv Credential NOI appendices.

## **GES Major Requirements (9 courses):**

In addition to the BEnv upper and lower division core requirements, the proposed Global Environmental Systems Major might require upper division coursework in three categories; Global Systems with a balance of social and natural science courses, Data Acquisition and Modeling, and Communication:

### **Global Systems (6 courses from both social and natural science course list)**

#### **Natural Sciences (choose a minimum of 2 courses)**

GEOG 314-4 The Climate System

GEOG 315-4 World Ecosystems

GEOG 316-4 Global Biogeochemical and Water Cycles

GEOG 317-4 Soil Science

GEOG 319-4 Landscape Ecology

GEOG 414-4 Climate Change

REM 4xx Climate, Oceans and Paleo-Environments (possible new course)

Any other FENV upper-division course that includes a global model or inventory. Courses from FAS and FASS may also be added (pending further consultation).

#### **Social Sciences (choose a minimum of 2 courses)**

DEVS 401-4 Issues, Concepts and Cases in Development and Sustainability

GEOG 321-4 Geographies of Global Capitalism

GEOG 322-4 World Resources

GEOG 428-4 World Forests

GEOG 442-4 A World of Cities (course recently approved by SCUS)

POL 452-4 Energy Policy

REM 350-3 Management and Policy for Sustainable Energy and Materials

### **Data Acquisition and Modeling**

GEOG 352-4 Spatial Analysis

GEOG 353-4 Advanced Remote Sensing

GEOG 451-4 Spatial Modeling

MATH 310-3 Introduction to Ordinary Differential Equations

MOCSSY 4xx Modeling Complex Social Systems

REM 311-3 Applied Ecology

REM 412-3 Environmental Modeling

## **Communication**

CMNS 342-4 Science and Public Policy: Risk Communication

CMNS 348-4 Globalization and Media

CMNS 349-4 Environment, Media and Communication

GEOG 351-4 Multimedia Cartography

GEOG 356-4 3D Geovisualization

\* Courses used to satisfy BEnv upper division core requirements cannot be double counted to satisfy GES major requirements.

Additional courses may be required to satisfy WQB requirements. However, an interdisciplinary major such as Global Environmental Systems already includes courses that meet Quantitative requirements, and required core courses may also meet the intent of B-Sci and B-Soc requirements.

## **Delivery Methods**

Face-to-face courses are the primary delivery method, but some distance education courses may be included.

## **Linkages between the learning outcomes and the curriculum**

Design of the Global Environmental Systems major will be driven by both BEnv Program Level Learning Outcomes (see BEnv Credential NOI appendices) and Global Environmental Systems Program Level Learning Outcomes (below). Design committees and the FENV Dean's Office will finalize these learning outcomes in development of the Full Program Proposal.

Draft BEnv program-level learning outcomes have been developed in the following areas (see BEnv Credential NOI appendices for details):

- Environmental Sciences – chemistry, earth systems, biology, and community ecology.
- Social Sciences – human role in nature, social and built environments, stewardship & governance, and the global scale.
- Methodology, Practice and Communication – quantitative, geospatial, qualitative and comparative analysis, modeling, environmental communication, collaboration and fieldwork.
- Integrative – complexity, controversy, decision-making, sustainability, systems, and organizational function and change.

In addition to the draft BEnv program-level learning outcomes, possible learning outcomes for the Global Environmental Systems major include:

- Understanding of the global dimensions of key environmental and economic systems, including climate change, resource scarcity and abundance, carbon and other biogeochemical cycles, and land use and land cover;
- Ability to understand environmental and economic systems at different temporal, spatial and comparative scales;
- Deeper understanding of modeling in either social or biophysical systems for projections, risk assessment and decision-making;
- Ability to use geospatial analytical tools in decision making; and
- Ability to communicate science, risk and complex system dynamics to a variety of audiences using different modes of communication.

The course selection articulated in the full program proposal would be driven by the finalized BEnv and GES program-level learning outcomes.

### **Distinctive characteristics**

Distinctive characteristics of the GES major BEnv are (also see BEnv NOI for more detail):

- Builds upon a foundation in the environmental social and natural sciences;
- Students learn methods needed to depict and analyze basic to complex systems and the interplay among these systems;
- Draws upon courses from several units within and outside of FENV;
- Program flexibility allows students to determine the balance between social and biophysical;
- Systems study;
- Knowledge integration and practice are built into the program design; and
- The major explicitly addresses climate change and provides the theories and tools needed to undertake graduate programs in global environmental model-building.

### **Anticipated completion time in semesters**

The BEnv may be completed in 8 semesters of full time study.

