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MEMORANDUM

ATTENTION	Senate	**DATE**	May 8, 2024
FROM	Dilson Rassier, Provost and Vice-President Academic, and Chair, SCUP	**PAGES**	1/121
RE:	Full Program Proposal for a Doctor of Philosophy in Environmental Science (SCUP 24-21)		

At its meeting on May 8, 2024, SCUP reviewed and approved the Full Program Proposal for a Doctor of Philosophy in Environmental Science.

Motion: That Senate approve and recommend to the Board of Governors the full program proposal for a Doctor of Philosophy in Environmental Science withing the Faculty of Environment, effective Fall 2025.

For Information

Included with the Full Program Proposal and approved by SGSC under delegated authority are the following curriculum changes effective Fall 2025:

New courses:

- EVSC 801 – Advanced Research Methods in Environmental Science (3)
- EVSC 896 – PhD Candidacy Exam (0)
- EVSC 898 – PhD Thesis (18)

C: Christina Giovas, Faculty of Environment, Associate Dean, Research and Graduate Studies
Rebecca Ho, Faculty of Environment, Manager, Academic and Administrative Services

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Full Program Proposal

April 11, 2024

School of Environmental Science

Faculty of Environment

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SUMMARY

The School of Environmental Science (herein referred to as "EVSC") proposes the creation of the Doctorate of Philosophy in Environmental Science. The proposed program reflects institutional approaches to achieving SFU's Academic and Strategic Research Plans, and the program will increase provincial capacity to train the next generation of Environmental Scientists to work at the intersection of traditional scientific disciplines. The environmental job market of British Columbia (B.C.) is projected to add approximately 10,000 new jobs over existing numbers between 2022 and 2032. This forecasted growth in environmental jobs will need to be met by more Environmental Science graduates.

The principal aim of the proposed program is to train the next generation of Environmental Scientists to solve pressing environmental-related problems at the local, regional, and international level. This training will help position B.C. as a worldwide leader in efforts to proactively adapt and plan for resiliency in the face of climate change. To achieve this aim, the goal of the program is to provide an interdisciplinary learning environment that offers the knowledge, critical thinking, and scientific research skills necessary to tackle present and future environmental problems. This interdisciplinary learning environment will reflect the diverse expertise of supervisory Faculty within EVSC and provide opportunities for trainees to integrate concepts and knowledge from multiple scientific disciplines. To achieve this goal, the objectives of the program are to provide PhD students with core courses that train them in environmental research design and quantitative analysis, in preparation for one-on-one, mentorship-based research training through the completion of a doctorate research thesis with Faculty supervisors from within EVSC.

The target audience for the proposed program is students with undergraduate Bachelor of Science degrees (or equivalent), and a Master of Science in Environmental Science or related disciplines (e.g., Biology, Earth Sciences, Engineering, Geology, Mathematics, Oceanography, Physical Geography, Physics, or Statistics). The program will be delivered in-person, with admissions during all three terms of an academic year. Students are expected to complete their degree in 12 terms, during which they will complete a research methods course (3 units), an elective selected by the student and their supervisor (3 units), attend the Environmental Science seminar series (1 unit), complete a candidacy exam and PhD research proposal (0 units), and PhD thesis research until program completion (18 units). Collectively, the research methods and the first part of the Seminar Series courses will culminate in development of a student research proposal. The PhD thesis will represent original, hands-on research that has the flexibility to be computationally-based, laboratory-based, or field-based (or a combination thereof). The candidacy exam and thesis defence have public examinations, and the latter serves as the culmination of the program.

The B.C. Provincial Budget squarely recognizes the importance of providing adequate funding to address the link between a sustainable and secure economy that works for everyone, and the challenges of climate change adaptation and resilience. The seriousness and difficulty of the problem was experienced by all B.C. residents during the tragic 2021 B.C. floods. Building sound and proactive policy and regional plans, rooted in collaborative and inclusive science, will require a diverse environmental science workforce, with training from the undergraduate through to post-graduate levels. The proposed program will prepare students for these roles and future employment demands, help to position B.C. for a more prepared and resilient future, and directly contribute to the local, regional, and Provincial economy through the filling of environmental- sector positions.

1) Proposed credential to be awarded

Doctor of Philosophy (PhD) in Environmental Science.

2) Location of program

The Doctor of Philosophy in Environmental Science program will be offered through the School of Environmental Science within the Faculty of Environment, on the SFU Burnaby Campus.

3) Academic unit(s) offering proposed program

This program will be offered by the SFU Faculty of Environment (here forward referred to as "FENV") and will be administered by EVSC.

4) Anticipated program start date

Fall 2025 or later.

5) Anticipated completion time

It is anticipated that the PhD program will be completed by a student in 12 terms.

6) Contact information

Please contact the EVSC Director, Karen Kohfeld, via email at ses_director@sfu.ca or phone 778-782-7624, if more information is required.

PROGRAM DETAILS

7) Aims, goals and/or objectives of the proposed program

The aim of this program is to train the next generation of Environmental Scientists to work at the intersection of traditional scientific disciplines and to help meet the growing economic demand for Environmental Scientists with post-graduate degrees in academia, government, and private industry. To achieve this aim, the goal of the program is to provide an interdisciplinary learning environment (i.e., integrating concepts, knowledge and translation from multiple scientific disciplines that are reflected by the diverse expertise of supervisory Faculty Members within EVSC) that provides the knowledge, critical thinking, and research skills beyond the master's level to prepare students to fill those positions. To achieve this goal, the objectives of the program are to provide doctorate students with core courses that train them in environmental research design and quantitative analysis, in preparation for one-on-one, mentorship-based research training through the completion of a doctorate research thesis with Faculty supervisors within the School.

The program has seven high-level learning outcomes such that graduating students will be able to: (a) independently identify a knowledge gap or broad research question on a relevant environmental problem; (b) lead the design of an independent research project that allows for development of in-depth expertise and addresses two or more relevant environmental questions, or a specific problem; (c) execute and lead independent research using current laboratory and field instrumentation, computer models, and/or statistical techniques to collect, manage, analyze, and interpret data; (d)

contextualize results through critical analysis and synthesis of environmental science literature; (e) write a PhD thesis that demonstrates in-depth expertise and that can be developed into publishable, peer-reviewed research papers; (f) communicate scientific research and analysis effectively through written and oral methods to a range of audiences; and (g) apply interdisciplinary environmental science knowledge and skills in diverse professional fields.

The proposed EVSC program reflects institutional approaches to achieving SFU's Strategic Research Plan 2023 in multiple ways. First, it is centred around interdisciplinarity in that EVSC Faculty Members address complex research problems which transcend any one discipline.

Second, it embodies engagement with partners and communities in that EVSC Faculty Members partner with diverse stakeholders and communities on research which intersects with society and nature. Third, it promotes knowledge mobilization in that EVSC Faculty Members and their students bridge the gap between society and scientific research in several important ways: the co-creation and synthesis of knowledge in partnership with knowledge users; active dissemination of results through publicly available repositories; and informing public debate, policies, and communities via effective communication of the broader significance of research findings.

A basic objective of our program proposal is to demonstrate the clear need for the PhD program in Environmental Science, both at SFU and within the province. We do so throughout the proposal in an incremental way with our responses that build off one another, adding more evidence as the proposal advances (e.g., within Sections 8, 9, 11 and 12, etc.). To help set the overall context for the need and differentiation of our proposed program, below we summarize the overarching and basic labour and economic needs for the program, and importantly, how it differs from similar programs at SFU and within B.C., usefully drawing upon an example research question to help illustrate program differentiation at SFU.

Labour and Economic Needs

The growing need and demand for expertise in environmental science is demonstrated along several different fronts. First, the climate crisis is requiring humanity to respond to new and difficult environmental challenges in the present and with haste. This necessarily requires a strong and capable workforce that can generate novel and creative ideas. Not surprisingly, there is a projected growth in the environmental workforce of approximately 10,000 new jobs in B.C. between 2022 and 2032 (see Sections 14 and 17). Furthermore, the Province is developing new coordinated policies and regulations to prepare B.C. for environmental impacts of the climate crisis and a growing population, including the Wild Salmon, Watershed Security, Coastal Marine, B.C. Flood and the Climate Preparedness and Adaptation Strategies (see Sections 14-17). The roll-out of these policies and regulations further increases need for a properly trained environmental workforce, as alluded to by support letters prepared for our proposed program application from NGOs, government, industry, First Nations, and university programs (see Appendix 3). Polling of undergraduates at SFU also supports the need for the proposed program (see Section 10).

Program Differentiation at the Institutional Level

It is important to note that the proposed program shares points of convergence but is distinct from programs in Earth Science (EASC) and Geography (Physical Geography, GEOG) at SFU (see Section 11). The points of convergence enhance the overall profile and impact of the SFU research landscape because all three programs contribute research output that advances understanding of the natural world from slightly different vantage points. For example, although their approaches

are different, EVSC, Earth Science and Geography all share expertise in geomorphology and hydrology, while EVSC and Geography additionally shared foci in landscape ecology, climate change and carbon cycling and EVSC and REM in coastal ecology and fire science. Yet, key distinctions in EVSC's technical expertise, research focus, and approach to student training offer novel opportunities and distinguish the proposed program from EASC and Geography as follows:

- EVSC has (and is developing) specialties in ecological restoration, post-wildfire change, marine and coastal science, environmental science data analysis, river dynamics, ecosystem functioning, and past climates. The existing programs do not share this collection of research focus and expertise.
- EVSC has a vision of providing students with a thematic overview of environmental science training as the physical, chemical and biological aspects of watershed processes across the land-to-ocean aquatic continuum of B.C. The existing programs do not have this type of thematic overview or approach to teaching environmental science.
- We maintain that the differences in disciplinary focus create unique academic cultures and perspectives for student learning between EVSC and the other departments. The overlap in topics allows for a similar scientific language to be spoken between these programs which creates complementarity for the benefit of SFU.

Illustrating Program Differentiation Using a Basic Research Problem

More specific differences can be illustrated by considering how the different programs might approach a scientific question. Here, we focus on how river longitudinal profiles develop in time and space. In addressing this question, Physical Geography[1] might apply a spatial emphasis that examines associated changes, inter-relationships, and behaviours through a process-based lens, contextualized by geomorphic principles that relate to river and landscape history over timescales that commonly range from the present to a maximum of a few million years (beginning of the Quaternary period). Embracing a holistic view of Earth surface processes, physical geographers commonly apply an inductive approach rooted in empiricism and field observations (sometimes laboratory experiments). They use these observations to propose theories of how river profiles evolve and change, with strong and clear ties to the prevailing geomorphic principles of the day, for example, the graded river profile, dynamic equilibrium, etc. Earth Science[2] shares this geomorphic focus, but Earth Science is concerned with deeper time and the entirety of processes from the Earth's surface to the core, requiring different approaches of theory development with a common focus on deductive reasoning (sometimes through reductionism). This involves development of mathematical models that can be tested via computer simulations (sometimes laboratory experiments), and then comparing these results to empirical data. As a result, these two approaches commonly meet in the middle, where empirically driven results vs. computer simulation results converge on complementary and competing theories.

Environmental Science sits between these two general approaches and often uses aspects of both to solve environmental problems. With respect to river profile evolution, not only might an Environmental Scientist utilize empirical and inductive approaches, but also deductive approaches

[1] Mayhew, S. (2015). "Physical geography." In A Dictionary of Geography. Oxford University Press.
[2] "Physical Geography is inextricably tied to and dependent on the geological perspective of "time" to help understand modern-day Earth surface landforms, as this is the playground of a geologist." Source: Norton, 1901, The relation of Physical Geography to other science subjects, Vol 14, No 345, Science."

to better understand why changes to river profiles (i.e., riverbed elevations from upstream to downstream) matter for a large number of present-day environmental problems.

Examples include how river profile adjustment can influence climate change adaptation planning, land use, or aquatic resource planning decisions. Whereas Physical Geography is also an interdisciplinary science, by construct, Environmental Science is an interdisciplinary science that is not tied to a collection of specific disciplinary scientific views and concepts. It draws upon various disciplinary viewpoints to help directly address environmental problems in a solution-oriented manner. This does not mean that Physical Geography or Earth Science does not provide solutions-oriented results. However, from a science frame of reference, it is not the foundational focus or drive of their research programs. Furthermore, whereas it cannot be denied that Physical Geography is concerned with connections between people, landforms and the environment, the focus on this inter-relationship has only strongly emerged in the last two decades along with the rise of Earth System Science[3]. On the other hand, Environmental Science grew out the modern-day environmental movement of the 20th century in recognition of the need for a field study that focuses squarely on environmental problems, potential solutions, and a cross/interdisciplinary approach to the supporting science.

Program Differentiation at the Provincial Level

Key points that distinguish our program from similar programs within B.C. include: (a) all Faculty within EVSC are directly housed within EVSC, as opposed to having homes in different departments with the ability to supervise students in an Environmental Science program; (b) similar to above, all Faculty Members within EVSC focus on interdisciplinary Environmental Science with a central focus on researching the physical and ecological basis of watershed-to-coastal ocean processes, and students will work within this continuum on a research-based MSc degree; and (c) the proposed program will build from our unique and existing collaborative and productive relationships with local, Provincial and Federal governmental and non-governmental environmental organizations and Indigenous groups, providing future students direct pathways for research engagement that will make an immediate impact in translating science into appropriate actions to protect vital resources and ecosystems.

8) How does the proposed program fit within the mandate of the institution?

As SFU prepares for the future, the University has evolved its Strategic Plan to respond to changing societal needs, as well as the people and communities represented in those needs. The plan is built around four priority elements: Uphold Truth and Reconciliation; Engage in Global Challenges; Make A Difference for B.C.; and Transform the SFU Experience. The proposed program directly engages the second and third priority elements as EVSC Faculty address, for example, global challenges related to a changing climate and ecosystem dynamics, as well as in the B.C. context by working to identify and communicate how natural hazards related to forest fire and landslides may impact river function, salmon populations and watershed processes, which collectively pose risks to communities and cities across B.C., and to vulnerable Pacific salmon populations which are struggling under mounting climate-related pressures. The proposed program also addresses the

[3] Pitman, 2005, On the role of geography in Earth System Science, Vol 36, Issue 2, *Geoforum*.

first priority element of the SFU Strategic Plan through continued development of established and ongoing collaborative relationships with Indigenous Peoples to research, better understand and address specific environmental problems related to ecosystem resilience in the face of rising sea levels in coastal zones, and species vulnerabilities to ecosystem degradation and impact from anthropogenic and climate change driven changes. Consequently, the research environment encompassed by EVSC Faculty Members thus provides a rich educational landscape in which to prepare new scientists to address global challenges and make a difference for B.C.

The proposed program in Environmental Science builds upon the Faculty of Environment's commitment to provide programming to train the next generation of environmental problem solvers. The Faculty of Environment was formed in 2009, originally comprising REM, the Department of Geography (home to Human and Physical Geography), and the undergraduate program in Environmental Sciences. As the Faculty has grown (now also including the Department of Archaeology), EVSC was subsequently formed to house the undergraduate program in Environmental Science and to oversee the joint SFU/BCIT (British Columbia Institute of Technology) Master in Ecological Restoration program[4].

As the context and necessity for addressing environmental issues has grown in the past decades, so has the need for innovative graduate programming that suits a wide range of students interested in understanding and tackling environmental problems within the Faculty of Environment. At one end of the spectrum, the Department of Geography offers students insights into the connections between the natural and human environment and aims to advance the fundamental understanding of the natural environment. At the other end, REM offers programming on how to manage environmental resources through improved decision-making within complex social, political, and economic frameworks. Here, we propose a new graduate program with a mission that rests between these two excellent programs and maintains a focus on training graduate students in the interdisciplinary science of environmental problem-solving. We recognize that this characterization somewhat oversimplifies the breadth of all three of these programs (in other words, a member of Geography can also work on applied problems, and a researcher within REM can also advance fundamental understanding, etc.). However, it is the mix of these three programs and their distinct academic cultures that provide a diversity of opportunities for a range of students and creates a faculty-wide strength for addressing regional-to-global challenges posed by environmental change.

EVSC was formed to house the highly successful undergraduate program in Environmental Science, which is among the largest undergraduate science programs at SFU. Several graduates from this program have expressed interest in pursuing research-based graduate work at SFU in EVSC. A graduate program in Environmental Science will offer a new opportunity for our graduates to obtain a post-graduate degree in their field of study at SFU.

Until 2024, EVSC had jointly taught a since-discontinued professional Master in Ecological Restoration graduate program with BCIT. The research and teaching expertise in ecological restoration has shaped the research landscape of EVSC, and as a result the research-based graduate

[4] The SFU/BCIT Master in Ecological Restoration (MER) was a joint, professional master's program that concluded in 2024. The MER program was course-intensive master's degree that did not offer a PhD program. The proposed program is centred around research-based mentorship for a PhD degree that includes but is not limited to ecological restoration research topics.

program in Environmental Science will give SFU a strategic advantage over other universities in Western Canada by providing opportunities for Environmental Science undergraduates to continue their education within an academic landscape that has roots in protection and preservation of ecosystems and nature, thus enhancing the opportunities for British Columbia to retain a highly-educated Environmental Science workforce.

9) How does the proposed program support the current academic and strategic plan of the institution?

The work being done within EVSC fully aligns with SFU's Academic Plan, which focuses on five important, and equal, challenges: (a) student life, learning and success; (b) academic quality/curriculum; (c) engagement; (d) bridging divides/interdisciplinarity; and (e) Faculty and staff renewal [1]. EVSC seeks to support SFU's (and the Faculty of Environment's) Academic Plan through the following activities:

- Ensuring curriculum design that supports students' sense of belonging, development, and communities of learning; welcoming and supporting students from all walks of life; enhancing programming and services for Indigenous and international students; and ensuring on-line academic, professional, and health-and-wellness support, along with personal advising service for students (student life, learning and success).
- Continuing to implement and refine course, program, and educational goals/learning outcomes; capitalizing on opportunities to advance innovative and exciting programming; promoting knowledge mobilization and open access to course materials (academic quality/curriculum).
- Developing community- and work-integrated learning opportunities and international collaborations (e.g., international field schools) to support academic and professional development for students; and enhancing the School's reputation at the national and international level (engagement).
- Facilitating dialogue to identify and act on best practices and opportunities; removing barriers that hinder advancement of interdisciplinary and transdisciplinary academic programming and scholarship; and fostering teaching collaborations across disciplines (bridging divides/interdisciplinary).
- Building academic policy and practice to improve hiring and retention of new Faculty and staff; supporting mentorship and knowledge-sharing among Faculty and staff; identifying best practices in Faculty-student relationships (e.g., mentoring, supervising, and advising); and ensuring that hiring and retention policies align with SFU's and the School's equity and diversity objectives (Faculty and staff renewal).

SFU's Research Plan (SRP - 2023-2028) articulates several broad strategic research goals [2]: (a) to enhance the university's profile at the national and international stage, (b) to work collaboratively with our partners across a wide spectrum (i.e., not-for-profit, government, industry, communities, etc.), and (c) to advance and accelerate research discoveries. Towards these goals, SFU's SRP embeds the university's institutional core values (critical thinking and academic freedom; excellence and responsibility; respect and reciprocity; equity and belonging; engagement and openness; resilience and sustainability; and innovation and adaptation) into research practice by recontextualizing these values through five institutional research priorities [2]: (a) Advancing community-centred climate innovation; (b) Supporting Health and Wellness of Individuals,

Populations and Communities; (c) Expanding the Foundations of Knowledge and Understanding our Origins; (d) Strengthening Democracy, Justice, Equity and Social Responsibility; (e) Transforming Industry and Economies through Technology, Management and Policy. The SRP serves as a road map to push the limits of discovery, elevate SFU's capacity in foundational research and knowledge mobilization, and develop its interdisciplinary research strengths, while building critical mass in areas that are strategically important and globally relevant.

As with the priority research areas of SFU's SRP, EVSC's proposed graduate program is centred on addressing real world problems through the education and training of tomorrow's environmental problem solvers. The EVSC graduate program will directly address three of the five priority research areas mentioned above [2]. First, the proposed graduate program seeks to advance community-centred climate innovation recognizing the pressing problem of climate change and rapid land-use change, and the need to develop scalable solutions at the community and regional level, to address the global challenges of climate change. As with other graduate programming in the Faculty of Environment, our graduates will examine the unprecedented shifts in environmental conditions, but with a focus on a quantitative, interdisciplinary lens that integrates aspects of classical fields within the natural sciences (e.g., Biology, Chemistry, Geology, and Physics). Additionally, the proposed program will focus on training graduates to contribute natural science understanding of environmental problems to solutions that promote a sustainable future. Second, the proposed graduate program aims to help expand the foundations of basic knowledge by training environmental scientists who contribute to better articulating physical and ecological processes (collectively environmental processes) in watershed and marine settings, while also identifying why "knowledge" matters for society, and in relation to planning for climate change adaptation. Third, the proposed graduate program will help transform industry and economies through technology in two important ways: (a) by clearly communicating the how, what and why of environmental processes from the headwaters to the coastal zone such that policy makers, planners and natural resource managers can develop improved approaches to manage natural resource development, from inception to implementation, and (b) develop the scientific understanding that is necessary to support more proactive anticipation of how climate change will impact future environmental conditions, facilitating society to plan in a more informed manner based on more realistic targets and likely trends.

10) Target Audience

The specific target audience for the PhD in Environmental Science are students with an undergraduate Bachelor of Science degree (or equivalent) and a graduate Master of Science in Environmental Science or a related discipline (e.g., Biology, Earth Sciences, Engineering, Geology, Mathematics, Oceanography, Physical Geography, Physics, or Statistics). Exceptional students can be admitted directly from a Bachelor of Science degree program with agreement from the EVSC Graduate Program Development Committee and in accordance with SFU's graduate admission criteria and policies (Graduate General Regulation 1.3.7a).

Both anecdotal evidence and the results of a survey of EVSC undergraduates suggest that there is interest in a PhD program in Environmental Science at SFU. Faculty Members within EVSC have all reported queries from undergraduate students about graduate research opportunities in Environmental Science, and Faculty Members have already accepted PhD students into their research groups through other SFU programs. Currently, EVSC Faculty Members supervise 8 PhD students that are placed in other programs.

We anticipate the Doctorate of Environmental Science has potential to fill a specific niche. A recent survey[5] of undergraduates in 3rd and 4th year Environmental Science courses at SFU suggest that 84% of survey participants would be interested in pursuing graduate degrees in Environmental Science[6], and the same number of students interested in pursuing graduate programming in Environmental Science at SFU if it were available[7]. A total of 76% of respondents, on a scale of 0 (not interested) to 5 (very interested) indicated high levels of interest (5) in pursuing a career in Environmental Science[8]. Last, and in general, as course offerings in EVSC have increased over the past 5 years, so have demands for those courses, as evidenced by the general increase over time in course enrollments at the undergraduate level (Figure 1).

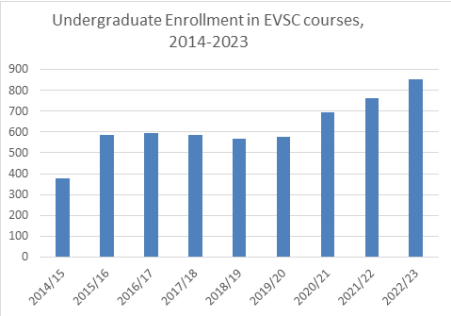

Figure 1. Enrollment in undergraduate EVSC courses from 2014 to 2023. SOURCE: SFU Institutional Research and Planning (https://irp.its.sfu.ca/ibi_apps/bip/portal/enrolment)

11) Related programs in the institution or other British Columbia post-secondary institutions and outside of British Columbia

While several SFU programs deliver graduate degrees with environmental content, we have identified 3 PhD programs at SFU that share the greatest similarity with the proposed program; 4 universities within British Columbia have related programs; 5 universities within Canada but outside of B.C. have related programs; and 2 regional universities (University of Washington and Washington State University) have related environmental science PhD programming. For this question, we briefly describe these programs; in our response to Question 12, we elaborate on how our proposed program is differentiated from these existing programs.

[5] The survey was conducted using SurveyMonkey and was advertised through the EVSC weekly newsletter (3 weeks), the EVSC undergraduate email list (once), and the EVSC student union (twice) in Fall 2023. 26 students responded to the survey, 23 of which were in the 3rd year or higher. Survey participants were kept anonymous.

[6] Survey participants were asked: "Are you interested in pursuing a graduate (Master/PhD) degree in Environmental Science?"

[7] Survey participants were asked: "If there was a graduate (MSc/PhD) degree in Environmental Science at SFU, would you be interested in it?"

[8] Survey participants were asked: "How interested would you be in pursuing a career in Environmental Science? (0 = not interested --> 5 = very interested)"

Related programs in the Institution

At SFU, the PhD programs which share the greatest similarity with the proposed program are in Earth Sciences (CIP: 40.06) and Physical Geography (CIP: 30.44 and 45.07), which is part of the Department of Geography. The PhD Earth Sciences requires 2 courses, an introduction to graduate studies and a research seminar course. Both courses are only 0-1 units, which is not a significant part of the program and graded on Satisfactory or Unsatisfactory basis. The PhD Geography program requires an introductory course (1 unit, graded on Satisfactory or Unsatisfactory) and any additional coursework specified by their supervisory committee. Both programs require a qualifying exam and thesis. Students in these two programs also sit for qualifying exams and write theses, which are the basis for peer-reviewed manuscripts/publications. SFU also offers a Doctorate of Resource and Environmental Management (CIP: 03.01) in REM where students can focus on environmental topics, including environmental science. This program requires 3 courses in the program's core subject areas, plus a thesis.

The proposed PhD program is different from these programs in that it provides the opportunity for students to conduct research within a department solely focused on interdisciplinary Environmental Science, with a central focus on researching the physical and ecological basis of watershed-to-coastal ocean processes (see Question 12). Furthermore, it is important to note that it is not unusual within Canada for prominent universities to house separate programs with graduate degrees in both Environmental Science and Geography (examples include University of Guelph, University of Victoria, McMaster University, Queen's University, Université du Québec à Montréal, and Université du Québec à Rimouski, University of British Columbia - Vancouver). To deliver programs in Geography and/or Environmental Science generally requires some fundamental overlap in knowledge in areas such as geomorphology, hydrology, and landscape change (for which both SFU departments have expertise; see Section 7). In fact, the importance of two co-existing programs is seen in the fact the other universities with existing Geography programs (e.g., UBC) are also now trying to launch Environmental Science programs.

Related Programs in British Columbia

Within British Columbia, there are 4 universities with related research-based PhD programs. Our program is differentiated from these various programs because of (a) its focus on interdisciplinary science rather than on environmental management, or socio-economic or socio- ecological systems, and (b) its plans to house primary research supervisors within EVSC rather than relying on supervisors housed solely in other departments (see Question 12d)

- University of Northern British Columbia offers a PhD in Natural Resources and Environmental Studies (CIP: 03.02). The program is moderately course intensive (4 required courses), and students choose an emphasis among Earth Systems & Dynamics (CIP: 30.38 and 40.06), Ecological Patterns and Processes (CIP: 26.13) and Societal Structures and Value (CIP: 45.01). The program is interdisciplinary, and supervising Faculty are drawn from numerous programs within the University.
- University of British Columbia-Okanagan (UBC-O) offers a PhD in Earth and Environmental Sciences (CIP: 40.06). The program has no course requirements, and students can focus their research on a wide range of sub-disciplines, including mantle dynamics, landscape ecology, and watershed processes. The environmental science aspect emphasizes Natural Resources (CIP: 03.02), Environmental Impact Assessment (CIP:

03.01), Watershed Processes and Landscape Ecology (CIP: 30.01). The UBC-O program has a substantial focus on environmental geosciences.

- University of Victoria offers a PhD in Environmental Studies (CIP: 3.01 and 30.01). The program has no course requirements, and students choose their research topic from three areas that focus largely on socio-ecological systems: Ethnoecology (CIP: 30.9999), Ecological Restoration (CIP: 30.01) and Political Ecology (CIP: 30.9999).
- University of British Columbia-Vancouver (UBC-V) offers a PhD through the Institute for Resources, Environment and Sustainability (CIP: 03.01). This inter- and transdisciplinary program focuses on a wide range of topics under the realm of environment and sustainability, with an emphasis on putting forth solutions to real world problems which integrate human and natural systems. Students are required to take two courses, with one of them an appropriate methods course.

Programs Outside of British Columbia

Outside of British Columbia, there are 6 universities with research-based PhD programs that have some similarity to the proposed PhD in Environmental Science. While our program has some overlaps with these programs, it is differentiated by (a) its central focus on researching the physical and ecological basis of watershed-to-coastal ocean processes rather than environmental geoscience, ecology and conservation, and environmental resource management, and (b) its physical proximity to the largest metropolitan area in Western Canada (Vancouver). Specific similar programs outside of B.C. include the University of Guelph which offers a PhD in Environmental Sciences (CIP: 03.01), in which students develop a high level of knowledge in the field of Environmental Science through a learner-centred approach, as well as expertise in specific aspects relating to their research. The University of Toronto-Scarborough's Department of Physical and Environmental Science offers a PhD in Environmental Science (CIP: 03.01), which is designed to provide a broad knowledge of current environmental research issues, and specific training in the most appropriate research methodologies to address questions that lie at the interface between traditional science disciplines. The University of Waterloo offers a PhD in Earth Science with an emphasis in water (CIP: 40.06), and a PhD in Geography with an emphasis in water (CIP: 30.44). The Earth Science PhD features a quantitative and scientifically rigorous education in water sciences, sustainable mining, Earth processes and geohazards, whereas the Geography PhD focuses on one of four geographical themes: climate change and environment, economy and society, Earth system science and geomatics. Furthermore, Dalhousie University offers a PhD in Earth and Environmental Science with research conducted in a wide range of fields including Hydrology (CIP: 40.06) and Climate Change (CIP: 30.35), i.e., fields most similar to Environmental Science. The program has strong ties with the Geological Survey of Canada. Queen's University offers a PhD in Environmental Studies (CIP: 03.01), providing students with graduate training in environmental studies, emphasizing interdisciplinarity and focusing on the concept of sustainability and sustainable practices, with a strong focus on the development of independent and critically-thinking environmental scientists. Lastly, the University of Washington offers a PhD within the School of Environmental and Forest Sciences (CIP: 03:02 and 03.05), with a range of focuses available for the degree. The degree is offered through the College of the Environment, which is the largest program of its kind in the United States of America. The mission of the College is to train the next generation of environmental scientists and policy innovators who address challenges ranging from the climate crisis to pollution of marginalized communities. Washington State University also offers a PhD in Environmental and Natural Resource Sciences

(CIP: 03.02), with areas of emphasis that include: Environmental Policy and Management (CIP: 03.0299), Aquatic and Forest Ecology (CIP: 26.13), Wildlife Ecology, Conservation and Biodiversity (CIP: 03.06 and 26.13), and Quantitative and Spatial Aspects of Natural Resources (CIP: 03.0299 and 26.11). Additionally, the Ph.D. program at Washington State University is designed to educate, train and mentor students in six "core competency" areas within the Environmental and Natural Resource sciences related to advanced knowledge in ecosystems and research methods, critical thinking, research ethics, science communication and subject matter expertise.

12) What differentiates the proposed program from all other related programs in the Province?

The proposed program will rely primarily on mentorship-based supervision from Faculty Members drawn directly from EVSC. Graduate students will be provided an educational basis of 2 required course (6 units) plus required attendance at Environmental Science seminars (1 unit). We define "mentorship-based" to mean that the primary focus of their degree will involve working closely with individual research supervisors and possibly thesis committee members to independently complete their thesis. Mentorship-based learning implies that the thesis will most often be directly related to research conducted as part of the research program of the supervisors within the EVSC department, such that a substantial part of the student learning process occurs through direct interactions with the research supervisor and other collaborators.

The core Faculty in EVSC who are responsible for supervising these graduate students have expertise in Environmental Science, bringing together knowledge and experience in physical, biological, and quantitative sciences. The program will emphasize the development of skills necessary to connect different disciplinary approaches to natural and mathematical sciences within the context of environmental problems. Additionally, the EVSC Faculty work with scientists and non-academic collaborators from many disciplines in the physical, computational, and biological sciences. These collaborators have potential to provide significant, job-related mentoring outside of the academic track, providing an in-depth understanding of how science is used to help solve pressing environmental problems. Our PhD program aims to engage these collaborators as co-supervisors and supervisory committee members, thus providing strong connections with professionals actively employed in the field of Environmental Science.

The combined expertise of the EVSC Faculty will provide a unique landscape for students to research environmental problems focused across the land-ocean aquatic continuum: from understanding physical, chemical, and biological aspects of watershed processes on land, to their behaviour in estuarine, coastal, and open ocean aquatic systems. Specifically, Faculty researchers within EVSC investigate river geomorphology, ecogeomorphology (post-wildfire landscape evolution), landscape ecology, soil science, climate and environmental change, coastal marine processes, and ocean biogeochemistry. Furthermore, the recent joint delivery of a Master of Ecological Restoration program[9], which was housed in EVSC, has resulted in unique research capacity in areas of terrestrial and marine ecological restoration. The creation of a PhD in

[9] The Ecological Restoration program run jointly with BCIT is ending as of Spring 2024.

Environmental Science will serve as a way to cultivate this expertise at Simon Fraser University within the new graduate program.

This program vision has been designed to be distinct from, and complementary to, the existing programs in the Province in the following ways:

- The proposed EVSC PhD program is differentiated from the Earth Science Doctorate program at SFU because, while students in this program can conduct research on an environmental science topic, they do so within a discipline-specific framework as opposed to the interdisciplinary, problem-solving space offered by Environmental Science (see Section 7). The proposed EVSC PhD program both complements and is differentiated from the Physical Geography Doctorate program. Our proposed program complements Physical Geography through our research Faculty expertise, which deepens and extends the University's position as a leading Canadian institution for research of rivers, watersheds and water-related environmental challenges, and extends its position by strengthening research in coastal marine processes, marine mammal ecology and ocean biogeochemistry.
- The proposed program is distinct from three of the interdisciplinary programs at three universities because of its focus on interdisciplinary science rather than on environmental management, or socio-economic or socio-ecological systems (e.g., REM, UBC-V Resource, Environment, and Sustainability; U Victoria Environmental Studies). Unlike the proposed program, which will focus on environmental science, several of these programs are designed as environmental management programs with strong focus in the social sciences (i.e., economics, policy, and planning) and/or humanities, that is supplemented with natural science training.

One existing program provides a strong grounding in environmental geosciences (surface and subsurface water pollution, natural hazards due to landslides and debris flows, etc.), with a PhD offered in Earth and Environmental Science (UBC-Okanagan). While this program may have some overlap, the proposed program will be centred more on researching the physical and ecological basis of watershed-to-coastal ocean processes.

The remaining program with the strongest overlap is UNBC. The proposed doctorate program is differentiated in terms of its general thematic focus of understanding physical and ecological changes from terrestrial watersheds to coastal regions, and the intent to expose all graduate students to research conducted across this continuum. Furthermore, the proposed program offers a unique interdisciplinary community in which students can learn and grow, because it plans to house primary research supervisors within EVSC rather than relying on supervisors housed solely in other departments. Physically housing students within one unit will create a more cohesive learning environment that nurtures opportunities for students working on related topics to learn from each other. Housing supervisory Faculty within one unit helps create a unified vision of programmatic goals and administratively facilitates communication and collaboration under the umbrella of these common goals. Finally, the proposed doctorate program will anchor important training opportunities in the largest metropolitan area of B.C., serving both local and non-local students.

13) An overview of the level of support and recognition from other post-secondary institutions, and relevant regulatory or professional bodies

Our program proposal is supported by 3 universities in B.C. including the University of Northern British Columbia (competing program), the University of Victoria, and the University of British Columbia-Vancouver (competing program). We also received supporting letters from 3 universities located in the United States and Europe (Portland State University, California State University Monterey Bay and La Rochelle Université (UMR7372)). We also have support from the kʷikʷəƛ̓ əm (Kwikwetlem) First Nations, NGOs (Project Watershed, Resilient Waters, Squamish River Watershed Society, and the Saturna Island Marine Research and Education Society), potential employers in the private sector (Keystone Environmental Ltd. and Coast Range Environmental Ltd.), and local and Federal government agencies in Canada and the United States (the City of Port Moody, B.B. Ministry of Environment and Climate Change Strategy, Environment and Climate Change Canada, Fisheries and Oceans Canada, and the U.S. Geological Survey). The support expressed in letters we have received is tangible and highlights the impact our Faculty have had in previous years of administering the Ecological Restoration Program, and underscores the environmental and economic impact our broader graduate program will have in the future:

"For the last few years, our most important collaboration has been with Simon Fraser University, specifically the Master of Science in Environmental Restoration headed by Ruth Joy. We've worked closely over four cohorts of this program, supporting six MSc students and one undergraduate, to do fieldwork on Saturna. They have also made a valuable and much appreciated contribution to this small community, and the experience has gone well beyond just a fieldwork project for all parties."

- Dr. Martin Wale, Saturna Island Marine Research and Education Society

"Kwikwetlem continues to face many challenges in protecting its territory from ongoing, multiple impacts to its environmental and cultural interests. One of those challenges is our Nation's capacity limits. Yet it has been Simon Fraser University that has provided even more support to our Nation in recent years. Kwikwetlem has greatly benefitted from the knowledge and assistance of SFU's Shawn Chartrand on many aquatic and restoration issues in recent years, including Shawn's and his student's most timely help on designing major restoration works on the Addington Point Marsh."

- Christa Williams, kʷikʷəƛ̓ əm (Kwikwetlem) First Nation

"As a research scientist with the Federal government, over the last six years I have developed a new program and hired a team of 17 biologists, technicians, and casual employees. One of the greatest challenges was in finding well trained and experienced graduates that have a breadth of knowledge and interdisciplinary skills to support the type of science that is needed in today's world of heightened awareness of environmental impacts. I see significant value in the proposed MSc and PhD program under SFU's Faculty of Environment's School of Environmental Science, and would welcome the addition of graduates into the workforce."

- Dr. Shelia J. Thorton, Fisheries and Oceans Canada

Finally, the professors and researchers within EVSC collaborate extensively with researchers and scientists at academic institutions (across B.C., Canada, and globally) as well as with Federal

agencies across Canada. Current examples include: Department of Fisheries and Oceans Canada, Parks Canada, the Hakai Institute, Western University of Ontario, University of Ottawa, University of Northern British Columbia, University of British Columbia, CNRS La Rochelle Université (UMR7372) and Laboratoire de Planétologie et Géosciences - UMR CNRS 6112, Leipzig University, Stockholm University, University of Barcelona, University of Bordeaux, University of New South Wales, University of Queensland, University of Tasmania, and Utah State University. As such, PhD students within the EVSC program will gain opportunities to network and learn skills from researchers at these collaborating institutions and beyond, further building these extensive partnerships, and fostering an atmosphere of sharing resources that enrich the graduate research experience.

There are no professional bodies that accredit graduate programs in this field in Canada.

14) What added value will the proposed program offer graduates in terms of employment opportunities?

As B.C. shifts to a cleaner and greener economy with stronger supporting governmental regulations, the environmental job market is projected to add approximately 10,000 new jobs over existing numbers between 2022 and 2032 [5]. This forecasted growth in environmental jobs will need to be met by more graduates trained in the Environmental Sciences, and related disciplines. Major components of the environmental job market include working in B.C. or Canada within the private sector as a consultant or for business and industry, in the public sector working for Municipal, Provincial, Indigenous or Federal government agencies, or in the not-for-profit sector working for conservation or advocacy organizations.

All these career paths require scientists who think critically and independently, are familiar with methods to investigate and understand interconnected environmental systems and natural phenomena, and are familiar with the scientific knowledge that underpins environmental regulations and impact analysis. Importantly, these career paths require environmental scientists who are skilled at communicating science within teams of diverse scientists, stakeholders, policy analysts, Indigenous organizations and Nations, lands managers, and industry representatives.

The proposed PhD program will prepare students for these roles and future employment demands required to help B.C. make a strong transition to a cleaner and greener economy, through their development of the skills listed below. We note that students are exposed to many of these skills at the undergraduate level, and that they develop an increasing independence to execute these skills at the master's level. At the PhD level, we anticipate that students will gain sufficient experience to take on leadership roles associated with professional activities in academia, industry, government, and/or non-governmental organizations. More specifically:

- Students will learn how to develop, measure, and lead plans to sample, monitor and report on the behaviour of natural phenomena; and design and lead the installation of environmental monitoring stations across the disciplines of terrestrial and aquatic ecology, fluvial geomorphology and soil science, coastal geomorphology, surface and subsurface hydrology and environmental chemistry;
- Students will learn how to independently develop and model ecological systems, landscape, riverine and wetland environments using statistical methods, continuum-based

approaches and probabilistic methods, including exposure to widely used modelling platforms designed for industry and applied analysis;

- Students will gain experience in how to lead efforts to communicate, in written and oral forms, the results of research. This includes placing their work in the context of the broader literature with focused research questions and objectives, summarizing methodological and theoretical approaches, analyzing results and findings, and highlighting the implications of their research with an emphasis on application. Students that graduate from the PhD program will most likely be prepared to pursue licensing in B.C. as a Professional Biologist, Geologist or Agronomist, or as a Professional-in- Training.

15) Do potential employers require a degree for graduates to gain employment in the field?

Yes. A PhD is a standard requirement for academic employment at the Assistant Professor level and above. In the private sector, at a minimum, employers generally require a bachelor's degree in Environmental Science, or a closely-related field such as Ecology, Biology, Earth Science, Geography, Hydrology, or Engineering [6]. A PhD degree results in higher salary earnings and also better enables scientists seeking professional licensure as a Biologist, Geologist or Agronomist because advanced degrees count toward the professional work requirements.

In the present-day context, the nature of environmental problems is complex. This commonly requires research level scientists to lead technical studies and possibly manage environmental projects with a more sophisticated overview of how to apply the principles of environmental science to problem-solving in a rigorous manner. As a result, within the environmental sector, preference is often extended to people with advanced graduate degrees because they can enter the work force with more fully developed skills that permit them to take on more advanced assignments, including project management for more complex projects, science development for specific environmental problems and applications, business development, and technical lead for more complex environmental investigations. For larger private consulting firms such as DHI group, "*over 80% of DHI people have a master's or PhD degree*…" (see Appendix 8 for DHI group LinkedIn post). For governmental organizations such as the Department of Fisheries and Oceans the careers page clearly states: "*for a research scientist position, you'll need a doctorate (PhD) in specialized scientific discipline*…" (see Appendix 8 for DFO career page). Consequently, a PhD in environmental science will provide a career pathway for research scientists outside of academia that would not be possible to someone with just a Bachelors or Masters degree (see Appendix 8 for additional job advertisements).

16) Potential areas/sectors of employment for graduates and/or opportunities for further study in the field

The B.C. Labour Market Outlook 2022 Edition [5] identifies four key job sectors for environmental scientists (Figure 2) [5]: (a) natural and applied sciences and related; (b) management; (c) education, law and social, community and government services; and (d) business, finance and administration. In sector (a), graduates of the proposed PhD program will find employment in the private sector with consulting firms, business, and industry; in sector (b), graduates will find employment with land management conservation organizations including Municipal, Provincial, Indigenous and Federal Government agencies; in sector (c), graduates will find employment as primary and secondary school teachers, enrichment program educators and

summer camp instructors with environmentally-oriented organizations; in sector (d), graduates will find employment with financial services which support the operations of the broader environmental market.