### **Enrolment plan for the length of the program**

If this NOI and the associated BEnv credential NOI are approved by SCUS and SCUP by March 2013, we hope to submit Full Program Proposals for the BEnv credential and GES major in summer or fall of 2013, with the target of getting approval from Senate and the Board of Governors by fall 2013. Allowing two months for the Ministry approval process we hope that prospective students will be able to apply for admission to the GES major in late fall 2013, beginning their studies in September 2014.

Recruitment will focus on four potential sources of students: direct entry from secondary schools, transfers from colleges, international students and undecided SFU students. We hope to admit 10 students in the first year, building to 20 students after 5 years. This would translate to a steady enrolment of approximately 60-70 students in the Global Environmental Systems program once it has matured.

## **Student Evaluation**

As per general regulations of the University, Faculty of Environment and the FENV unit in which the program is administered.

## **Program Design, Governance and Assessment**

A design committee will be established to develop and refine the GES major into a Full Program Proposal. The committee will be made up of primarily faculty members from FENV units but may include some non-FENV faculty with expertise in the major area. All FENV units will have the option to participate in each of the BEnv design committees. The GES design committee will propose the structure and specific courses for the GES major, needed for Full Program Proposal (FPP) including:

- Whether the GES major should be developed under the BEnv credential;
- Review of the GES major in terms of overlap with existing programming; and
- Determining the focus, program level learning outcomes, courses, structure and capstone
- Experience specific to the GES major.

The design committee will also provide recommendations on the BEnv core as it relates to the GES major, and appropriate home unit(s) for student advising and program administration.

FENV Dean's Office, working with the Design Committee, will provide the Full Program Proposal to the Faculty of Environment Undergraduate Curriculum Committee for approval.

As part of the development of the FPP, FENV will propose a governance model for the GES major. We anticipate that the individual FENV units that are most closely aligned with the content of the major will provide administration, should the unit(s) wish. Otherwise, the FENV Dean's Office is ready to provide administrative, advising and scheduling support as needed. Housing the major in existing units with Dean's Office support should minimize the resources required to mount these programs. Since we anticipate that the GES major will be interdisciplinary, involving courses from most FENV units, curriculum modifications should be undertaken with the involvement of all FENV units. One possible model is that the GES design committee would evolve into a steering committee responsible for reviewing and making recommendations for changes. The FENV Undergraduate Curriculum Committee would be responsible for approval of any GES major curricular changes.

The GES major would be assessed as per university regulations. Programs administered by individual units within FENV will be reviewed as part of the normal external review process.

## **Level of Support and Recognition from other Post-Secondary Institutions**

As per SFU's transfer credit procedures, student may transfer from BC colleges or universities to enroll into BEnv programs.

## **Evidence of Student Interest and Labour Market Demand**

For information on student interest and labour market demand see the BEnv credential NOI.

## **Summary of Resources Required and Available to Implement the Program**

The GES major can be mounted at a relatively low cost by providing students with the flexibility to satisfy graduation requirements using existing courses from FENV, and in some cases non-FENV, units. This is part of FENV's goal of taking advantage of the synergy within newly joined FENV units. The selection of required and elective courses will be drawn mainly from existing courses, thereby reducing the costs of developing and teaching new courses. Nevertheless, we anticipate up to 2 new courses (climate, oceans and paleo-environments; and modeling in complex social systems) may be needed in order to mount the GES major, should it be approved.

We hope to also reduce the resources necessary by using unfilled seats in existing FENV and non-FENV courses, increasing class sizes where appropriate, and taking advantage of existing administrative capacity in FENV units and the FENV Dean's Office. However, the small number of new courses and possible increases in offerings of existing courses will require additional faculty resources and teaching assistantships.

Increased AFTEs will bring increased revenues to FENV. We are making efforts to increase FENV international student enrolments, currently low in comparison to other Faculties, by working with Fraser International College.

## **Related programs at SFU or other British Columbia post-secondary institutions**

The following programs are related and particular attention will be paid to evaluating and avoiding duplication.

- B.A. Geography
- B.A. Geography Environment Specialty
- B.Sc. Environmental Science
- B.Sc. Geographic Information Science
- B.Sc. Physical Geography

An initial scan of similar undergraduate programs dealing with environmental systems identified only a few programs, mainly in the U.S. UBC's Global Resource Systems seems to focus on land and food systems and does not have an emphasis on geospatial modeling and analysis.

## **List of faculty members who will be teaching**

Faculty – REM -Sean Cox, Mark Jaccard, Karen Kohfeld; Geography – Shiv Balram, Alex Clapp, Suzana Dragicevic, Nick Hedley, Meg Krawchuk, Anders Knudby, Lance Lesack, Geoff Mann, Eugene McCann, Margaret Schmidt, Kirsten Zickfeld.

## **Proposed Program Contact Person:**

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