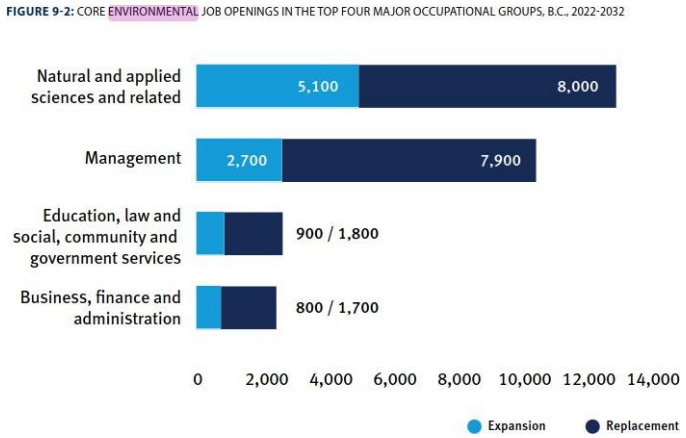

Figure 2. Projected core environmental job openings in the top main four major occupational groups in B.C. from 2023-2032 [5].

Graduates will also be qualified to work within the environmental industry as a consultant, or for private businesses that need environmental guidance to comply with applicable regulations and laws, and as a non-governmental and governmental agency scientist and program manager. Graduates will also be well suited to pursue teaching credentials to teach general environmental, biological, and physical science to secondary school students. New opportunities for graduates will also manifest over the next several decades as British Columbia's Clean Economy [5] focus takes more shape and pushes ahead.

17) What labour market needs would the proposed program meet for the Province? (Please include no more than 5 applicable National Occupational Classification (NOC) codes.)

The current National Occupational Classification (NOC 2021) codes do not fully capture the labour markets for graduates of the proposed PhD program in Environmental Science because it is, by definition, an interdisciplinary program. As a result, a purely NOC-based analysis will likely under-estimate the true market labour projected needs for Environmental Scientists, which is projected to be roughly 10,000 new environmental positions between 2023 and 2032, or a 13% increase over the labour pool in 2022 [5]. Below we highlight the key NOC codes in descending order of highest project job growth to least, for the 4 most applicable codes.

- **41400 – Natural and applied science policy researchers, consultants and program officers.** Occupations here include Certified Agronomist, Fisheries Analyst, Environmental Impact Analyst, Scientific Consultant, Hydrologist and Water Resources Scientist, etc.
- **21110 – Biologists and related scientists.** Occupations here include Ecologist and Natural Resource Manager.
- **21102 – Geoscientist and oceanographer.** Occupations here include Environmental Geoscientist, Geophysical Scientist, Hydrologist, and Coastal Scientist.
- **21109 – Other professional occupations in physical sciences.** Occupations here include Soil Scientist.

- **21202 – Urban and land use planner.** Occupations here include Environmental Planner and Environmental Impacts Analyst, neither of which requires a planning background, but does require training in Environmental Science and related fields in order to advise the review of projects that could impact the environment, ecosystems and natural processes.

Job openings in those NOC codes within B.C. are projected to grow by roughly 13% between 2023 and 2032, or by approximately 10,000 jobs. In addition, a projected additional 20,000 existing positions will need to be filled by new employees due to retirement, etc. [5]. More broadly, it is expected that there will be roughly 170,000 job openings in 2025 within the environmental job sector, with 35,000 of these in the core environmental sector [11]. All projections point to relatively strong job growth for the environmental market, which the proposed PhD program will service for the benefit of Canada and the Canadian environment.

18) Plans for admissions and transfer within the British Columbia post-secondary education system.

Any graduate from the B.C. post-secondary education system satisfying the University admission requirements as stated in Graduate General Regulation 1.3.7a (Admission to a Doctoral Program) are eligible to apply to the program. We do not anticipate transfers into or out of the program from outside the university.

19) Enrollment Plan

The anticipated student enrollment for the program over the first three years focuses on full- time students only as the program will not offer a part-time option. Table 1 summarizes the anticipated (and minimum viable) enrollments for the first two academic years of the program, as well as a projected steady-state enrollment. The steady-state enrollment in the EVSC PhD program is anticipated to range between 8 and 12; this number of students at steady-state relates to the funding support that EVSC Faculty generate from a variety of sources, ranging from grants of tens of thousands of dollars to multi-million-dollar magnitudes. These projected enrollment numbers are partly based on the actual enrollment of graduate students supervised by EVSC Faculty (these graduate students are currently housed in other units at SFU), as well as on an informal survey of EVSC Faculty Members assessing the projected size of their research group based on incoming funding and project needs based on expressed interest by SFU undergraduates in EVSC. We anticipate a further increase in the number of applications, which could be supported by additional admissions as existing tenure-track Faculty mature and win larger research grants.

The existing and proposed course offerings within EVSC can easily accommodate this intake of PhD students. The required "Advanced Research Methods in Environmental Science" course (proposed course EVSC 801) will be taught by the same professor who teaches the research methods course designed for MSc students (proposed in the MSc program, EVSC 601), and the EVSC Seminar course (EVSC 608). Thus far, feedback from other departments has suggested that EVSC graduate students would be welcome to participate in their departments' elective courses. Although no memoranda of agreement exist, when possible, students would have a choice of elective courses.

Table 1. Anticipated enrolments in the first three years of the new PhD degree program.

Start Year	Yr. 1	Yr. 2	Steady-State

Students enrolled	5-6	8-10	8-12

Our enrollment plan includes a commitment to ensure increased participation of women and equity-deserving groups in Environmental Science. Environmental problem-solving implicitly requires that solutions work for diverse elements of communities, and B.C. and Canada are becoming increasingly focused on reconciliation with Indigenous Peoples. We will focus on representing diverse role models in recruiting and advertising materials. Greater than 60% of current tenure-track Faculty in EVSC are women. The current number of female students enrolled in the Master of Ecological Restoration program is 66%; that program is ending in 2024, but we expect the proposed program to have similar demographics.

20) Delivery methods

The program will be delivered in-person, with admissions during all three terms of an academic year (as with other programs at SFU, such as BISC and EASC). We anticipate that admissions will happen predominantly during the Fall term, but we have kept the flexibility of admissions during all three terms to accommodate the year-round nature of environmental fieldwork. For example, for research projects that require field work in February or March, this approach allows students to get a head start on fieldwork and data collection as soon as funding is available. Students who are admitted in terms other than Fall will enroll in the required "Advanced Research Methods in Environmental Science" course during their first fall term along with the rest of their cohort. Students who begin during the Spring or Summer terms will likely be more advanced than their peers who enter during the Fall term, in terms of conceptual development of their research proposals. Furthermore, the frontloading of technical skills in close collaboration with their research supervisor during the previous term(s) will have the benefit of providing them with concrete examples of why they need theory.

The thesis represents original, hands-on research, and this work has the flexibility to be computationally-based, laboratory-based, or field-based, or a combination of these modes. Students are expected to complete their degree in 12 terms, during which they will complete a research methods course (3 units), an elective selected by the student and their supervisor (3 units), attend the Environmental Science seminar series (1 unit), complete a candidacy exam and PhD research proposal (0 units), and PhD thesis research until program completion (18 units).

Collectively, the two required courses (i.e. "Research Methods in Environmental Science" and "Environmental Science Seminar") will serve to develop a cohort experience for entering students. The research methods course will run in the Fall term and the seminar series will run during both the Fall and Spring terms. Currently, EVSC hosts a successful seminar series which will become a required course and a source of cohesion and cohort-building opportunities for the program. As part of the Environmental Science Seminar course, students will develop focused reviews of each seminar to cement their active learning across the wide range of topics emphasized in the seminars.

Students complete the candidacy exam prior to the end of the fourth term of enrollment, which consists of a public presentation showcasing their proposed research, followed by questions from the public and then closed-door questioning from the students' supervisorial committee and an arms-length external examiner. The purpose of the closed-door questioning is to assess the student's depth of knowledge regarding their proposed research and their ability to defend the

proposed research. The completed thesis has a public examination and serves as the culmination of the program.

21) Eligibility for scholarships, awards, and financial aid

Students are eligible for all awards funded through the university's operating budget and adjudicated by the Senate Graduate Awards Adjudication Committee. These include Entrance Scholarships and Graduate Fellowships, as well as SFU and SCA Endowed and Private Awards. Additionally, all research students will receive the SFU PhD Research Scholarship, which is awarded annually for four years from the start of the program. Students will also be eligible for Teaching Assistantships, as well as Research Assistantships and graduate stipends funded through Faculty research grants. Students are also encouraged to apply to external fellowships, such as NSERC CGS-M, PGS-D, and CGS-D for students who are Canadian citizens or Permanent Residents. Furthermore, EVSC's Graduate Program Development Committee and the School's Program Assistant are responsible for developing and maintaining guaranteed funding guidelines consistent with SFU's policy on guaranteed minimum funding (SFU Graduate General Regulation 1.17). All Faculty Members in EVSC are responsible for meeting the minimum funding guarantee.

Last, students admitted to the program can make use of SFU's financial aid program.

22) Does the proposed program offer an alternative exit, if appropriate?

No.

23) Resources required and/or available to implement the program

The proposed PhD program in Environmental Science will need the following resources to be available:

- Utilize current Faculty Members to teach the required and breadth courses in the program. The program currently has 2 full professors, 1 associate member, and 4 assistant professors with active research programs who are affiliated with the EVSC program, and who are available to teach the required and breadth courses. All courses in this program except for EVSC 608 have been previously developed in support of delivering the dissolved Master of Ecological Restoration program (program dissolved as of the end of Spring term 2024). Furthermore, the framework for EVSC 608 is already in place through the well-established EVSC Seminar Series. We do not foresee the need to hire additional Faculty over the next 2-3 years;
- Utilize existing administrative processes in place that were developed to administer the MSc in Ecological Restoration. These include processes to: (a) advertise the program to potential students; (b) review graduate applications, prepare short lists and communicate decisions to applicants; (c) advertise scholarships and others forms of funding, review scholarships applicants, prepare short lists and communicate decisions; (d) help students navigate graduation paperwork and filings, etc.;
- Utilize existing graduate level courses within EVSC to support delivery of the required and elective courses within program. The proposed, required research methods course (EVSC 801) will run together with the Research Methods course proposed under the MSc program (EVSC 601) and be taught by the same instructor. The required EVSC Seminar Series

(EVSC 608) has also been proposed under the MSc program. Other EVSC courses will serve as possible electives: EVSC 645 (Environmental Data Analysis), EVSC 660 (Ecogeomorphology), EVSC 691 (Directed Studies), EVSC 695 (Special Topics), as well as EVSC 610 (Advanced River Restoration). This last course was proposed under the MSc program.

- Encourage students to take advantage of elective courses offered by other graduate programs (e.g., BISC, GEOG, REM, EASC, and STAT) to support their individualized research program and fulfill their elective course requirements.
- It is important to note that all faculty within EVSC already supervise full laboratories of graduate students and postdoctoral researchers in other programs, and therefore their workloads will not change substantially through the establishment of the EVSC program. If anything, the benefit of establishing the EVSC program will be to centralize and simplify management of environmental science graduate students and their research within a unified program.

EVSC presently does not receive Base Allocation Support for Students (BASS) funding from SFU's Graduate Studies. As a result, the proposed PhD program will require BASS funding to help support graduate students in the program, in addition to other potential funding sources such as through Teachings Assistantships, MITACS, NSERC, and other available scholarship funds.

We do not anticipate the need for teaching assistants in administering the taught courses in the proposed graduate program. We do not anticipate the need to hire any additional administrative staff to support the program and will rely on current staff members in EVSC for program administration. The program has been designed to minimize impacts on other units within the Faculty of Environment and to work as much as possible within the constraints of the existing school. The proposed PhD program in Environmental Science will not eliminate or impact other PhD programs in the Faculty of Environment, but rather will complement the existing PhD in Physical Geography by expanding and enhancing the breadth of environmental science pursued and accomplished within the Faculty of Environment (see response to Question 12, above).

Teaching in the proposed PhD program in Environmental Science will not impact teaching loads in other units because the complement of Faculty in EVSC will teach courses that can satisfy the requirements of the program and may benefit other programs by offering courses that students in other units may take to satisfy their respective course work requirements. Students in the proposed program will likely take courses within other units. However, this is not seen as an impact, but rather a benefit as it will build an overall stronger community of environmental scientists at SFU by exposing students to a greater diversity of thought and scholarship, offering opportunities to build new collaborations and joint research pursuits.

24) Program evaluation and academic/administrative oversight

The proposed program will be governed by the EVSC School Committee and EVSC's Graduate Program Development Committee. The EVSC School Committee holds approximately 5-6 meetings (once per month) during the Fall and Spring terms of the academic year, with additional meetings as necessary. The Graduate Program Development Committee consists of a minimum of three continuing Faculty Members from EVSC, to handle program development and administration (please see Appendix 5 for more details regarding the Graduate Program

Committee, which was voted on and approved by EVSC faculty as part of the EVSC Governance document). This committee will conduct reviews of the program curriculum every 3 years.

As with other academic departments at Simon Fraser University, EVSC is subject to an external review approximately once every seven years. This review process involves evaluating the academic planning, strengths, and weaknesses of the School while also obtaining feedback from experts in the field of Environmental Science who are external to SFU. The new proposed PhD degree program would be reviewed as part of this process. On an annual basis, EVSC currently holds an annual Town Hall meeting to gather feedback from undergraduate students and plans to establish a similar model for the graduate program.

25) Faculty Members' teaching/supervision

The proposed program is a mentorship-based research program which draws upon the expertise of Faculty housed directly within EVSC (Table 2). As such, EVSC Faculty Members will teach the required graduate courses and act as primary supervisors for PhD students. The current complement of EVSC Faculty consists of 2 full professors (1 fully appointed, 1 cross-appointed), 1 associate professor (cross-appointed), 4 assistant professors (1 cross-appointed), and 1 lecturer (cross-appointed). Areas of specialization include water and watershed science, geomorphology, climate change, paleoceanography and paleoclimatology, coastal carbon cycling, marine science, ecological restoration, community and landscape ecology and evolution, soil science, post-wildfire landscape evolution, and environmental fluid dynamics.

The current complement of Faculty represents the minimum number of Faculty required to deliver the proposed program. If and when additional Faculty hires are made to the program, they will be targeted to address crucial aspects of quantitative environmental data analysis as well as complementary expertise in environmental science that addresses physical, chemical, and biological processes across the land-ocean aquatic continuum. The current complement of faculty already presents sufficient overlap to accommodate the teaching of required EVSC courses. Additionally, supervisors are all required to establish workplans with their graduate students prior to study and administrative leaves.

Table 2. Faculty Members with teaching/supervision responsibilities within EVSC.

Dr. Shawn Chartrand Assistant Professor, EVSC Area of expertise: Water Science, River geomorphology, Arctic landscape evolution, River restoration Courses*: EVSC 601, 608, 610, 691, 695	Dr. Ruth Joy Assistant Professor, EVSC Area of expertise: Quantitative environmental data analysis, Ecological restoration, marine science Courses*: EVSC 601, 608, 645, 691, 695
Dr. Karen Kohfeld Director and Professor, EVSC & REM Area of expertise: Climate change, Carbon cycling, Oceanography, Paleoceanography Paleoclimatology Courses*: EVSC 601, 608, 691, 695	Dr. Chelsea Little Assistant Professor, EVSC & REM Area of expertise: Biological watershed science, ecosystem ecology, community Ecology Courses*: EVSC 601, 608, 691, 695

Dr. Brendan Murphy Assistant Professor, EVSC Area of expertise: Physical watershed science, post-wildfire landscape evolution, physical and coupled ecological dynamics of river systems. Courses*: EVSC 601, 608, 660, 691, 695	Dr. Margaret Schmidt Associate Professor, EVSC & Department of Geography Area of expertise: Soil Science Courses*: EVSC 601, 608, 691, 695
Dr. Jeremy Venditti Professor, EVSC Area of expertise: Water Science, Environmental fluid dynamics, River geomorphology, Landscape evolution Courses*: EVSC 601, 608, 691, 695	**Note:** EVSC 645, 660, 691, and 695 are currently being offered in EVSC to graduate students housed in other programs and are on SFU's academic calendar; these are not new courses. Therefore, course proposal forms for these are not included in this FPP package as they have already passed Senate.

*We have listed all courses that faculty could potentially teach, in case the primary instructor goes on study leave.

EVSC has a growing cohort of Adjunct Faculty that already contributes to supervision of graduate students and post-doctoral fellows at SFU, including Craig Orr (Ecological Restoration), Ray Kostaschuk (River Geomorphology), Ryan Bradley (Water Science), Arvind Saraswat (Air Quality), Harald Yurk (Marine Sciences), Leonard Sklar (Water Science), Scott Williamson (Circumpolar Environments), Erika Eliason (Zoology), and Eric Deal (Geomorphology). These individuals are expected to contribute as co-supervisors and supervisory committee members for our PhD students.

26) Is the program focus primarily on meeting social benefit(s) or economic benefit(s)?

Graduates of the proposed PhD program will benefit the Canadian social and economic systems equally because Environmental Science sits at the interface between, and interconnects economic growth, environmental protection and resilience, and human well-being. Environmental Science concerns issues such as biodiversity, the global ecosystem, and climate change (Figure 3) [9], and these issues set the context for how the natural world and human actions interact to affect people, human health, and society in general. For example, in the present-day world focused on confronting the challenges of anthropogenic climate change, environmental protection and management is a means to foster resilience for nature and ecosystems, while helping to clarify how industry and business can integrate environmental policies and laws into their plans for growth and new business development. Environmental Science informs these policies and laws and thus plays a critically important role in the economic health of Canadian society, as well as the health of Canadian residents and citizens.

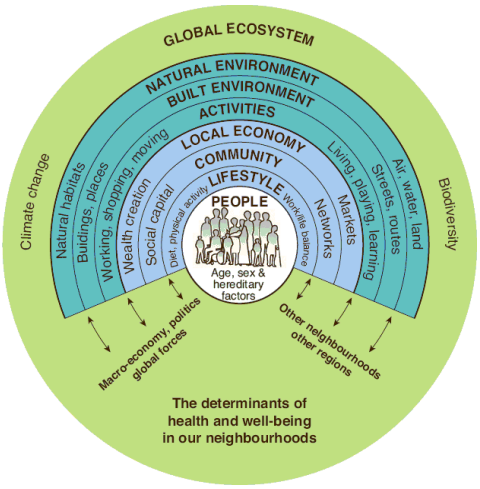

Figure 3. Determinants of health and well-being in our neighbourhoods [9].

27) How would the proposed program advance social goods or government priorities?

The proposed PhD program in Environmental Science will support government priorities from the Municipal to the Provincial and Federal levels in many ways. For example, the 2023 Provincial Budget Strategic Plan [7] for British Columbia details five priorities that the appropriations are built to address [8]. The fifth of these priorities is summarized as: "Fighting climate change and building a sustainable and secure economy that works for everyone" [7][8].

Provincial expenditure estimates for 2023 are set at approximately $255 million for the Ministry of Environment and Climate Change Strategy, and includes programs such as: Environmental Protection, Climate Action, and Clean B.C. Program for Industry. The proposed PhD program in Environmental Science aligns with these programs under the Provincial Climate Change and Sustainability Priority. In particular, B.C. aims to envision and implement climate change adaptation strategies that continue to enable a growing economy, and one that is more secure in the context of multiple challenges that climate change brings to everyday life and business functionality and operations. The need for such preparedness was made quite clear in the aftermath of the 2021 B.C. floods when the transportation network across southern B.C. was severely debilitated, agriculture was brought to a standstill with significant loss and destruction, and supply chains were disrupted because of an inability to transport goods.

Earth and environmental scientists were some of the first responders sent into the field in the aftermath of the floods to help Provincial and Municipal governments understand real-time risks to people and infrastructure, to identify pathways to restore services, and to begin planning to address the most critically pressing emergencies and broader issues. Graduates from our program will have the skills to directly engage during similar future disasters, and also to help meet the need for an additional forecasted roughly 10,000 newly trained professional scientists and supporting roles to help B.C. meet their Clean Economy goals [5], as well as those of the present strategic planning [7][8]. Our graduates will form part of the bridge between Government, Society, Business, and the Environment, making it possible to realize a future that understands the real risks and challenges that climate change will continue to bring.

28) What social, cultural, regional, community, environmental, institutional and/or intellectual benefit would the proposed program provide?

The United Nations has declared the period 2021-2030 as the Decade on Ecosystem Restoration [12]. A primary goal is to raise global awareness for the importance of a functioning natural world, and to highlight restoration leaders from around the world who are making a difference. This includes efforts to set aside land as protected natural preserves, as the B.C. Government has done in association with First Nations to protect Incomappleux Valley southeast of Revelstoke.

Recent graduates of the former SFU/BCIT Master in Ecological Restoration program of SFU are playing a direct role to help preserve and protect ecosystems in the Vancouver Metro region by working directly with and for environmental non-governmental agencies, ecological consulting firms, and First Nations to plan and implement strategies that place ecosystem restoration and protection on par with economic development and growth—a necessary step to realize a sustainable future for the region. For example, three students of the Master in Ecological Restoration program now work for the kʷikʷəƛ̓əm (Kwikwetlem) First Nation in their consultation office. The students prioritize consultation requests and prepare recommended actions for band council to consider in making decisions regarding land uses on the Nation's unceded lands, and suitable compensatory mitigation to improve target ecosystems functions in response to land conversion. These involvements directly benefit First Nations and the local economy and foster the continued growth of regional ecosystem protection and restoration. Graduates of the proposed PhD program in Environmental Sciences will develop a similar base of knowledge, research, and environmental problem-solving skills to continue these important efforts. They will work with the same Faculty who mentored these prior students and build upon existing relationships and long-term research programs designed to support informed land and water stewardship. These graduates will have the opportunity to take part in the development of meaningful relationships with Indigenous groups and land owners to facilitate mutually beneficial and coordinated local and regional environmental planning within terrestrial, coastal and marine settings.

29) How would the proposed program support economic growth and/or government economic priorities?

The Province of B.C. surveyed public participants during an economic planning meeting, and the poll shows that B.C. residents believe, among other things, that addressing the Climate Emergency, Upholding and Strengthening Environmental and Social Standards, and Modernizing Value-added Natural Resources are keys to B.C.'s economic future (Figure 4) [8]. The Province responded to the people's voices by developing an economic plan which prioritizes Clean Growth stating that "Modernizing our forest sector will ensure forestry remains a source of good jobs and economic security for communities across B.C." [8], and "Tackling the climate emergency is driving economic innovation and new clean jobs" [8].

The proposed PhD program in Environmental Science will contribute to the collective efforts to address the goals and ideals of B.C. residents, as well as the economic priorities of the Province. Addressing the Climate Emergency will require broadly trained Environmental Scientists that can help plan for regional and provincial resilience and adaptation due to the effects of the changing climate, including new policy mechanisms to better protect fragile natural ecosystems and species, and envisioning bold environmental restoration programs to preserve coastal habitats which afford storm protections to nearby residents and infrastructure, as well as critically important habitat for

countless marine and terrestrial species. Providing a vibrant economic future for B.C. will require that environmental protections and climate change planning occur in close coordination with industry and government so protective and effective growth- oriented policies can be outlined which also offer clear pathways to meet economic goals. This will require post-graduate trained environmental scientists.

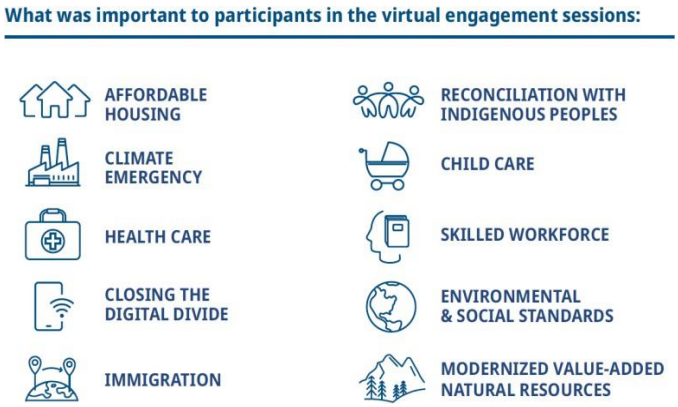

Figure 4. Infographic showing the results of what was important to participants in virtual community engagement sessions [8].

The Province also states that "Environmental, Social and Governance values (ESG) offer a tremendous opportunity for B.C. companies to showcase their advantages" [8] This point highlights what we raise above with respect to close coordination between environmental planning and economic growth, underscoring the need for broadly trained environmental scientists that can fill many different positions in the private and public sectors in the coming decades. In fact, the Labour Market Outlook 2022 forecasts that the Province will fill roughly 140,000 new jobs in the Professional, Scientific and Technical Services sectors through 2032 (Figure 4) [8]. This is the second-largest jobs category in the job market forecast, and further underscores the need for post-secondary and post-graduate trained Environmental Scientists. Specifically, the B.C. Labour Market Outlook 2022 indicates that roughly 13,000 of the 140,000 jobs will be focused on the environmental sector (Figure 5) [8]. Our proposed program will effectively support this need by adding highly-qualified and trained scientists to the labour pool.

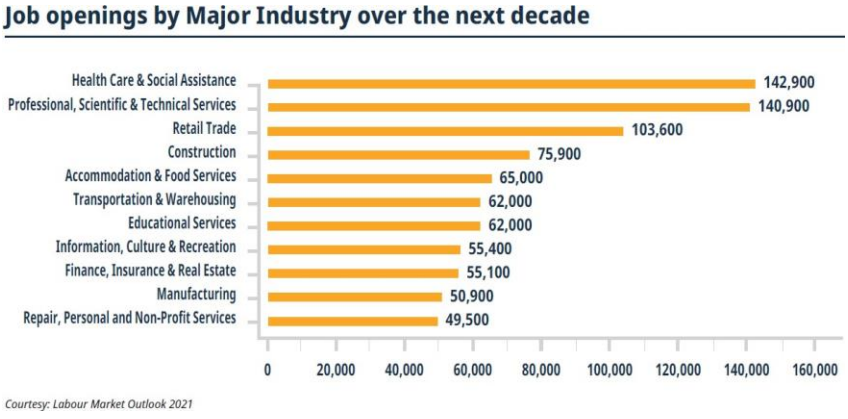

Figure 5. Infographic showing job openings by major industry between 2023-2032 [8].

Lastly, the Province states that "British Columbians agree natural resources are an enormous economic advantage. We also share a deep commitment to bold and immediate action to tackle the climate crisis" [8]. Our proposed program will work to train scientists who have a "deep commitment to [taking] bold and immediate action to tackle the climate crisis" which will help the economy because our natural resources also attract many businesses who wish to work here and we are training people to take action against climate change. Clean growth is one of two challenges the B.C. government is prioritizing with their economic plan, and they say that investing in and working towards clean growth is an opportunity "for British Columbia to lead in shaping tomorrow's high-skill, competitive, low-carbon economy" [8]. EVSC can directly contribute to all of the above economic goals and social priorities through our existing research programs that emphasize (a) better understanding of the influence of shipping traffic to marine mammals in order to develop more protective policies and industry practices, (b) better understanding of hazards associated with forest fire, and related impacts to aquatic species due to downstream effects cascades, (c) better understanding of the role of landslides and rockfalls on the migration behaviour and success of Pacific Salmon, which can have significant impacts to local and regional livelihoods, as well as the fabric of cultural identity for Indigenous Peoples of B.C., (d) better understanding of how carbon is stored and cycled in coastal marine environments with new knowledge leveraged to plan more resilient and climate-aware environmental restoration programs, and (e) better understanding of how climate change is influencing landscape change in the Arctic, with important implications for near-shore water quality and habitat conditions, as well as identifying future hazards related to locations more likely to change abruptly. Our contributions will only grow through the proposed PhD program and our impact will be strengthened.

30) What direct and/or indirect economic, industrial or labour market benefits would the program offer the student, community, region or province?

Related to B.C.'s economic vision for Clean Growth [8], the Province is in the process of developing an integrated set of bold environmental plans for marine and terrestrial environments: the Coastal Marine Strategy, the B.C. Wild Salmon Strategy [10] and the Watershed Security Strategy (Figure 6) [13]. Combined, these comprehensive plans provide a framework for collaborative and shared responsibility with Indigenous Peoples regarding proactive management and care for coastal ecosystems, watersheds and the salmon which depend on both for their life cycles.

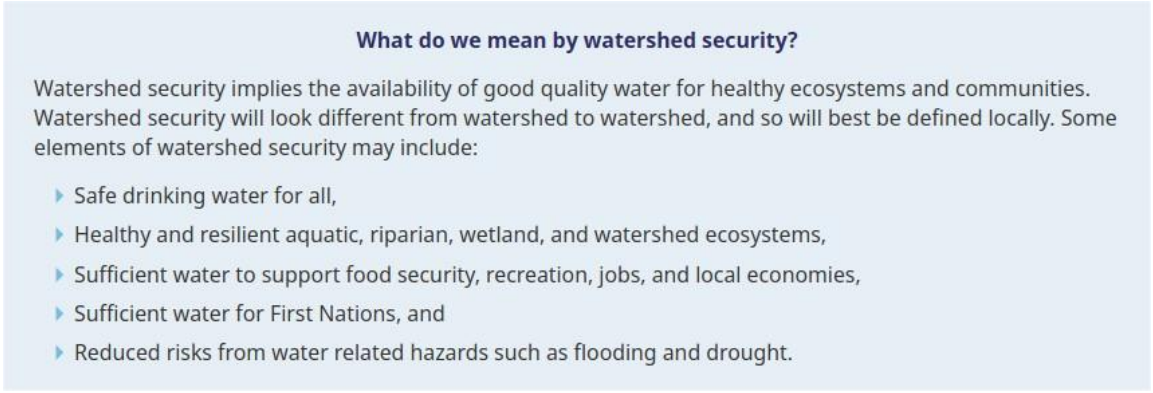

Figure 6. Definition of "watershed security" according to the B.C. Watershed Security Strategy [13].

Specifically, the Province stated "Maintaining healthy watersheds is vital to ensure that good-quality water is available to support ecosystems, economies, cultures and communities throughout British Columbia. Healthy watersheds are also important for reducing the risks and effects of floods, droughts and wildfires, and for increasing protection against such events in a changing climate.", and "Integrating the watershed security strategy with B.C.'s Wild Salmon Strategy and its first-ever coastal marine strategy will address how B.C. stewards the ecosystems that species, such as wild salmon, rely upon." [10]

As noted for the labour outlook published in 2022, the Province will fill roughly 13,000 jobs over the next decade in the environmental sector, which will require a strong supply of trained post-secondary and post-graduate Environmental Scientists. Our proposed program will directly address this need at the post-graduate level by producing scientists trained in marine mammal protection, coastal processes and restoration planning, watershed ecology and science, fire science, river geomorphology and integrated salmon science, and Arctic landscape response to climate change. Graduates of our previous Master of Ecological Restoration program have gone on to jobs that directly address the need for trained environmental scientists in B.C. (Figures 2 and 5), taking on employment with First Nations, private consulting firms, government agencies and not-for-profit environmental organizations. Some of our graduates are already directly addressing the idea of watershed security as proposed by B.C. (Figure 6) [13], working on issues related to environmental flows and water security for rivers and salmon.

We will build upon these direct economic and workforce successes with our proposed PhD program in Environmental Science and will contribute directly to the Province's vision for more impactful stewardship of marine and terrestrial ecosystems, and the transition to a clean economic landscape. Moreover, the impact of our program will be central to the Metro Vancouver region as many of our students are expected to be local, and therefore are anticipated to go on to support the local economy and environmental sector. This will help to better position B.C. and the Metro Vancouver region to continue to be a leader in the Pacific Northwest region.

Combined, this will help position B.C. to compete and win in a global economy that puts a premium on responsible integration of economic and environmental plans and visions. As stated by Kelly Greene, Parliamentary Secretary for Fisheries and Aquaculture, "We have shared values as coastal peoples, and we are working to protect what matters to us all. One of the most unifying calls through this engagement has been to prioritize wild salmon restoration and other important wild fish populations. It is important to bring those shared values to the forefront in building a sustainable marine and coastal economy for all British Columbians." [10]

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Appendices

Appendix 1 Calendar entry

Appendix 2 New courses

1. EVSC 801 – Advanced Research Methods in Environmental Science (3 units)
2. EVSC 896 – PhD Candidacy Exam (0 units)
3. EVSC 898 – PhD Thesis (18 units)

Appendix 3 Letters of support

Academic Departments

1. Dr. Brian Starzomski, Ian McTaggart-Cowan Professor and Director, School of Environmental Studies, University of Victoria, BC, Canada, starzom@uvic.ca
2. Dr. Doug Smith, Professor, Applied Environmental Science, California State University Monterey Bay, dosmith@csumb.edu
3. Dr. Jonathan Fink, Professor of Geology and Director Digital City Testbed Center, Portland State University, Portland, OR, USA, jon.fink@pdx.edu
4. Dr. Roger Wheate, Professor, Faculty of Environment, Coordinator, NRES Graduate program, University of Northern British Columbia, BC, Canada, roger.wheate@unbc.ca
5. Dr. Tiphaine Jeanniard du Dot, Research Scientist, Marine Predators Biology and Ecology Laboratory, CEBC-CNRS, La Rochelle Universite, France, tiphaine.jeanniard-du-dot@cebc.cnrs.fr
6. Dr. Navin Ramankutty, Professor and Canada Research Chair I in Data Science for Sustainable Global Food Systems and Director, Institute for Resources, Environment, and Sustainability, University of British Columbia, BC, Canada, navin.ramankutty@ubc.ca

Government

7. Angela Crampton, Environmental Coordinator, Environment and Parks, City of Port Moody, BC, Canada
8. David Ranson, Executive Director, Provincial Services Branch, Conservation and Recreation Division, BC Ministry of Environment and Climate Change Strategy, Victoria, BC
9. Dr. Amy E East, U.S. Geological Survey, Santa Cruz, CA, USA.
10. Dr Greg McClelland, Senior Wildlife Biologist, Canadian Wildlife Service, Environment and Climate Change Canada, Gregory.mcclelland@ec.gc.ca
11. Dr. Sheila J. Thornton, Research Scientist, Marine Mammal Conservation Physiology Program, Pacific Science Enterprise Centre, Fisheries and Oceans Canada

First Nations

12. Christa Williams, Lands and Resources Director, kʷikʷəƛ̓əm (Kwikwetlem) First Nation

Non-Governmental Organizations

13. Caitlin Pierzchalski, Executive Director, Project Watershed, Comox Valley, BC, Caitlin.pierzchalski@projectwatershed.ca

14. Dan Straker, Project Manager, Resilient Waters, MakeWay Charitable Society, Vancouver, BC, CANADA, dan@resilientwaters.ca
15. Edith Tobe (Executive Director) and Francesca Knight (President), Squamish River Watershed Society, Squamish, BC, Canada, srws@shaw.ca
16. Dr. Martin Wale, Saturna Island Marine Research and Education Society (SIMRES), Saturna Island, BC, Canada

Potential Private Sector Employers

17. Azadeh Gheibi, Field Biologist, Keystone Environmental Ltd, Burnaby, BC, Canada
18. Varsha Rani, Field Biologist, Keystone Environmental Ltd, Burnaby, BC, Canada
19. Karlene Loudon, Principal Consultant and Biologist, CoastRange Environmental Ltd, Squamish, BC, Canada

Appendix 4 Memo from the library

Appendix 5 Details of program steering committee

EVSC Steering Committee

1. Dr. Karen Kohfeld, Professor and Department Chair, EVSC
2. Dr. Shawn Chartrand, Assistant Professor, EVSC
3. Dr. Brendan Murphy, Assistant Professor, EVSC
4. Dr. Jeremy Venditti, Professor, EVSC

Appendix 6 Abbreviated curriculum vitae for faculty

1. Dr. Tara Holland, Lecturer, Department of Geography, EVSC
2. Dr. Ruth Joy, Assistant Professor, EVSC
3. Dr. Chelsea Little, Assistant Professor, EVSC and REM
4. Dr. Margaret Schmidt, Associate Professor, Department of Geography and EVSC

Appendix 7 Budget for the proposed program (financial and personnel)

Appendix 8 Sample Environmental Position Job Postings and Career ads

These are positions for which current graduate students supervised by EVSC faculty members have applied:

1. Department of Fisheries and Oceans: "*For a research position, you'll need a doctorate (Ph.D.) in a specialized scientific discipline*" (pg. 4)
2. DHI Group: "*Over 80% of DHI people have a master's or PhD degree, and several of our colleagues at the Danish DHI offices also teach at DTU"* (pg.1)
3. Essa Technologies Ltd.: "*You possess or are about to complete a Master's or PhD degree in environmental sciences, climate sciences, earth science, ecology, biology, resource management"* (pg. 3)
4. NumerixS Quant Team: "*Mandatory: PhD. In mathematics, physics or related fields in quantitative disciplines with a Masters in the hard sciences (including if you will be graduating with a PhD within the next 12 months)"* (pg. 1)
5. Ocean Associates Inc.: *"PhD degree from an accredited college or university with a major directly related in a field of study as related to the requirements of this position with*

emphasis in marine science, fisheries, quantitative ecology, oceanography, data science, or similar fields; or, equivalent relevant experience" (pg. 5)

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 1: Calendar Entry

March 6, 2024

School of Environmental Science

Faculty of Environment

Environmental Science

Doctor of Philosophy

Description of Program

The Doctor of Philosophy (PhD) degree in the School of Environmental Science at Simon Fraser University provides rigorous training in interdisciplinary environmental problem-solving. The Doctor of Philosophy degree combines coursework with independent research at the intersection of traditional scientific disciplines, preparing students for a broad range of careers in environmental fields.

Admission Requirements

Applicants must satisfy the university admission requirements as stated in Graduate General Regulations 1.3 in the SFU Calendar. A master's degree in environmental science, or the equivalent, is required.

Program Requirements

The program consists of minimum 7 units of course work and a thesis (18 units). Student may be required to complete additional course work at the discretion of the supervisory committee.

Students must complete:

EVSC 801 Advanced Research Methods and Design in Environmental Science (3),

EVSC 608 Environmental Science Seminar

EVSC 896 Doctoral Candidacy Exam

And one graduate elective course (3 units minimum, chosen in consultation with student's supervisor),

And a thesis

EVSC 898 – PhD Thesis (18).

Program Length

Students are expected to complete the program requirements within twelve terms.

Other information.

Thesis

The program requires the submission and successful defence of a thesis.

Academic Requirements within the Graduate General Regulations

All graduate students must satisfy the academic requirements that are specified in the Graduate General Regulations, as well as the specific requirements for the program in which they are enrolled.

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 2: New Courses

March 6, 2024

School of Environmental Science

Faculty of Environment

SFU GRADUATE STUDIES

NEW GRADUATE COURSE PROPOSAL

Course Subject (eg. PSYC) EVSC	**Number** (eg. 810) 801	**Units** (eg. 4) 3

Course title (max. 100 characters) Advanced Research Methods in Environmental Science

Short title (for enrollment/transcript - max 30 characters) Advanced Research Methods

Course description for SFU Calendar *(course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description. Max. 50 words)

An examination into the general philosophical foundations of science, the nature of scientific disputes, and the relevance of these to Environmental Science. Students will lead critical reading discussions and they will prepare a draft research proposal outlining two -three questions they intend to examine in their research.

Rationale for introduction of this course

This course provides an overview of research methods commonly used in the Environmental Sciences, including guided development of research proposal that will be used to meet the program requirements of MSc students

Term of initial offering (eg. Fall 2019) Fall 2025	**Course delivery** (eg 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year every term	**Estimated enrollment per offering** 8

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

none

Prerequisite and/or Corequisite

none

Criminal record check required? ☐ Yes (if yes is selected, add this as prerequisite) | **Additional course fees?** ☐ Yes ☑ No

Campus where course will be taught ☑ Burnaby ☐ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components* ☑ Lecture ☐ Seminar ☐ Lab ☐ Research ☐ Practicum ☐ Online ☐ Other: _____

Grading Basis ☑ Letter grades ☐ Satisfactory or Unsatisfactory ☐ In Progress/Complete

Repeat for credit? ☐ Yes ☑ No	**Total repeats allowed?** 0	**Capstone course?** ☐ Yes ☑ No
Required course? ☑ Yes ☐ No	**Final exam required?** ☐ Yes ☑ No	**Repeat within a term?** ☐ Yes ☑ No

Combined with an undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and what the additional course requirements are for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Dr. Karen Kohfeld, Dr. Jeremy Venditti, Dr. Shawn Chartrand
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

~~Academic Unit / Program~~	~~Name (typically, Graduate Program Chair)~~	
School of Environmental Science	Karen Kohfeld	**Email** ses_director@sfu.ca

ACADEMIC UNIT APPROVAL

☒ A course outline / syllabus is included

Non-departmentalized faculties need not sign

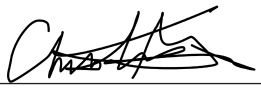
Department Graduate Program Committee Shawn Chartrand	**Signature** 	**Date** February 27, 2024
Department Chair Karen Kohfeld	**Signature** 	**Date** February 27, 2024

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee (FGSC) Christina Giovas	**Signature** 	**Date** March 6, 2024

A library review will be conducted. If additional funds are necessary, Graduate Studies will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee (SGSC) Mary O'Brien	**Signature** 	**Date** April 22, 2024

ADMINISTRATIVE SECTION (for Graduate Studies office only)

Course Attribute: _____
Course Attribute Value: _____
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: _____
Financial Aid Progress Units: _____

Course Outline - EVSC 801 – Advanced Research Methods in Environmental Science

Calendar Objective/Description

An examination into the general philosophical foundations of science, the nature of scientific disputes, and the relevance of these to Environmental Science. Topics covered include the following fundamental concepts: science, the scientific method, reliable knowledge, poor science, hypothetical-deductive approach, hypothesis testing and research design, and multiple knowledge systems. Students will lead critical reading discussions on these class topics, they will prepare prepare a mid-term paper detailing research methods applied to their area of scholarly work, and they will prepare a draft research proposal outlining two -three questions they intend to examine in their research.

Course Details:

The application of research methods and design in Environmental Science is based on a common starting point: the identification of research questions, developed from observations made of natural phenomena, from trial experiments or field data collections efforts, or through analysis of existing data. Within this overall context, we will explore and learn about the nature of scientific research, how to learn to think critically about science and research contributions, how to formulate and communicate your thoughts and ideas both verbally and through writing, and how these topics connect with real world environmental problems. We will advance through these themes with selected readings, discussion and assignments, and doctoral students in this class will be responsible for leading classroom discussions on some of the selected readings.

The course will involve development of a midterm paper that explores research methods used within the student's area of study and culminate in the development of a PhD research proposal that can be used to meet program requirements for the PhD in Environmental Science

Course Level Education Goals:

After successfully completing this course, students can:

1. Lead a classroom discussion on a topic relevant to this course, including the development of a research question, establishment of a research and data management plan, or data analysis technique.
2. Explain what science is and is not. Explain the basics of the scientific method, where it can lead us, and where it cannot lead us.
3. Explain and implement one way to develop focused research questions.
4. Understand and explain the different and most common methods used to conduct science. Elaborate on the most important methods used to design experiments in the student's area of expertise.
5. Conduct an experiment and draw basic conclusions, placing the results in the proper statistical context.
6. Explain the components of a research design and data management plan.
7. Understand how to critically evaluate scientific contributions, and how to identify existing knowledge gaps. Understand how to document and summarize review of scientific contributions, to explain the work to your colleagues.

Grading:

- Class Engagement Quizzes: 10%
- Leading paper discussions – 10%
- Class Participation and Paper Summaries: 15%
- Mid-term exam: 15%
- Mid-term paper, focused on research methodologies: 15%
- Final Project - Draft Research Proposal, elaborating 2-3 research questions: 35%

Note: The draft proposal will need to be commensurate with the expectations of a doctoral degree, framed around several research questions which are addressed within appropriate chapters of the students' dissertations.

Pre-requisites:

N/A

Textbook and Reading:

Readings provided by the instructor.

SFU GRADUATE STUDIES

NEW GRADUATE COURSE PROPOSAL

Course Subject (eg. PSYC) EVSC	**Number** (eg. 810) 896	**Units** (eg. 4) 0

Course title (max. 100 characters) PhD Candidacy Exam

Short title (for enrollment/transcript - max 30 characters) PhD Candidacy Exam

Course description for SFU Calendar *(course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description. Max. 50 words)

An examination into the general philosophical foundations of science, the nature of scientific disputes, and the relevance of these to Environmental Science. Topics covered include the following fundamental concepts: science, the scientific method, reliable knowledge, poor science, hypothetical-deductive approach, hypothesis testing and research design, and multiple knowledge systems. Graded on a satisfactory/unsatisfactory basis.

Rationale for introduction of this course

Students will complete a candidacy exam in order to advance to PhD candidate status which is required to conduct the proposed research. This exam will evaluate the students ability to defend their proposed PhD research, and demonstrate adequate knowledge on the specific topics and subjects of their proposed research.

Term of initial offering (eg. Fall 2019) Fall 2025	**Course delivery** (eg 3 hrs/week for 13 weeks) n/a
Frequency of offerings/year Every term	**Estimated enrollment per offering** 2

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

None

Prerequisite and/or Corequisite

None

Criminal record check required? ☐ Yes (if yes is selected, add this as prerequisite) **Additional course fees?** ☐ Yes ☒ No

Campus where course will be taught ☒ Burnaby ☐ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components* ☐ Lecture ☐ Seminar ☐ Lab ☐ Research ☐ Practicum ☐ Online ☒ Other: Independent

Grading Basis ☐ Letter grades ☒ Satisfactory or Unsatisfactory ☐ In Progress/Complete

Repeat for credit? ☒ Yes ☐ No	**Total repeats allowed?** 1	**Capstone course?** ☐ Yes ☒ No
Required course? ☒ Yes ☐ No	**Final exam required?** ☐ Yes ☒ No	**Repeat within a term?** ☐ Yes ☒ No

Combined with an undergrad course? ☐ Yes ☒ No If yes, identify which undergraduate course and what the additional course requirements are for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course
Faculty of EVSC for their own graduate students: Drs. Kohfeld, Venditti, Murphy, Chartrand, Joy, Little, Schmidt, others.
Additional faculty members, space, and/or specialized equipment required in order to offer this course
None

CONTACT PERSON

Academic Unit / Program	**Name (typically, Graduate Program Chair)**	**Email**
School of Environmental Science	Karen Kohfeld	ses_director@sfu.ca

ACADEMIC UNIT APPROVAL

☐ A course outline / syllabus is included

Non-departmentalized faculties need not sign

Department Graduate Program Committee Shawn Chartrand	**Signature** 	**Date** February 27, 2024
Department Chair Karen Kohfeld	**Signature** 	**Date** February 27, 2024

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

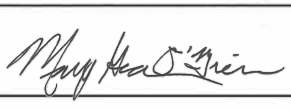
overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee (FGSC) Christina Giovas	**Signature** 	**Date** March 6, 2024

A library review will be conducted. If additional funds are necessary, Graduate Studies will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee (SGSC) Mary O'Brien	**Signature** 	**Date** April 22, 2024

ADMINISTRATIVE SECTION (for Graduate Studies office only)

Course Attribute: _____
Course Attribute Value: _____
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: 6
Financial Aid Progress Units: 6

SFU GRADUATE STUDIES

NEW GRADUATE COURSE PROPOSAL

Course Subject (eg. PSYC) EVSC	**Number** (eg. 810) 898	**Units** (eg. 4) 18

Course title (max. 100 characters) PhD Thesis

Short title (for enrollment/transcript - max 30 characters) PhD Thesis

Course description for SFU Calendar *(course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description. Max. 50 words)

An examination into the general philosophical foundations of science, the nature of scientific disputes, and the relevance of these to Environmental Science. Topics covered include the following fundamental concepts: science, the scientific method, reliable knowledge, poor science, hypothetical-deductive approach, hypothesis testing and research design, and multiple knowledge systems. Graded on a satisfactory/unsatisfactory basis.

Rationale for introduction of this course

This course provides credit for independent research undertaken towards a doctoral degree, and is required for the PhD program.

Term of initial offering (eg. Fall 2019) Fall 2025	**Course delivery** (eg 3 hrs/week for 13 weeks) n/a
Frequency of offerings/year Every term	**Estimated enrollment per offering** 2

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

None

Prerequisite and/or Corequisite

None

Criminal record check required? ☐ Yes (if yes is selected, add this as prerequisite) **Additional course fees?** ☐ Yes ☒ No

Campus where course will be taught ☒ Burnaby ☐ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components* ☐ Lecture ☐ Seminar ☐ Lab ☐ Research ☐ Practicum ☐ Online ☒ Other: Independent

Grading Basis ☐ Letter grades ☒ Satisfactory or Unsatisfactory ☐ In Progress/Complete

Repeat for credit? ☐ Yes ☒ No	**Total repeats allowed?** 0	**Capstone course?** ☒ Yes ☐ No
Required course? ☒ Yes ☐ No	**Final exam required?** ☐ Yes ☒ No	**Repeat within a term?** ☐ Yes ☒ No

Combined with an undergrad course? ☐ Yes ☒ No If yes, identify which undergraduate course and what the additional course requirements are for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course EVSC Faculty for their own graduate students: Drs. Kohfeld, Venditti, Murphy, Chartrand, Joy, Little, Schmidt, others
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program School of Environmental Science	**Name (typically, Graduate Program Chair)** Karen Kohfeld	**Email** ses_director@sfu.ca

ACADEMIC UNIT APPROVAL

☐ A course outline / syllabus is included

Non-departmentalized faculties need not sign

Department Graduate Program Committee Shawn Chartrand	**Signature**	**Date** February 27, 2024
Department Chair Karen Kohfeld	**Signature**	**Date** February 27, 2024

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee (FGSC) Christina Giovas	**Signature**	**Date** March 6, 2024

A library review will be conducted. If additional funds are necessary, Graduate Studies will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee (SGSC) Mary O'Brien	**Signature**	**Date** April 22, 2024

ADMINISTRATIVE SECTION (for Graduate Studies office only)

Course Attribute: GCAP
Course Attribute Value: THESIS
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: _____
Financial Aid Progress Units: _____

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 3: Letters of Support

School of Environmental Studies, University of Victoria
Applied Environmental Science, California State University Monterey Bay (USA)
Digital City Testbed Center, Portland State University (USA)
Faculty of Environment, University of Northern British Columbia
CEBC-CNRS, La Rochelle Université (France)
Institute for Resources, Environment, and Sustainability, University of British Columbia
City of Port Moody
BC Ministry of Environment and Climate Change Strategy
U.S. Geological Survey (USA)
Environment and Climate Change Canada
Fisheries and Oceans Canada
Kwikwetlem First Nation
Project Watershed
Resilient Waters
Squamish River Watershed Society
Saturna Island Marine Research and Education Society (SIMRES)
Keystone Environmental Ltd.
CoastRange Environmental Ltd.

March 6, 2024

School of Environmental Science

Faculty of Environment

University of Victoria
Faculty of Social Sciences | School of Environmental Studies
B243b Turpin Building PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
T 250-472-5070 | ses@uvic.ca | https://www.uvic.ca/socialsciences/environmental |

July 12, 2023

Dear curriculum committee-

It is my pleasure to send this letter in support of the new graduate program (MSc and PhD) proposed by the School of Environmental Science at Simon Fraser University. The environmental challenges the world faces require creative solutions across as many areas of expertise as possible. Demand from students for excellent training toward these solutions is exploding across North America, and in British Columbia in particular. SFU's School of Environmental Science is well-positioned to provide science-focused training for students, toward environmental solutions. This research-focused program fills a unique niche between the broader training students might receive across natural and social sciences in the University of Victoria's School of Environmental Studies, and the greater coursework of SFU's own Resource and Environmental Management group. Graduate student demand in this field is strong, and the faculty complement of the SFU School of Environmental Science has a good proposed program to meet this demand, train excellent scholars, and contribute to good research in support of environmental solutions in BC and around the world. This is likely to be a successful program in an area of great need.

If I can be of any further service, or clarify anything, please don't hesitate to contact me. All the best in your development of this program.

Sincerely,

Brian

Brian Starzomski, Ph.D.
Ian McTaggart-Cowan Professor & Director
School of Environmental Studies
University of Victoria
starzom@uvic.ca

California State University
MONTEREY BAY
Extraordinary Opportunity

Applied Environmental Science
100 Campus Center
Seaside, CA 93955-8001
831-582-4120
831-582-4122 Fax

27 October 2023
Dr. Karen Kohfeld, Director
School of Environmental Science &
School of Resource and Environmental Management
Simon Fraser University

Dear Dr. Kohfeld,

I am writing to strongly support the creation of MS and PhD programs in Environmental Science at Simon Fraser University. In 2006, I led the development of our MS in Environmental Science and have participated in program reviews for similar programs at other universities. The program at CSUMB has been very successful at building a regional workforce with the capacity to engage in the complex professional world of environmental compliance, resource management and policy. Our success is rooted in developing a robust intellectual toolbox through real-world projects. From this experiential vantage, I am confident that your programs will achieve their goals.

Your proposed programs address regional workforce needs and will serve the intellectual and professional needs of your faculty. Your emphasis on experiential learning is underscored by the 18 units (of 30 total) that will be dedicated to thesis work in the MS program and 10 terms of research for the PhD. You have the requisite interdisciplinarity in the core faculty, and an additional diverse skillset in adjunct faculty. Your faculty has strong ties with the regional academic and professional communities; this will lead to a well-greased pipeline for your students to engage in internships and to step into local careers.

You have clearly identified the external and internal needs for these graduate programs, and have established how your programs will successfully address those needs. Your proposed programs share two elements that will sustain them long into the future. Your very robust undergraduate programs will keep a steady stream of students filling your seats, and you will have upper administrative support because the programs clearly articulate with the University strategic goals.

Sincerely,

Doug Smith, Professor Douglas Smith

Jonathan Fink, Director
Digital City Testbed Center
Professor of Geology

Post Office Box 751
Portland, Oregon 97207-0751

503-725-9995 tel
503-725-5555 fax
jon.fink@pdx.edu

November 14, 2023

Professor Karen Kohfeld, Director
School of Environmental Science
Simon Fraser University
Burnaby, BC V5A 1S6

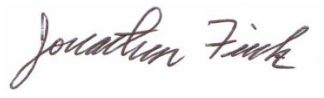
Dear Professor Kohfeld:

I'm writing in support of the proposed establishment of new environmental science graduate programs at SFU. I've read through the program descriptions and feel that the proposed programs would help fill important gaps in the supply chain of environmentally aware employees in Canada and beyond. The link to SFU's existing strengths in environmental restoration is a plus, and the highly interdisciplinary cadre of faculty builds on more than a decade of successful environmental academic innovation at SFU. The topics covered by the new degree programs respond to the interests of increasing numbers of students and the needs of government, nonprofit and corporate employers confronting the implications of accelerating climate change and the associated requirements for wiser resource extraction and public policy.

My positive assessment of these proposals comes from having been involved in many similar initiatives at Arizona State University and Portland State University. At ASU, where I was a geology professor for 27 years, I held several administrative roles, including Vice Provost and Vice President for Research and Director of the Global Institute of Sustainability, which included the world's first degree-granting School of Sustainability. I was recruited to PSU in 2010 to be their first Vice President for Research, and later served as Director of their Earth, Environment and Society PhD program, which has similarities to the PhD you are proposing. At PSU, we are now in the process of creating a new School of Climate and Society (the actual name is still TBD), which is similar to the merger that SFU underwent in 2009 (I was offered the position of Dean of the new school at SFU in 2009 but decided to take the PSU position instead). My awareness of SFU's evolution comes in part from having had a half-time position in the Research and Innovation office of UBC from 2017-2021, where I continue to hold an adjunct faculty position in the Earth, Ocean and Atmospheric Sciences Department.

Establishing the kinds of interdisciplinary programs that you are proposing can be quite challenging--administratively, politically, financially, and socially. I commend the SFU faculty members and administrators who have taken the current initiative this far and wish you success in getting final approval. Your students and your fellow Canadians will be better off for this effort.

Sincerely



UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA

October 27, 2023

Dear Drs. Karen Kohfeld and Shawn Chartrand

I am pleased to write a letter of support for the proposed Master's of Science and PhD degrees in Environmental Science at Simon Fraser University to help meet the demand for Environmental Scientists with post-graduate degrees in academia, government, and private industry. These degree programs proposed by the School of Environmental Science would seem to complement existing graduate degrees at SFU and elsewhere rather than compete with them.

This would be true in relation to our similar graduate programs at UNBC which run under the umbrella of Natural Resources and Environmental Studies. At the Master's level, students may pursue several streams including Environmental Sciences, and equally the PhD may involve an Environmental Sciences focus. The number of faculty members available to supervise in the proposed SFU – SES programs are similar to ours at UNBC.

In both cases at UNBC, the main limitations in drawing students are the number of faculty members and available funding, and this would not be impacted by additional programs in the province; indeed there is a need for more such options. The coursework at UNBC is noted to be interdisciplinary, and with more courses than in the proposed new programs at SFU, but this is true in comparison with most other similar programs at other universities.

We look forward to following the progress of these proposed programs at SFU.

Yours sincerely,

R.D.Wheate

Dr. Roger Wheate, Professor
Faculty of Environment, UNBC
Coordinator, NRES Graduate program

Tiphaine Jeanniard du Dot, PhD
Chargée de Recherche, Research Scientist

Centre d'Études Biologiques de Chizé
CNRS – La Rochelle Université (UMR7372)
405 rte de la Canauderie
79360 Villiers en Bois, France
Tel : + 33(0) 5 49 09 96 00 / +33(0) 6 77 44 40 71
Email : tiphaine.jeanniard-du-dot@cebc.cnrs.fr
http://www.cebc.cnrs.fr

Villiers en Bois, June 11th 2023

Re: Support for School of Environmental Science Graduate Program Application

Dear Dr Karen Kohfeld,

I am writing this letter in enthusiastic support of a graduate program in the School of Environmental Science at Simon Fraser University (SFU). As a research scientist at the Centre d'Etudes Biologiques de Chizé, Centre National de la Recherche Scientifique (CEBC – CNRS) and La Rochelle University in France, I have established collaborations with the research faculty in the department and I have had the opportunity to closely observe the academic supervision and research conducted in environmental and marine science within the School of Environmental Science.

Over the past few years, I have been working closely with faculty member Dr Ruth Joy on an internationally funded project on Impacts of Climate Change on Arctic Ice seals. This France Canada Research Fund provided the resources to fund a PhD student, Andrea Mendez-Bye, co-supervised between myself at CNRS and Dr Joy in the School of Environmental Science, and for travels for the French and Canadian teams (which include PhD and post-doc students from both countries) to regularly meet in person. The expansion of the School to include a fully supported graduate program would benefit this student in their intellectual growth and academic success. It would also streamline such opportunities as cotutelle PhD degrees between SFU and CNRS - La Rochelle University which was an original motivation of this co-supervised PhD student (and is currently not possible without the proposed program change). One example of building such an international partnerships is through the '2023 New Frontiers Research Fund's International Joint Initiative for Research in Climate Change Adaptation and Mitigation'. In March 2023, a Notice of Intent was submitted to this call for proposals, that if funded, would provide three years of research support for HQP between our two institutions.

I am supportive of the expansion of the graduate program not only for collaborations, but also to encourage the exchange of students to provide opportunities to experience first-hand the strength of diverse backgrounds in research. Student and faculty exchanges also encourage a

wide range of perspectives that enrich and promote a culture of respect. The proposed graduate school within the School of Environmental Science could provide important research experiences to graduate students through institutional exchanges and field work opportunities. For example, Dr Joy and I are currently working on enhancing the capabilities of both of our respective institutions to understand and investigate the dynamics of killer whales that face significant energy (prey-related) constraints off the west coast of British Columbia. An MSc student of my CNRS collaborator, Dr Christophe Guinet, is scheduled to join Dr Joy's lab as an intern to gain experience in working with the Southern Resident killer whales. This student's research has focused on the killer whales in the Southern Ocean, providing for an exciting exchange of ideas and experiences about killer whale habits in different oceanic environments.

In conclusion, I wholeheartedly endorse the new research-intensive Master and PhD graduate program in the School of Environmental Science at Simon Fraser University. I have no doubt that the program will thrive and attract the best and brightest minds from around the world with graduates from the program continuing on to make significant contributions in the environmental science field that positively impact the oceans and society at large.

Sincerely,

Dr Tiphaine Jeanniard du Dot

Research Scientist CEBC-CNRS, Marine Predators Biology and Ecology Lab

THE UNIVERSITY OF BRITISH COLUMBIA
Institute for Resources, Environment and Sustainability
Faculty of Science

Vancouver Campus
Aquatic Ecosystems Research Laboratory
(AERL Building)
4th Floor, 2202 Main Mall
Vancouver, BC Canada V6T 1Z4

ires.ubc.ca

January 30, 2024

Dr. Karen Kohfeld
Director and Professor, School of Environmental Science
Professor, School of Resource and Environmental Management
Simon Fraser University

Dear Dr. Kohfeld,

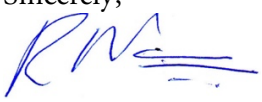
The Institute for Resources, Environment and Sustainability (IRES) is in strong support of your proposed new graduate program in Environmental Sciences.

As our world faces the climate crises alongside numerous other environmental challenges, the need for more highly trained graduates is only likely to increase. As such, while your program is likely to draw some students who might be in competition with our own graduate program and others like it, we believe that the demand for environmental education will exceed what any of our existing programs can supply. The more students we can train in these domains, the better off we will be in the long run.

A graduate program for the School of Environmental Science (SES) also makes sense to us -- your current faculty are supervising students through other programs and it would be better for them to train their students through their own graduate program. The focus on a research-intensive master's and PhD program is also appropriate given the strong research faculty in SES.

We wish you luck in developing these programs, and maybe some of your master's graduates will come do their PhDs with us, and vice-versa.

Sincerely,



Navin Ramankutty,
Director, Institute for Resources, Environment and Sustainability

PORT MOODY
CITY OF THE ARTS

100 Newport Drive, Port Moody, B.C., V3H 5C3, Canada
Tel 604.469.4500 Fax 604.469.4550
www.portmoody.ca

June 21, 2023

File No. 11-5280-01/01

Dr. Ruth Joy
School of Environmental Science
Faculty of Environment
Simon Fraser University
Burnaby BC, Canada

Dear Dr. Ruth Joy

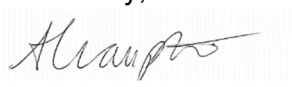
Re: Letter of Support – SFU Proposed M.Sc. Program in Environmental Science

We are excited to hear about the M.Sc. Program in Environmental Science proposed by SFU's School of Environmental Science. A more specialized graduate degree program in our region that is focused on developing skills needed to tackle environmental problems will help develop a resource of environmental professionals well suited to work in local and regional government. Recent collaborations between the City of Port Moody and SFU include:

- Graduate research: The City provided financial support for a graduate research project looking at current fish populations in Port Moody Arm. This project followed up on work done by the City in 2011 and provided useful data on changes to fish populations in local marine areas. The partnership also provided an opportunity for SFU, City staff and local stewardship groups to work together tackling environmental issues.
- Environmental events: Staff attended SFU's School of Environmental Science earth day event at the marine science centre located at Reed Point Marina in Port Moody. This event provided an opportunity to showcase the city's role in environmental management.
- Co-op students: The City of Port Moody Environment Division has hired co-op students from the Faculty of Environment undergraduate program and look forward to continuing this fruitful collaboration that provides practical experience in local government to young environmental professionals.

The creation of a M.Sc. Program in Environmental Science will further strengthen the working relationship between SFU and the City of Port Moody, Environment & Parks.

Yours truly,



Angela Crampton, M.Sc.

Environmental Coordinator, Environment & Parks

Reference: 401492

Dr. Karen Kohfeld
Director & Professor
School of Environmental Science
Faculty of Environment, 8888 University Drive
Burnaby B.C. V5A 1S6

June 12, 2023

Sent via email: ses_director@sfu.ca

Dear Dr. Karen Kohfeld:

Re: Letter of support for SFU's proposed environmental science Master's & PhD Program

Effective management of parks and protected areas today requires a multidisciplinary approach that brings together fields such as conservation biology, ecology, anthropology, sociology, and many other natural and social sciences. At the same time, there is a general skills shortage of highly trained people with the right combination of skillsets to fulfill the needs of public sector employers such as BC Parks. BC Parks employees are often required to develop and use skills at the interface between science and policy that traditional curricula may not cover.

Simon Fraser University is proposing a new graduate-level program in Environmental Science to train the next generation of environmental problem solvers. This program would combine the strengths of the Department of Geography (focusing on the connections between the natural and human environment) and the School of Resource and Environmental Management (focusing on decision-making within complex social, political, and economic frameworks). This program will recognize the importance of climate change and ecological restoration, and train students in measuring, modelling, and predicting natural phenomena.

While the University of British Columbia offers a similar program in Resource and Environmental Management, this program will differ by providing a stronger focus on the natural science aspects of resource management.
BC Parks supports the creation of this interdisciplinary program, which will benefit all British Columbians by training a new generation of local and international talent to become conservation practitioners and positioning them well for the type of highly skilled jobs that protected areas management will require in the coming years.

Sincerely,

David Ranson
Executive Director, Provincial Services Branch
Conservation and Recreation Division
Ministry of Environment and Climate Change Strategy

Amy E. East, Ph.D.
U.S. Geological Survey
Santa Cruz, CA, USA
6 July 2023

To Whom It May Concern:

I am writing to voice my strong support for the proposed Master of Science and Doctor of Philosophy graduate programs in Environmental Science at Simon Fraser University. I write in particular on behalf of the physical-sciences side of the environmental-science community, as it is clear that Simon Fraser University has much to offer graduate students in this field of study. As a research scientist with the U.S. Geological Survey specializing in geosciences, I interact with multiple faculty members and one of the postdoctoral research associates in environmental science at SFU and I am familiar with the peer-reviewed scientific literature that they have published.

The School of Environmental Science at SFU is widely regarded as a high-level base for learning in its field. The faculty members' expertise in scientific problems related to climate change, anthropogenic environmental impacts, natural resources and sustainability, and Earth system science is broad and rigorous. To highlight several examples in the physical sciences, faculty in the School of Environmental Science are engaged in studies of watershed dynamics, wildfire effects, climate and landscape evolution, and landslide hazards (together with their influence on ecosystems) that are at the top of their field (e.g., the work of Profs. Jeremy Venditti, Shawn Chartrand, and Brendan Murphy, the three faculty members whose research I am most familiar with). The undergraduate and postdoctoral programs in the School of Environmental Sciences already provide world-class educational opportunities to students and early-career scientists. Growing the school through MSc and Ph.D. degree programs will provide new, valuable opportunities that leverage the faculty's strengths as well as the physical setting of southern B.C. (an ideal place to study environmental science) and will complement the graduate programs in Earth Sciences and other departments.

In summary, Simon Fraser University is well positioned to make a greater impact on the field of environmental sciences by developing Masters' and Ph.D. degree programs through the School of Environmental Science, and I look forward to the new research findings of students who will study through these programs.

Sincerely,

Amy E. East

June 21, 2023

Simon Fraser University, School of Environmental Science

To Whom it May Concern,

Letter of Support for the proposed PhD and MSc in Environmental Science

Please accept this letter of support for the proposed Doctor of Philosophy (Ph.D.) in Environmental Science and Master's of Science (M.Sc.) in Environmental Science programs offered by the School of Environmental Science in the Faculty of Environment at Simon Fraser University.

Todays' climate of rapid and broadscale environmental change has created an increasing need for Environmental Scientists that can apply a quantitative and interdisciplinary science approach to a range of new and evolving problems. The proposed Ph.D. and M.Sc. degrees will ensure that SFU is contributing high-quality Environmental Scientists well-equipped to meet current and emerging issues that are important to Canadians.

The program's focus on quantitative and interdisciplinary science that prioritizes environmental thinking and problem-solving compliments ECCC's research, monitoring, and restoration programs and provides a number of opportunities for collaboration.

Sincerely,

Greg McClelland, PhD
Senior Wildlife Biologist
Canadian Wildlife Service
Environment and Climate Change Canada / Government of Canada
Gregory.mcclelland@ec.gc.ca/ Cell: 778-952-9432

June 16, 2023

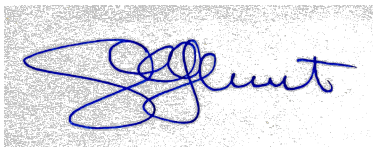
To Whom it May Concern,

I am very pleased to provide support for Simon Fraser University's proposed School of Environmental Science Masters and PhD program. I have had the pleasure of working with Dr. Ruth Joy and a number of students under the joint SFU/BCIT professional Masters of Ecological Restoration program, but found myself frequently wanting to have an opportunity for students explore thesis topics to a greater depth and develop their research questions more fully than the previous program would allow.

As a research scientist with the federal government, over the last six years I have developed a new program and hired a team of 17 biologists, technicians, and casual employees. One of the greatest challenges was in finding well trained and experienced graduates that have a breadth of knowledge and interdisciplinary skills to support the type of science that is needed in today's world of heightened awareness of environmental impacts. I see significant value in the proposed MSc and PhD program under SFU's Faculty of Environment's School of Environmental Science, and would welcome the addition of graduates into the workforce.

I look forward to ongoing opportunities to work with SFU's School of Environmental Science and to the development of a research-intensive graduate degree program.

Kind regards,



Sheila J. Thornton, PhD
Research Scientist
Marine Mammal Conservation Physiology program
Pacific Science Enterprise Centre
4160 Marine Drive, West Vancouver V7V 1N6

2-65 Colony Farm Road, Coquitlam, BC V3K 5X9 tel: (604) 540-0680 fax: (604) 525-0772

kʷikʷəƛ̓əm
Kwikwetlem First Nation

June 15th, 2023

Dr. Karen E. Kohfeld
Director and Professor, School of Environmental Science
Simon Fraser University

Sent by email to: sesdir@sfu.ca

Re: kʷikʷəƛ̓əm First Nation support of SFU's proposed Faculty of Environment Graduate Program in Environmental Science

Dear Dr. Kohfeld:

kʷikʷəƛ̓əm (Kwikwetlem) First Nation is writing to enthusiastically support Simon Fraser University's proposed Environmental Science Master's & PhD Program.

kʷikʷəƛ̓əm continues to face many challenges in protecting its territory from ongoing, multiple impacts to its environmental and cultural interests. One of those challenges is our Nation's capacity limits.

kʷikʷəƛ̓əm frequently relies on the help of academic institutions and scientists to provide our Nation with scientific support to resolve those challenges. Currently, the University of British Columbia is providing significant help assessing and resolving fish passage issues on kʷikʷəƛ̓əm territory. Indeed, without such timely help, the restoration projects and planning we have in place would not be progressing at the pace we desire and require.

Yet it has been Simon Fraser University that has provided even more support to our Nation in recent years. kʷikʷəƛ̓əm has greatly benefitted from the knowledge and assistance of SFU's Shawn Chartrand on many aquatic and restoration issues in recent years, including Shawn's and his student's most timely help on designing major restoration works on the Addington Point Marsh.

Above and beyond, the Faculty of Environment has given us additional direct and continuing support in bolstering kʷikʷəƛ̓əm capacity. Our Nation's Lands and Resources Department currently employs three graduates of the SFU-BCIT Master's Program in Ecological Restoration Program. Those employees have brought a wealth of scientific, cultural and practical knowledge to help our Nation, and have significantly bolstered kʷikʷəƛ̓əm capacity. Moreover, kʷikʷəƛ̓əm Environmental Advisor Dr. Craig Orr, as an Adjunct Professor in the Faculty of Environment, currently serves as an invaluable link between SFU and kʷikʷəƛ̓əm, helping us to continue to bring needed academic help to our Nation.

It should thus be apparent that kʷikʷəƛ̓əm will continue to benefit not only through its solid relationship with SFU, but also if SFU develops its graduate program and continues to provide needed academic and scientific assistance that to date has greatly aided kʷikʷəƛ̓əm and other Indigenous groups.

kʷikʷəƛ̓əm wishes SFU all success in establishing this vital program.

Best regards,

Christa Williams
Lands and Resources Director

cc. Craig Orr, Environmental Advisor, kʷikʷəƛ̓əm First Nation

Comox Valley Project Watershed Society
2356a Rosewall Crescent, Courtenay, BC, V9N 8R9
Phone: (250) 703-2871 Fax: 703-2872 Email: info@projectwatershed.ca
www.projectwatershed.ca

June 29, 2023

Province of British Columbia
Ministry of Education
620 Superior St. – 5th Floor
Victoria, BC
V8V 1V2

To Whom It May Concern,

I am writing today in support of the proposed programs based out of Simon Fraser University for a Masters and Ph.D in Environmental Science.

Project Watershed is a non-profit stewardship society that has been working in environmental stewardship in the Comox Valley since 1993. Our current work largely focuses on ecological restoration, research, and education and outreach. Many of our staff have expertise in ecological restoration, botany, ecology, modelling, and estuarine research at either a Masters level or higher. Two of our staff are graduates of the SFU/BCIT Ecological Restoration Masters program, and we've supported two other students with applied research projects from the same program. We've found that the SFU program has equipped their students with a solid understanding of ecological concepts, applied research, field work, and restoration techniques that has prepared them to be an asset in our workplace. Some of the core skills we'd like to see highlighted in this program include field sampling, application of ecological restoration techniques, project management, study and sampling design, data management, and statistical analysis.

As employers of SFU alumni and supporters of current students within SFU Masters programs, we're happy to offer our support of the proposed program and emphasize our confidence in SFU's School of Environmental Science in providing a solid educational background for individuals looking to move into a diversity of workplaces in the environmental sciences field. A program with an emphasis on application of science concepts, and lab and field skills will help support the future success of students of the proposed program.

Please feel free to contact me if you have any questions or require any further information.

All the best,

Caitlin Pierzchalski
Executive Director, Project Watershed
Caitlin.pierzchalski@projectwatershed.ca

Date: July 7, 2023

Province of British Columbia
Ministry of Education
620 Superior St. – 5th Floor
Victoria, BC
V8V 1V2

Subject: Creation of SFU Masters and Ph.D in Environmental Science

To Whom it May Concern,

I am writing today in support of the proposed programs based out of Simon Fraser University for a Masters and Ph.D in Environmental Science.

Resilient Waters is a project of MakeWay Charitable Society focused on flood mitigation projects in the Lower Mainland that centre multiple benefits for stakeholders, particularly First Nations values and restoring salmon habitat. Working with Shawn Chartrand, and benefitting from the results of ER research projects, we've gotten great value from what the program has accomplished. Some of the core skills we'd like to see highlighted in this program involve running community and partner involved field research that integrate both qualitative and quantitative (including Indigenous Knowledge), and integrate this information into projects that benefits those partners. As a community partner I would be very excited to help facilitate these connections.

We are seeing a drastic increase in the need for qualified environmental science professionals with a breadth of knowledge to undertake the work required in the age of climate change and biodiversity crisis. We're happy to offer our support of the proposed program and emphasize our confidence in SFU's School of Environmental Science in providing a solid educational background for individuals looking to move into a diversity of workplaces in the environmental sciences field. A program with an emphasis on application of the breadth of skills required will help support the future success of students of the proposed program.

Sincerely,

Dan Straker
Project Manager, Resilient Waters
MakeWay Charitable Society
dan@resilientwaters.ca
604-812-9676

SQUAMISH RIVER WATERSHED SOCIETY

Box 1791, Squamish, BC, V8B 0B3
Phone: 604.892.7919
E-mail: srws@shaw.ca; Website: www.squamishwatershed.com
Charities registration #87365 2861 RR0001

Dr. Karen Kohfeld
Director and Professor
School of Environmental Science, Faculty of Environment
Simon Fraser University
8888 University Drive
Burnaby, BC V5A 1S6

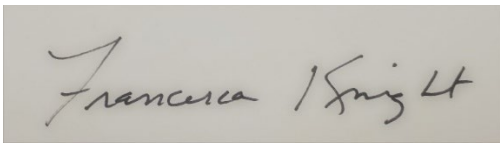
June 14, 2023

Dear Dr. Kohfeld:

We are writing in support of SFU's proposed Master's and PhD programs in the School of Environmental Science. In perusing the materials sent to us outlining the scope and intent of the programs, we concluded that the proposed programs appear to be an excellent interdisciplinary blend of many areas of both hard science and public and social policy. In our work at the Watershed Society, we are increasingly seeing the impacts of climate change in many aspects of our local watersheds, including many areas where we are involved with ecological restoration work. We believe that a graduate program like the one the School of Environmental Science is proposing could prepare students for the very difficult environmental and social conditions that we see in the future.

On behalf of the Squamish River Watershed Society,

Edith B. Tobe, RPBio
Executive Director



Francesca Knight, M.Sc., R.P. Bio.
President

SIMRES

Saturna Island Marine Research and Education Society

27th June 2023.

Re: Proposed Environmental Science Master's & PhD Program

To whom it may concern:

The Saturna Island Marine Research and Education Society (SIMRES) is a small non-profit working society on Saturna, in the middle of the Salish Sea, whose mission is to support research and education related to the natural environment, with much of our work focused on the critically-endangered Southern Resident Killer Whales (SRKW).

Our most effective strategy has been building research collaborations and partnerships. There are many occasions when organizations working together can achieve things that none of the partners could do by themselves. For the last few years, our most important collaboration has been with Simon Fraser University, specifically the Master of Science in Environmental Restoration headed by Ruth Joy. We've worked closely over four cohorts of this program, supporting six MSc students and one undergraduate, to do fieldwork on Saturna. They have also made a valuable and much appreciated contribution to this small community, and the experience has gone well beyond just a fieldwork project for all parties.

We were therefore pleased to hear of the proposed Environmental Science Master's & PhD Program, and write to offer our full support for this important and timely development.

Dr. Martin Wale

www.simres.ca

SIMRES is based on TEKTEKSEN. We acknowledge the ancestral territories and pre-Confederate Douglas Treaty rights of the Coast & Straits Salish peoples, particularly the Tsawout and Tseycum nations, on which we live, work and play,.

PO Box 117, 727 Trillium Trail, East Point, Saturna Island, BC V0N 2Y0

June 26, 2023

Attn: Provincial Ministry of Education

Re: Support for the proposed SFU's Environmental Science Master's and PhD program

I am writing to express my wholehearted support for Simon Fraser University's new Master's and PhD program in Environmental Science. As an alumna of this esteemed institution, I am thrilled to learn about the university's continued dedication to fostering academic excellence and innovation in the field of environmental science.

I had the privilege of pursuing my graduate studies at Simon Fraser University, majoring in Environmental Science, and I can confidently assert that my professional success as an Environmental Scientist is undoubtedly owed to the exceptional education and opportunities I received during my time at the university.

One of the most distinctive features of Simon Fraser University's Environmental Science program is its comprehensive curriculum, which seamlessly integrates theoretical knowledge with practical applications. The interdisciplinary approach exposed me to a diverse range of subjects, including environmental policy, ecology, climate change, and sustainable resource management. Through engaging lectures, hands-on fieldwork, and collaborative research projects, I developed a deep understanding of the complex environmental challenges we face today and gained the skills necessary to address them effectively.

Moreover, the university's commitment to fostering critical thinking and independent research greatly influenced my intellectual growth. The guidance and mentorship I received from esteemed faculty members in particular Dr Ruth Joy my supervisor, were instrumental in shaping my research interests and honing my analytical skills. Their unwavering support and encouragement propelled me to explore innovative solutions to environmental problems and pushed me to reach new heights in my academic journey.

Immediately after graduating from Simon Fraser University, I was fortunate enough to secure a position at an environmental consulting firm. The practical knowledge and expertise I acquired during my studies played a pivotal role in securing this opportunity and allowed me to make a meaningful contribution to the organization right from the start.

Based on my firsthand experience, I have the utmost confidence that the new Master's and PhD program in Environmental Science at Simon Fraser University will continue to produce exceptional graduates who are equipped to tackle pressing environmental issues and drive positive change. The university's dedication to

providing students with a well-rounded education, coupled with its emphasis on experiential learning and research excellence, ensures that graduates are well-prepared for both academic and professional pursuits.

I wholeheartedly support the university's efforts to expand its academic offerings in the field of environmental science. I am certain that this new program will attract talented individuals from diverse backgrounds who are passionate about environmental conservation and sustainable development. By investing in this program, Simon Fraser University will not only contribute to the advancement of scientific knowledge but also nurture future leaders who will shape a more sustainable and resilient future for our planet.

In conclusion, I would like to extend my deepest gratitude to Simon Fraser University for the transformative educational experience it provided me. I am confident that the new Master's and PhD program in Environmental Science will uphold the university's exceptional standards and continue to produce outstanding graduates who will make a positive impact in their respective fields. I sincerely recommend this program to prospective students who aspire to contribute to the advancement of environmental science.

Thank you for your time and consideration. Please feel free to reach out to me if there is anything further, I can do to support Simon Fraser University or the new program.

Sincerely,

Keystone Environmental Ltd.

Azadeh Gheibi, MSc, BIT
Field Biologist

June 26, 2023

Attn: Provincial Ministry of Education

Re: Support for the Proposed SFU's Environmental Science Master's and PhD Program

As an alumna of Simon Fraser University's School of Environmental Science (School) and a Field Biologist working in environmental consulting, I fully support the proposed new research-intensive Master's and PhD program.

My experience at the School and as a member of Ruth Joy's (Faculty Member at the School) team allowed me to gain the relevant skills and knowledge to be a successful field biologist as part of the Marine Science team at Keystone Environmental Ltd. During my time at the School, I received tremendous support from my supervisor, Ruth Joy, and the school, although the list of instances is too long to mention.

The courses I took at SFU, such as Project Management and Policy for Ecological Restoration, Seminars in Research Methods, and First Nations and Social Perspectives of Ecological Restoration, have provided me with different perspectives that will make me a more well-rounded biologist and environmental scientist. Through Ruth, I had the opportunity to work on an exciting project alongside Fisheries and Oceans Canada and Cetus Research and Conservation Society, which ultimately led to my current job in consulting.

Even with the limited number of courses I took at the School, I have been able to thrive as a field biologist, and I expect my career trajectory to continue on a positive path. If the School's Master's and PhD programs were to be established, they would produce environmental scientists who are not only technically skilled but also capable of understanding diverse perspectives. Such environmental scientists would meet the demands of academia, government organizations, and private industry in the field of environmental science.

Sincerely,

Varsha Rani, MSc, BIT
Field Biologist

Suite 320-4400 Dominion Street
Burnaby, BC V5G 4G3 | Canada
Ph: 604.430.0671
Fax: 604.430.0672
keyinfo@keystoneenvironmental.ca
keystoneenvironmental.ca

COASTRANGE ENVIRONMENTAL

DATE: **June 5, 2023**

TO: **Karen Kohfeld, Director & Professor**
School of Environmental Science, Simon Fraser University

FROM: **Karlene Loudon, R.P.Bio., CoastRange Environmental Ltd.**

RE: **Letter of Support**
SFU Environmental Science Graduate Program

As a Simon Fraser University alumna, I am excited to learn about the development of an Environmental Science graduate program. I believe this program addresses a need not yet tended to by universities in our region.

After completing a business degree in 2007, I worked as a Curriculum Developer for various post-secondary institutions. However, my love for and curiosity about the natural world led me to environmental sciences and, eventually, a second degree. I completed the Bachelor of Science (Physical Geography Major, Biogeophysical Stream) in 2013; a stream that offers great flexibility and has notable and welcome overlaps with SFU's Bachelor of Environmental Science. After graduation, I spent several years gaining work experience, refining my career ambitions, and determining my additional education requirements for becoming a Registered Professional Biologist (R.P.Bio.). During these years, I spent more time than I would like to mention researching graduate programs in BC, across Canada and, eventually, throughout the Western United States. I wanted to return to SFU, but I struggled to match my academic needs and interests with SFU's existing graduate programs. The Master in Resource Management and the Master of Science in Biology are well renowned programs with significant strengths. I was, however, looking for a program that was science-focused, as opposed to interdisciplinary, and broader in scope than biology. I was looking for program that would allow me to take a few required courses and complete a thesis to meet R.P.Bio. requirements. The proposed Environmental Science graduate program at SFU would have been a great fit.

I ended up completing a Master of Natural Resources at Oregon State University in 2019. This degree, combined with my professional experience as a Research Biologist for the Department of Fisheries and Oceans Canada and an Environmental Consultant, met the R.P.Bio. requirements. I opened CoastRange Environmental Ltd., a small environmental consulting firm based in Squamish, BC, in 2020. These days, I reach out to SFU graduates when I am in need of skilled staff or sub-contractors. It is important that these individuals can work independently and think critically. It is important that their knowledge extends beyond biology, and that they understand how biota and the physical environment interact. It is also important that they have fulfilled the academic requirements for becoming a Qualified Environmental Professional (QEP). The proposed Environmental Science graduate program has potential to meet these

needs and guide aspiring professionals towards a rewarding career as independent thinkers with sought after environmental knowledge.

I would like to thank Simon Fraser University for acknowledging a need for a program such as this, and for taking the steps required to bring it to life.

Warm Regards and best of luck!

Karlene Loudon, B.T.M., B.Sc., M.N.R., R.P.Bio., QEP
Principal Consultant + Biologist
CoastRange Environmental Ltd.
kloudon@coastrangeenvironmental.ca

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 4: Library Memo

March 6, 2024

School of Environmental Science

Faculty of Environment

SFU SIMON FRASER UNIVERSITY

MEMO

SFU Library

8888 University Drive
Burnaby, BC V5A 1S6
Canada

ATTENTION **RAJDEEP DHADWAL**

FROM Mar González Palacios

RE PhD in Environmental Science

DATE 06 March 2024

Dear Rajdeep,

The library is pleased to support the creation of the newly proposed PhD in Environmental Science.

The primary support and Liaison Librarian for this program is Jenna Walsh, Indigenous Initiatives Librarian & Librarian for Indigenous Studies, Archaeology, Environmental Science, and Resource & Environmental Management. Jenna provides research and teaching support, and expertly stewards our ever-adapting collection of Environmental Science resources.

We are confident we are equipped to support students in this program with existing resources. Should new faculty hires be made or specific PhD research requirements arise, we will need collaborate with you to ensure that we are supporting the related research and teaching needs.

In addition to personal support from Jenna, Graduate students are also well supported by the SFU Library Research Commons, as well as other Library resources and services such as Research Data Management.

The SFU Library welcomes the creation of this program and looks forward to partnering with it as it develops.

Best,

Mar González Palacios
Associate Dean of Libraries, Collections and Content Strategy

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 5: Program Steering Committee

March 6, 2024

School of Environmental Science

Faculty of Environment

The EVSC Graduate Program Development (Steering) Committee (GPDC) is an interim committee established to assist with the development of the Masters and Ph.D. programs for the School. As the new programs develop and come into place, this committee will transition towards overseeing operation of graduate programs within EVSC and will then be referred to as the "Graduate Program Committee" (GPC).

The GPDC is composed of:

1) Chair (Assistant Professor, Associate Professor, or Professor)
2) Minimum of two EVSC research faculty members (Assistant Professor, Associate Professor, or Professor)

The GPDC is currently formed with the following membership; abbreviated CVs are provided on the following pages.

Dr. Karen Kohfeld (chair)
Director, School of Environmental Science, Simon Fraser University
Professor, School of Environmental Science and School of Resource and Environmental Management, Simon Fraser University

Dr. Shawn Chartrand
Assistant Professor, School of Environmental Science, Simon Fraser University

Dr. Brendan Murphy
Assistant Professor, School of Environmental Science, Simon Fraser University

Dr. Jeremy Venditti
Professor, School of Environmental Science, Simon Fraser University

KAREN ELIZABETH KOHFELD, PhD, Honoris Causa *June 2023*

School of Resource and Environmental Management and School of Environmental Science, Simon Fraser University, Burnaby, BC, Canada, V5A 1S6 – kohfeld@sfu.ca

EDUCATION:

Ph. D., Earth and Environmental Sciences, Columbia University, NY, NY, USA 1998
Thesis Title: Geochemistry and Ecology of Polar Planktonic Foraminifera, and Applications to Paleoceanographic Reconstructions. Adviser: R. F. Anderson
M. Phil., Geology, Columbia University, New York, NY, USA 1995
M. A., Geology, Columbia University, New York, NY, USA 1993
Sc. B., Geology/Biology, Brown University, Providence, RI, USA 1990

BIOSKETCH:

My work investigates past and present Earth system processes using regional-to-global environmental datasets of ocean and terrestrial proxies, to evaluate which processes are most important in climate and carbon cycling. I also explore regional impacts of climate change on ecosystems, carbon storage, and human infrastructure. My recent work with Parks Canada, DFO, West Coast Environmental Law, and the Commission for Environmental Cooperation examines carbon dynamics in salt marshes and seagrass ecosystems as well as understanding the effects of coastal ocean acidification in the Salish Sea. I recently served as an expert panel member for the Council of Canadian Academies on "Understanding and Leveraging Canadian Carbon Sinks."

Keywords: Climate change, regional and global carbon cycling, biogeochemical cycles, blue carbon, paleoceanography, paleoclimatology, wind speed behavior, global dust cycle, global data-model comparisons

ACADEMIC HONORS AND AWARDS (2018-2023):

Honorary Ph.D., Faculty of Science, Stockholm University, Stockholm, Sweden (awarded 2022 due to COVID) 2022
Union Lecturer and Plenary Speaker, International Union on Geology and Geophysics 2019
Canadian National Committee for Scientific Committee on Oceanographic Research (CNC-SCOR) East Coast Tour Speaker 2018

PROFESSIONAL EXPERIENCE (SINCE 2001):

Professor and Director, School of Environmental Science, Professor, School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC, CANADA 2022-present
Professor, School of Resource and Environmental Management (3/4) and School of Environmental Science (1/4), Simon Fraser University 2019- present
Professor, School of Resource and Environmental Management (REM), SFU 2017 -2019
Associate Professor, Tier 2 Canada Research Chair in Climate, Resources, and Global Change, REM, SFU 2012-2017
Assistant Professor, Tier 2 CRC in Climate, Resources, and Global Change, School of Resource and Environmental Management, REM, SFU 2006-2012
Asst Professor/Ph.D. Faculty Member, School of Earth and Environmental Sciences, Queens College, City University of New York, USA 2004-2006
Senior Scientist, Max Planck Institute for Biogeochemistry, Jena, Germany 2001-2004

FUNDING

Awarded 41 grants worth >CAD $3.5 million (since 1995)

INTERNATIONAL CONFERENCES, MEETINGS, & WORKSHOPS

132 Conference Abstracts, 46 Speaker Invitations, 18 convened workshops/sessions (since 1994)

KAREN ELIZABETH KOHFELD, PhD, Honoris Causa June 2023

School of Resource and Environmental Management and School of Environmental Science, Simon Fraser University, Burnaby, BC, Canada, V5A 1S6 – kohfeld@sfu.ca

SELECT PUBLICATIONS (61 since 1996)

JCR h-index: 28; Google scholar h-index: 34; Times cited: 5495 (Web of Science); Student contributors underlined

Chastain, S. G., **K.E. Kohfeld**, M. G. Pellatt, C Olid, M. Gailis, Quantification of blue carbon on the Pacific Coast of Canada *Biogeosciences*, 19, 5751–5777, https://doi.org/10.5194/bg-19-5751-2022, **2022**

CCA (Council of Canadian Academies). *Nature-Based Climate Solutions*, Ottawa (ON): The Expert Panel on Canada's Carbon Sink Potential, CCA, ISBN: 978-1-990592-15-7, 260 pp, **2022**.

Jones, J, **KE Kohfeld**, H. Bostock, X. Crosta, M. Liston, G. Dunbar, Z Chase, A Leventer, H. Anderson, and G. Jacobsen, Sea ice changes in the southwest Pacific sector of the Southern Ocean during the last 140 000 years, *Climate of the Past*, 18, 465–483, https://doi.org/10.5194/cp-18-465-2022, **2022**.

Simpson, E, D. Ianson, and **KE Kohfeld**, Using Endmember Models to Estimate Seasonal Carbonate Chemistry and Acidification Sensitivity in Temperate Estuaries, *Geophysical Research Letters*, 49, e2021GL095579. https://doi.org/10.1029/2021GL095579, **2022**

Gailis, M**, KE Kohfeld**, MG Pellatt, D Carlson, Quantifying blue carbon for the largest salt marsh in southern British Columbia: implications for regional coastal management, *Coastal Engineering Journal*, 63:3, 275-309, https://doi.org/10.1080/21664250.2021.1894815, **2021**.

Wadham, JL, J Hawkings, L. Tarasov, L. J. Gregoire, R. G.M. Spencer, M. Gutjahr, A. Ridgwell, and **KE Kohfeld**, Ice sheets matter to the global carbon cycle, *Nature Communications* 10 (2567), doi:10.1038/s41467-019-11394-4, **2019**.

Murphy, S., MG Pellatt, and **KE Kohfeld**, A 5,000-year fire history in the Strait of Georgia Lowlands, British Columbia, Canada, *Frontiers in Ecology and Evolution- Paleoecology* 7:90 doi: 10.3389/fevo.2019.00090, **2019.**

Kohfeld KE, and Z Chase, Temporal evolution of mechanisms controlling ocean carbon uptake during the last glacial cycle, *Earth and Planetary Science Letters* 472: 206-215, http://dx.doi.org/10.1016/j.epsl.2017.05.015, **2017**.

Savo, V., D Lepofsky, J Brenner, **KE Kohfeld**, J Bailey, and K Lertzman, Observations of climate change among subsistence-oriented communities around the world**,** *Nature Climate Change* 6 (2016): 462-473, doi:10.1038/nclimate2958, **2016**.

Cross, B, **KE Kohfeld**, HJ Bailey, AB Cooper, Historical variability in wind speed behavior in relation to hydroelectric reservoir inflows, and their implications for wind power development, *PLoSONE,* 10(8): e0135730. doi:10.1371/journal. pone.0135730, **2015**.

Spry, C, **KE Kohfeld**, D. Allen, K. Lertzman, D. Dunkley, Characterizing Pineapple Express Storms in the Lower Mainland of British Columbia, *Canadian Water Resource Journal*, DOI:10.1080/07011784.2014.942574, **2014**.

Kohfeld, KE, R. Graham, A. De Boer, LC. Sime, EW Wolf, C. Le Quere, and L. Bopp, Glacial-interglacial changes in Southern Hemisphere Westerly Winds: Paleo-data synthesis, *Quaternary Science Reviews,* doi:10.1016/j.quascirev.2013.01.017**, 2013. "Highly Cited Paper" in Geosciences (2014-2016)***

Kohfeld, KE and A. Ridgwell, Glacial-interglacial variability in atmospheric CO_2. In: Le Quéré, C. and E. S. Saltzman (eds.) *The Surface Ocean - Lower Atmosphere Processes, Geophysical Monograph Series, Volume 187, 350 pp*, **2009. Invited**

Kohfeld, KE, C Le Quéré, R.F. Anderson and S.P. Harrison, Role of marine biology in glacial-interglacial CO_2 cycles, *Science,* 308 (5718): 74-78, **2005**.

SUPERVISORY TRAINING OF HIGHLY QUALIFIED PERSONNEL

Senior Supervisor (Active): 1 Ph.D., 5 Masters

Senior Supervisor (Completed): 22 Masters, 2 PhD, 2 summer supervision

Service on Supervisory Committees (Active): 1 Masters (Completed): 8 Masters, 6 PhD

Service on Exam Committees: 6 PhD, 1 Masters

Shawn M. Chartrand

Simon Fraser University, Burnaby, B.C., Canada • School of Environmental Science
e-mail: shawn.chartrand@sfu.ca • website: https://sites.google.com/view/shawnchartrand

EDUCATION

PhD	University of British Columbia, Vancouver, Canada Physical Geography, Advisor: Marwan Hassan and Mark Jellinek	2017
M.S.	Case Western Reserve University, Cleveland, USA Geological Sciences, Advisor: Peter Whiting.	1997
B.A.	Case Western Reserve University, Cleveland, USA Major: Environmental Geology with Departmental Honors, Minor: Biological Sciences	1995

PROFESSIONAL POSITIONS

Assistant Professor, Simon Fraser University, Burnaby, B.C. Canada	July 2021 - present
Limited Term Research Faculty, Simon Fraser University, Burnaby, B.C. Canada	2019 - June 2021
NSERC Postdoctoral Fellow, Vanderbilt University, Nashville, TN, USA	2017 - 2019
Teaching Fellow, University of British Columbia, Vancouver, Canada	2017 - 2018
NSERC PhD Research Fellow, University of British Columbia, Vancouver, Canada	2013 - 2016
Research and Teaching Assistant, University of British Columbia, Vancouver, Canada	2012 - 2017
Principal Geomorphologist, Balance Hydrologics, Berkeley, USA	2016 - 2021
CEO and Principal Geomorphologist, Balance Hydrologics, Berkeley, USA	2008 - 2016
Staff Geomorphologist, Balance Hydrologics, Berkeley, USA	2000 - 2008

Interests

My primary research focuses on Earth surface dynamics within temperate and Arctic environments. I work on problems at spatial scales ranging from the sediment particle to the drainage basin, and for temporal scales of fractions of a second to thousands of years. I utilize field-based methods, mathematical theory development, numerical models and laboratory experiments. My present work is organized under several different themes: (1) sediment transport in rivers based on stochastic and probabilistic theory; (2) channel network development in Arctic permafrost environments responding to climate change; (3) mountain river geomorphology with an emphasis on pool-riffles; (4) application of climate change science to environmental planning of river corridors, water resources and riverine habitat.

Keywords: Geomorphology, Geophysics, Sediment Transport, Climate Change, Arctic, Drainage Basins

Publications

17. **Chartrand, S.M.**, et al. (2023). *Nature Communications*, DOI: 10.1038/s41467-023-40795-9 (in publication).
16. **Chartrand, S.M.**, et al.. (2023). *Earth Surf. Dynamics,* 11, 1–20, DOI: 10.5194/esurf-11-1-2023.
15. Hassan, M.A., **Chartrand, S.M.** et al. (2022). *Water Resources Research*, 58, e2022WR032796, DOI: 10.1029/2022WR032796.
14. Zwiep, S, **Chartrand, S.M. (2022).** *Journal of Open Source Software,* 7(74), 4282, DOI: 10.21105/joss.04282.
13. **Chartrand, S.M. (2022).** In: Chembolu, V., Dutta, S. (eds) Recent Trends in River Corridor Management. Lecture Notes in Civil Engineering, vol 229. Springer, Singapore, DOI: 10.1007/978-981-16-9933-7_2.
12. Wright, M. et al.. *Earth Surface Processes and Landforms*, 1– 13, DOI: 10.1002/esp.5335.
11. Hassan, M.A.et al. (2021). *Water Resources Research,* 57(2), DOI:10.1029/2020WR028048.
10. Zhang, C.^ et al. (2020). *Earth Surface Processes and Landforms,* 45(2), 280– 294, DOI:10.1002/esp.4722.
9. **Chartrand, S.M.**, et al. (2019). *Earth Surface Processes and Landforms*, 44(15), 3020– 3041, DOI: 10.1002/esp.4695.
8. Hassan, M.A. et al. (2018). *Earth Surface Processes and Landforms*, 44(3), 736– 751, DOI: 10.1002/esp.4527.

7. Zhang, C.et al. (2018). *Geomorphology*, 311, 51-62, DOI: 10.1016/j.geomorph.2018.03.023.
6. **Chartrand, S.M.** et al. (2018). *Journal of* G*eophysical Research: Earth Surface,* 123(11), 2735– 2766, DOI: 10.1029/2017JF004533.
5. Hassan, M.A.et al. (2017). In Open Channel Hydraulics, River Hydraulic Structures and Fluvial Geomorphology*, edited by A. Radecki-Pawlik, S. Pagliara, J. Hradecky, and E. Hendrickson,* pp. 322–348, CRC Press.
4. Ferrer-Boix, C., **Chartrand, S.M.** et al. (2016). *Geophysical Research Letters,* 43, 6313– 6323, DOI:10.1002/2016GL069824.
3. **Chartrand, S.M.**,et al. (2015). *Water Resources Research,* 51, 8704– 8728, DOI: 10.1002/2015WR017840.
2. **Chartrand, S.M.**et al. (2011). *Geomorphology,* 129, DOI: 10.1016/j.geomorph.2011.01.020.
1. **Chartrand, S.M**., and Whiting, P.J. (2000). *Earth Surface Processes and Landforms,* 25(6), DOI: 10.1002/1096-9837(200006)25:6<583::AID-ESP92>3.0.CO;2-3.

Research/Project Funding

2023-2027 NSERC Discovery Grant - P.I.: **Chartrand** - Channel Width Control of Bed Topography in Gravel-bed Rivers ($175,000 CAD) + ECR Supplement ($12,500 CAD)

2023-2027 NSERC Discovery Grant Northern Research Supplement - P.I.: **Chartrand** - Channel Width Control of Bed Topography in Gravel-bed Rivers ($50,000 CAD)

2022-2023 City of Santa Cruz - P.I.: **Chartrand** - Ensemble Modeling of Hydrologic Conditions under Climate Change for City of Santa Cruz Water Supply and Environmental Flows ($150,000 USD)

2021-2022 City of Santa Cruz - P.I.: **Chartrand** - Modeling of Hydrologic Conditions under Climate Change for City of Santa Cruz Water Supply and Environmental Flows ($76,497 USD)

2017-2019 NSERC Postdoctoral Fellowship - P.I.: **Chartrand** - Links Between Rarefied Particle Motions and Gravel-bed River Bed Topography ($90,000 CAD)

2013-2016 NSERC Alexander Graham Bell Doctoral Research Fellowship - P.I.: **Chartrand** - Pool-riffle Mountain Streams: Experimental Investigation of Formative Processes ($105,000 CAD)

2012-2013 University of British Columbia Research Fellowship - P.I.: **Chartrand** - ($22,000 CAD)

1995-1997 Case Western Reserve University Graduate Research Fellowship - P.I.: **Chartrand** - Geometric Structure of Step-pools in Mountain Streams ($30,000 USD)

1996 Geological Society of America Graduate Research Award - P.I.: **Chartrand** - Pool-riffle Mountain Streams: Experimental Investigation of Formative Processes ($1,5000 USD)

Student Research/Project Funding

2023-2024 NSERC CGS M - Supervisor: **Chartrand**, Graduate Student: Camryn Good - Optimization of the Green Gravel Kelp Restoration Technique Using Bull Kelp (Nereocystis leutkeana) ($17,500 CAD)

2022-2023 MITCS - Supervisors: **Chartrand** and Orr, Graduate Student: Erica Harvey - Hydrologic connectivity between side channels and off-channel irrigation ponds, Mamquam River, Squamish, B.C. ($15,000 CAD)

2022 Private Donor Funding - Supervisors: **Chartrand** and Orr, Graduate Student: Edward Anderson - Numerical modeling of tidal marsh evolution by rising sea levels, ($15,000 CAD)

2021 NSERC USRA - Supervisor: **Chartrand**, Student: Sarah Zwiep - Probabilistic modeling of bedload transport under rarefied conditions ($5,000 CAD).

2020-2021 MITCS - Supervisors: **Chartrand** and Orr, Graduate Student: Kevin Hutchins - Tidal Channel Habitat Offsetting Evaluation for the Pattullo Bridge Replacement Project, Fraser River, B.C. ($15,000 CAD)

2020-2021 NSERC CGS M - Supervisor: **Chartrand**, Graduate Student: Victoria McInnis - Connecting wetland habitats for the northern red-legged frog (Rana aurora) ($17,500 CAD)

Brendan P. Murphy, Ph.D.

Assistant Professor | Simon Fraser University | School of Environmental Science

EDUCATION

2016	Ph.D.	Geological Sciences, The University of Texas at Austin (Texas, USA) *NSF Graduate Fellow* Dissertation: 'Feedbacks among chemical weathering, rock strength and erosion with implications for the climatic control of bedrock river incision'
2010	B.S.	Geology, The College of William & Mary (Virginia, USA) *Magna Cum Laude, Phi Beta Kappa, High Honors in Geology*

CURRENT APPOINTMENTS

2020 – present	Assistant Professor *School of Environmental Science, Simon Fraser University*
2020 – present	Adjunct Assistant Professor *Department of Watershed Sciences, Utah State University*

RESEARCH INTERESTS

I am a quantitative watershed scientist, and my research focuses on the imprint of climate on Earth surface and the processes that shape it, watershed-scale sediment dynamics modeling, and the coupled response of physical and ecological systems to natural and human-driven perturbations. My active research projects include: 1) geomorphic, hydrologic, and ecological responses to wildfire, post-fire geohazards, and the natural and human resource impacts from wildfire, 2) the influence of climate on erosion processes and landforms, and 3) ecogeomorphology and ecosystem resilience to disturbance.

SELECTED PUBLICATIONS

*Co-author designations: †Postdoctoral fellow, *Graduate student, **Undergraduate student*

Murphy B. P., Johnson J. P., Gasparini N. M. & Sklar L. S. (2016). Chemical weathering as a mechanism for the climatic control of bedrock river incision. *Nature,* 532, 223-227.

Murphy B. P., Yocom L. L. & Belmont P. (2018). Beyond the 1984 perspective: narrow focus on modern wildfire trends underestimates future risks to water security. *Earth's Future,* 6(*11*), 1-6.

Murphy B. P., Czuba J. A. & Belmont P. (2019). Post-wildfire sediment cascades: a modeling framework linking debris flow generation and network-scale sediment routing, *Earth Surface Processes and Landforms,* 44(*11*), 2126-2140.

Murphy B. P., Walsworth T. E., Belmont P., Conner M. M. & Budy P. (2020). Dynamic Habitat Disturbance and Ecological Resilience (DyHDER): modeling population responses to habitat condition, *Ecosphere*, 11(*1*), 1-26.

†David S., **Murphy B. P.**, Czuba J. A., †Ahammad M. & Belmont, P. (2022). USUAL Watershed Tools: a new geospatial toolkit for hydro-geomorphic delineation, Environmental Modelling & Software, 159, 105576.

*Wall S., **Murphy B. P.**, Belmont P. & Yocom, L. (2022). Predicting post-fire debris flow grain sizes and depositional volumes in the Intermountain West, USA, Earth Surface Processes and Landforms.

*Healy B. D., Budy P., Yackulic C. B., **Murphy B. P.**, Schelly R. C. & McKinstry M. C. (2022). Exploring metapopulation-scale suppression alternatives for a global invader in a river network experiencing climate change, Conservation Biology, 37(1), e13993.

*Fisher A., Belmont P., **Murphy B. P.**, MacDonald L., Ferrier K. L. & *Hu K. (2021). Natural and anthropogenic controls on sediment rating curves in northern California coastal watersheds, Earth Surface Processes and Landforms, 46(8), 1-19.

CURRENT FUNDING

Total Research Grants & Contracts: $189,500 CAD + $1,400,1922 USD

Lead / Sole Principal Investigator

- NSERC Discovery Grant (2021 – 2026), *Climate, erosion & sediment dynamics: Investigating controls on landscape evolution* (**$162,500 CAD**)
- National Science Foundation (2019 – 2023), Geomorphology & Land-use Dynamics, Co-PIs: Patrick Belmont, Jon Czuba, *Collaborative Research: Predicting post-wildfire sedimentation of reservoirs: probabilistic modeling of debris flow generation and downstream sediment routing* (**$480,033 USD**)
- BC Ministry of Forests (2022 – 2023), *Post-Wildfire Debris Flow Assessments in British Columbia* (**$27,000 CAD**)

Co-Principal Investigator

- Joint Fire Science Program (2020 – 2024), Larissa Yocom, **Brendan Murphy** & Patrick Belmont, *Evaluating fuel treatment efficacy in reducing risk of high-severity fire and downstream impacts* (**$445,159 USD**)
- Colorado Dept. of Transportation (2023-2025), Belize Lane, **Brendan Murphy**, Larissa Yocom & Patrick Belmont, *Planning and mitigation for direct post-wildfire sediment hazards to transportation infrastructure* (**$200,000 USD**)
- US Forest Service (2022 – 2027), Patrick Belmont, **Brendan Murphy** & Scott David, *Long-term planning to reduce wildfire risk to transportation infrastructure for US Forest Service* (**$60,000 USD**)
- Utah State Extension Water Initiative (2022 – 2024), Patrick Belmont, **Brendan Murphy**, Hope Braithwaite, Larissa Yocom & Scott David, *Reducing wildfire-related risks to water infrastructure in Utah* (**$75,000 USD**)
- Utah Dept. of Transportation (2022 – 2023), Patrick Belmont, Scott David & **Brendan Murphy**, *Proactive Planning Tool to Reduce Wildfire Erosion and Sedimentation Risks* (**$70,000 USD**)
- Utah Dept. of Transportation (2022 – 2023), Scott David, **Brendan Murphy** & Patrick Belmont, *A Geospatial Toolkit for Rapid Assessment of Post-wildfire Risks to Infrastructure* (**$70,000 USD**)

RESEARCH SUPERVISION

Direct research supervision (2020 – present): 3 postdocs, 5 graduates, 4 undergraduates

Postdoctoral Fellows

- Scott David, Utah State University, Dept. of Watershed Sciences, 2020 – present
- Muneer Ahammad, Utah State University, Dept. of Watershed Sciences, 2022 – present
- Justin Stout, Utah State University, Dept. of Watershed Sciences, 2020 – 2021

Graduate Students

- Jorrin Lenton, MSc, Simon Fraser University, Dept. of Earth Sciences, 2023 – present
- Casey Langstroth, MS, Utah State University, Dept. of Watershed Sciences, 2022 – present
- Alec Arditti, MS, Utah State University, Dept. of Watershed Sciences, 2020 – 2022
- Sara Wall, MS, Utah State University, Dept. of Watershed Sciences, 2019 – 2021
- Lauren Nickell, MS, Simon Fraser University, Dept. of Earth Sciences, 2021 – 2022 (dnf)

Undergraduate Students

- Yanik Nill, Simon Fraser University, School of Environmental Science, 2023 – present
- Kayla Holloway, Simon Fraser University, Dept. of Biological Sciences, 2022 – present
- Jorrin Lenton, Simon Fraser University, School of Environmental Science, 2021 – 2023
- Danica Rogers, Simon Fraser University, School of Environmental Science, 2022 – 2023

JEREMY G. VENDITTI

School of Environmental Science, Simon Fraser University
8888 University Drive, Burnaby BC, V5A 1S6, Canada
Cell: (604) 767.2247 **E-mail**: jeremy_venditti@sfu.ca

Educational Background

2003 Ph.D.	Physical Geography (Geomorphology), UNIVERSITY OF BRITISH COLUMBIA, Canada Initiation and Development of Sand Dunes in River Channels. (Supervisor: M.A. Church)
1997 M.Sc.	Physical Geography (Geomorphology), UNIVERSITY OF SOUTHERN CALIFORNIA, USA Spatial and Temporal Turbulence Structure over Sub-Aqueous Dunes: Field and Laboratory Experiments (Supervisor: B.O. Bauer)
1995 B.Sc.	Physical Geography, UNIVERSITY OF GUELPH, Canada Factors Affecting the Distribution of Heavy Metal Contaminants in Bed Sediments of Fraser Estuary (Supervisor: R.A. Kostaschuk)

Academic Positions

2019 – current	PROFESSOR, School of Environmental Science, Simon Fraser University
2019 – current	ASSOCIATE MEMBER, Department of Earth Sciences, Simon Fraser University
2019 – 2022	DIRECTOR, School of Environmental Science, Simon Fraser University
2016 – 2022	PROFESSOR, Department of Geography, Simon Fraser University
2013 – 2018	DIRECTOR, Environmental Science Program, Simon Fraser University
2014	VISITING ASSOCIATE, Geological and Planetary Sciences, Caltech
2012 – 2016	ASSOCIATE PROFESSOR, Department of Geography, Simon Fraser University
2006 – 2012	ASSISTANT PROFESSOR, Department of Geography, Simon Fraser University
2004 - 2006	POSTDOCTORAL SCHOLAR, Department of Earth and Planetary Sciences, University of California Berkeley

Most Significant Publications

Deal, E., **J.G. Venditti**, S. Benavides, †R.W. Bradley, Q. Zhang, K. Kamrin, J.T. Perron (in press). Grain shape effects in bed load sediment transport, Nature, 613: 298-302 (*on the cover of January 12 issue*).

Bradley, R.W., **J.G. Venditti** (2021). Mechanisms of dune growth and decay in rivers, Geophysical Research Letters, 48 (20), e2021GL094572

Hurson, M., **J.G.Venditti**, C. Rennie, E. Kwoll, K. Fairweather, D. Haught, K. Kusack, M. Church (2022). Amplification of plunging flows in bedrock canyons, Geophysical Research Letters, 49 (12): e2022GL098487.

Venditti, J.G., T. Li, E. Deal, E. Dingle, M. Church (2020). Struggles with stream power: Connecting theory across scales stream power. Geomorphology, 366: 106817, doi: 10.1016/j.geomorph.2019.07.004. (*Invited as part of 50th Binghamton Symposium*)

Li, T., T.K. Fuller, L. Sklar, K. Gran, **J.G. Venditti** (2020) A mechanistic model for lateral erosion of bedrock channel banks by bedload particle impacts. Journal of Geophysical Research – Earth Surface, 125: 1-30.

Bradley, R. and **J.G. Venditti**, (2017). Depth scaling of dunes, Earth-Science Reviews 165: 356–376, doi: 10.1016/j.earscirev.2016.11.004

Lamb, M.P. and **J.G. Venditti** (2016). The grain size gap and abrupt gravel-sand transitions in rivers due to suspension fallout, Geophysical Research Letters, 43: 3777–3785, doi:10.1002/2016GL068713.

Venditti , J.G., C.D. Rennie, J. Bomhof, R.W. Bradley, ***M. Little, M. Church (2014). Flow in bedrock canyons, Nature, 513: 534-537. doi:10.1038/nature13779.

Venditti, J. G., and M. Church (2014). Morphology and controls on the position of a gravel-sand transition: Fraser River, British Columbia, Journal of Geophysical Research - Earth Surface, 119, doi:10.1002/2014JF003147.

Career Highlights

RESEARCH

- One edited book, one atlas, 90 peer-reviewed contributions (including 4 in review), 9 conference proceedings, 15 technical reports & 10 data archives
- Articles in *Nature, Geophysical Research Letters, Earth Science Reviews, Geology, Journal of Geophysical Research, Water Resources Research* & *Sedimentology*
- 150+ conference presentations including 35 invited talks at major international conferences (AGU, GSA), keynote talks at symposiums & seminar talks at major research universities (Caltech, MIT, Illinois, Minnesota, Bremen, Wageningen, Potsdam, USGS)
- ~$7.2M in research funds from NSERC, CFI & industry and governments collaborations
- Supervised 58 research personnel supported by grants at SFU.
- International collaborations with scientists from Caltech, Woods Hole Oceanographic Institute, MIT, University of Washington, USGS, University of Texas at Austin, Wageningen, UMass Amherst, Berkeley, UC Santa Barbara, Durham, Wageningen
- Established the River Dynamics Laboratory at SFU
- Leading $5M interdisciplinary investigation of the Big Bar Landslide
- 75 media stories about my research since 2011

SERVICE

- Founding Director of School of Environmental Science
- Participation in Departmental (appointments, resources, graduate studies, tenure & promotions), Faculty (Dean's advisory, undergraduate curriculum) & University committees
- Host and organizer of 2011 conference *Coherent Flow Structures in Geophysical Flows at Earth's Surface* (120 participants; 21 Canadian, 22 European, 56 USA, 13 from Asia).
- Associate Editor *Sedimentology* 2011-2013
- Member of applied geomorphology advisory boards & expert witness in 3 court cases
- Reviewed manuscripts for *Science*, *Nature*, *Geophysical Research Letters, Geology & PNAS* amongst others

TEACHING

- Supervised 17 post-doctoral fellows
- Senior supervisor for 26 graduate & undergraduate theses (8 PhD, 15 MSc, 3BSc)
- Participation on 10 additional thesis committees (5 PhD, 5 MSc)
- External examiner on 5 graduate theses (Illinois, Wageningen, Victoria, SFU Earth Sciences)
- 23 upper & lower division undergraduate classes (990 students), including 5 field schools
- Development of disciplinary courses & interdisciplinary undergraduate & graduate seminars

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 6: Abbreviated Curriculum Vitae for Faculty

March 6, 2024

School of Environmental Science

Faculty of Environment

Abbreviated curriculum vitae for faculty

In addition to the committee members of the GPDC (see Appendix 5), the following CVs comprise the rest of the continuing faculty members of the School who will also be teaching in EVSC's graduate programs, once established.

Dr. Chelsea Little
Assistant Professor, School of Environmental Science, Simon Fraser University

Dr. Margaret Schmidt
Associate Professor, Department of Geography and School of Environmental Science, Simon Fraser University

Dr. Ruth Joy
Assistant Professor, School of Environmental Science, Simon Fraser University

Dr. Tara Holland
Senior Lecturer, Department of Geography and School of Environmental Science, Simon Fraser University

CHELSEA J. LITTLE
Chelsea_little@sfu.ca • www.littleecologygroup.ca

EDUCATIONAL BACKGROUND

PhD in Ecology, University of Zürich, Zurich, Switzerland 2019
Dissertation: Keystone shredders and the headwater stream meta-ecosystem; Advisor: F. Altermatt

MS in Ecology & Biodiversity, Université Montpellier II*, Montpellier, France 2014
MS in Biology, Uppsala University*, Uppsala, Sweden 2014
Thesis: Community, functional group, and species responses to decades of experimental warming in the High and Low Arctic; Advisors: J. Alatalo & E. Cooper, University of Tromsø
***** *Part of the dual-degree Erasmus Mundus Master Programme in Evolutionary Biology*

BA in Biology, Dartmouth College, Hanover, NH, USA 2009
Thesis: Effects of mine disturbance & contamination on pollination of subalpine wildflowers; Advisor: R. Irwin

EMPLOYMENT HISTORY

Simon Fraser University, Burnaby, BC, Canada January 2021-present
Assistant Professor, Schools of Environmental Science & Resource and Env, Management

University of British Columbia, Vancouver, BC, Canada 2019-2020
Killam Postdoctoral Research Fellow, Dept. of Zoology

BIOSKETCH

My research examines on how the spatial relationships among ecosystems influences their functioning and biodiversity. I use approaches from community, ecosystem, and landscape ecology to address this in both terrestrial and aquatic ecosystems, and in particular in watersheds. My current work focuses on: 1) the spatial signature of ecosystem processes in watersheds; 2) how animal movement contributes to resource heterogeneity on the landscape; 3) biodiversity and ecosystem function in freshwater ecosystems; and 4) the assembly of ecological communities and its relationship to structure, and function. I integrate data and insights from field-based experimental and observational techniques, laboratory experiments, simulation modeling, and data synthesis, using spatial and non-spatial statistics and meta-analysis so draw robust conclusions about key ecological processes.

AWARDS AND RECOGNITION (2017-2023)

Outstanding Paper Award ($390) 2020
Early Career Section, Ecological Society of America

Distinction for Doctoral Thesis ($1,300) 2019
University of Zurich, Faculty of Science

Outstanding Student Research in Ecology Award ($400) 2018
Student Section, Ecological Society of America

Best Aquatic Sci. Student Talk at ESA Annual Meeting ($400) 2017
Aquatic Ecology Section, Ecological Society of America

FUNDING (2017-2023)

Ecosystem Functioning in Watershed Meta-Ecosystems 2021-2025 $152,500
NSERC Discovery Grant & Launch Supplement

Little Ecology Group 2021 $95,000
SFU New Faculty Start-Up Grant

Killam Postdoctoral Research Fellowship 2019-2021 $104,000
Izaak Walton Killam Memorial Fund for Advanced Studies

GRADUATE SUPERVISION AS PRIMARY SENIOR SUPERVISOR

Masters in Resource Management (active): 1 student
Masters of Science (active): 1 stduent

SELECTED PUBLICATIONS (underline denotes Little Ecology Group trainee)

Schutz Z.B.D., **Little C.J.** (2023) Coleoptera Associated with Intermittent Streams and Their Riparian Zones in South Coastal British Columbia. *The Canadian Entomologist* e16.

Datry T., *et al.* (including **Little C.J.**). (2023) Causes, Responses, and Implications of Anthropogenic versus Natural Flow Intermittence in River Networks. *BioScience* 73:9–22.

Gareis J.A.L., *et al.* (including **Little C.J.**). (2022). Using Wikipedia Assignments to Teach Critical Thinking and Scientific Writing in STEM Courses. *Frontiers in Education* 7:905777.

Little C.J.*, Rizzuto M.*, Luhring T.M., Monk J.D., Nowicki R.J., Paseka R.E., Stegen J.C., Symons C.S., Taub F.B., Yen J.D.L. (2022) Movement with meaning: Integrating information into meta-ecology. *Oikos* 2022:e08892.

Mackay J., Nikiforuk K., Szojka M., **Little C.J.**, Fleri J.R., Germain R.M. (2021) Animals connect plant species and resources in a meta-ecosystem. *Landscape Ecology* 36:1621–1629.

Gounand I., **Little C.J.,** Harvey E., Altermatt F. (2020) Global quantitative synthesis of ecosystem functioning across climatic zones and ecosystem types. *Global Ecology and Biogeography* 29: 1139–1176.

Altermatt F., **Little C.J.**, Maechler E., Wang S., Zhang X., Blackman R.C. (2020) Uncovering the complete biodiversity structure in spatial networks: the example of riverine systems. *Oikos* 129:607-618.

Little C.J., Fronhofer E.A., Altermatt F. (2020) Nonlinear effects of intraspecific competition alter landscape-wide upscaling of ecosystem function. *The American Naturalist* 195(3):432-444.

Maechler E.*, **Little C.J.***, Wuethrich R., Alther R., Fronhofer E.A., Gounand I., Harvey E., Huerlemann S., Walser J.-C., Altermatt F. (2019) Assessing different components of biodiversity across a river network using eDNA. Environmental DNA 1(3):290-301.

Little C.J., Fronhofer E.A., Altermatt F. (2019) Dispersal syndromes can impact ecosystem functioning in spatially structured freshwater populations. *Biology Letters* 15:20180865.

Gounand I., **Little C.J.,** Harvey E., Altermatt F. (2018) Cross-ecosystem carbon flows connecting ecosystems worldwide. *Nature Communications* 9:4825.

Fronhofer E.A., et al (including **Little C.J.**) (2018) Bottom-up and top-down control of dispersal across major organismal groups. *Nature Ecology & Evolution* 2:1859-1863.

Bjorkman A.D., et al (including **Little C.J.**). (2018) Plant functional trait change across a warming tundra biome. *Nature* 562:57-62.

Little C.J. & Altermatt F. (2018) Landscape configuration alters spatial arrangement of terrestrial-aquatic subsidies in headwater streams. *Landscape Ecology* 33:1519-1531.

Little C.J. & Altermatt F. (2018) Species turnover and invasion of dominant freshwater invertebrates alter biodiversity-ecosystem function relationship. *Ecological Monographs* **88**:461-480.

Little C.J. and Altermatt F. (2018) Do priority effects outweigh environmental filtering in a guild of dominant freshwater macroinvertebrates? *Proceedings of the Royal Society B*: 285:20180205.

Gounand I., Harvey E., **Little C.J.**, Altermatt F. (2018) Meta-Ecosystems 2.0: Rooting the Theory Into the Field. *Trends in Ecology and Evolution* 33:36-46.

Little C.J., Cutting H.B.U., Alatalo J.M., Cooper E. (2017) Short-term herbivory has long-term consequences in warmed and ambient high Arctic tundra. *Environmental Research Letters* 12:025001.

CURRICULUM VITAE

Margaret Grace Schmidt
Department of Geography and School of Environmental Science, Faculty of Environment
Simon Fraser University, Burnaby, B.C. V5A 1S6
604-307-1543, margaret_schmidt@sfu.ca

Professional Employment

Sept. 2019 – current	*Associate Professor*, School of Environmental Science, SFU (cross-appointed with the Department of Geography)
Sept. 1998 - current	*Associate Professor*, Department of Geography, SFU

Education

Ph.D. (Soil Science), 1992. University of BC

M.Sc. (Forestry), 1986. Lakehead U.

B.Sc. (Agriculture, Resources Management Major), 1983. U. of Guelph.

Research Interests

Soil science; predictive soil mapping; modelling soil classes and soil properties; modelling soil carbon stocks, carbon saturation, and carbon sequestration; the impacts of forest management practices on forest soil properties and nutrient availability

Research Funding

2022-2023. Annual: $237500. Project title: Investigating crop and soil properties using remote sensing big data for supporting precision agriculture. Source: Mitacs Accelerate. Collaborators: Dr. B. Lu from SFU is the internship supervisor; I am the co-supervisor. B. Lu prepared the Mitacs Accelerate Proposal with input from myself. Dr. Lu will be the senior supervisor for the graduate students and postdoctoral fellows working on this project, and I will be a committee member and advisor with regards to soil properties and agriculture.
Institution of Co-Investigator(s): The partner organizations are Terramera Inc, and i-Open Technology.

2020-2023. Annual: $85,000. Project title: Developing predictive soil mapping approaches to support enhanced forest resource inventories and evaluate soil carbon sequestration in British Columbia. Source: Forest Innovation Program, Canadian Wood Fibre Centre, Natural Resources Canada. Collaborators: Dr. B. Heung from Dalhousie U. is the PI; I am one of 4 core team members.

2020-2021. Annual: $20,000. Project title: Enhanced evaluation of factors affecting soil carbon stocks and their response to management. Source: Ministry of Environment. Collaborators: Dr. C. Bulmer of the B.C. Ministry of Forests, Lands and Natural Resource Operations

2019-2020. Annual: $30,000. Project title: Evaluating soil carbon stocks and their variation in forest soils of the Kamloops area. Source: Ministry of Environment. Collaborators: Dr. C. Bulmer of the B.C. Ministry of Forests, Lands and Natural Resource Operations.

2018-2019. Annual: $30,000. Project title: Evaluation of digital methods for mapping soil carbon and to support predictive ecosystem mapping using lidar data. Source: **:** BC Ministry of Forests, Range and Natural Resource Operations. Collaborators: Dr. C. Bulmer of the B.C. Ministry of Forests, Lands and Natural Resource Operations.

2017-2018. Annual: $25,000. Project title: Predictive soil mapping- processes and characteristics of BC soils. Source: BC Ministry of Forests, Lands and Natural Resource Operations. Collaborators: Dr. C. Bulmer of the B.C. Ministry of Forests, Lands and Natural Resource Operations.

2016-2017. Annual: $18,000. Project title: Digital Mapping of Soil Parent Material, Development, and Attributes in the Kamloops Area. Source: BC Ministry of Forests, Lands and Natural Resource Operations. Collaborators: Dr. C. Bulmer of the B.C. Ministry of Forests, Lands and Natural Resource Operations

Graduate Supervision

Babak Kasraei. Evaluation of soil organic carbon sequestration potential, and stocks in BC and comparison of uncertainty estimation approaches in predictive soil mapping. PhD Sept. 2020 – present.

Adrienne Arbor. Comparing the performance of existing pedotransfer functions with machine learning-generated pedotransfer functions on BC soils. MSc. Sept. 2020 – present.

William Bethel. Use of remotely sensed data and machine learning to map moisture regime and ecosystem types near Kamloops, BC and in Nova Scotia. MSc. Sept. 2018 – 2021.

Babak Kasraei. High-resolution digital soil mapping for managed forests using airborne LiDAR data. MSc Sept. 2017 – July 2020.

Jin Zhang. Spatial distribution of soil class and soil pH in the Thompson-Okanagan Region, BC. MSc. Sept. 2014 – Nov. 2019.

Brandon Heung. Regional-scale digital soil mapping in British Columbia using legacy soil survey data and machine-learning techniques. PhD. Sept. 2013 – April 2017.

Maciej Jamrozik. Effects of bigleaf maple on the growth and morphology of mature conifers in the southern coastal forests of British Columbia. MSc. Sept. 2012 – Nov. 2016.

Chris Scarpone. Modelling of Exposed Bedrock and Soil Depth in the Critical Zone of Southern British Columbia. MSc. Sept. 2012 – Nov. 2015.

Ruth Joy

Assistant Professor · Graduate Program Chair of Ecological Restoration

School of Environmental Science, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada, V5A 1S6

rjoy@sfu.ca | http://www.sfu.ca/ rjoy

Education

Simon Fraser University — *Burnaby, BC*

PhD Statistics — *2010 - 2013*

- Advisor: Dr. Richard Routledge
  PhD Thesis: Methodology for analysing at-sea dive behaviour of a marine mammal

Simon Fraser University — *Burnaby, BC*

MSc Statistics — *2000 - 2002*

- Advisor: Dr. Richard Routledge
  MSc Thesis: Assessing infilling methods for missing data in spawning salmon estimates

University of Victoria — *Victoria, BC*

BSc Biology (Co-Op) — *1991 - 1996*

Professional Experience

2023 +	**Assistant Professor, Ecological Restoration Program Chair**, School of Environmental Science, SFU
2021-2023	**Assistant Professor Practitioner, Ecological Restoration Program Chair**, School of Environmental Science, SFU
2022-2027	**Adjunct Professor**, Faculty of Graduate Studies (Computer Science), Dalhousie University
2020-2025	**Adjunct Professor**, Department of Statistics and Actuarial Science, SFU
2014-2020	**Senior Marine Mammal Consultant**, SMRU Consulting, St Andrews University, Scotland
2010-2013	**PhD Student**, Department of Statistics and Actuarial Science, SFU
2002-2010	**Biostatistician**, Institute for the Oceans and Fisheries, University of British Columbia
2000-2002	**MSc Student**, Department of Statistics and Actuarial Science, Simon Fraser University
1996-2000	**Biologist**, Ministry of Environment, Nanaimo Regional Office

Academic Awards

2022	**Dean's Award of Excellence in Research**, Faculty of Environment, SFU

Research Interests

My general research interests are in developing quantitative methods to advance marine science, and make optimal use of emerging complex ocean data types and dynamical models. A few current research projects are:

Real-time data assimilative forecasting for Southern Resident Killer Whales : This work is focused on developing a forecasting system for pod movement of Southern Resident Killer Whales (SRKW) in the Salish Sea. We are developing a probabilistic forecasting system based on a state space model - an ensemble-based particle filter with online parameter estimation.

Acoustic whale detection using Machine Learning : The processing and analysis of hydrophone (acoustic) data streams allows for detection and classification of different whale types. We are using signal processing and convolutional neural nets to drive real-time data processing of high throughput data.

Analysis of Animal Movement Data : Bio-logging sensors record in-situ marine animal movement and behaviour on various time-scales. We are developing time series and signal processing approaches for analysing these data. Applications are being undertaken for hooded seals in the Eastern Arctic, and Double-crested Cormorants in the Strait of Georgia.

Grants & Scholarships

2024-2026	**Liber Ero Postdoc, Awarded to Peter Thompson**, Liber Ero Fellowship Program	*$170,000*
2023-2024	**Oil Spill Response, Conservation and Protection**, Fisheries and Oceans Canada	*$51,750*
2023-2025	**MITACS**, Awarded to MSc student A. Houwelling, JASCO Applied Sciences	*$ 95,000*
2022-2026	**Canada Nature Fund**, Fisheries and Oceans Canada	*$ 1.5 million*
2022-2026	**France Canada Research Fund and PhD Student Grant**, French Embassy and Ministry of Higher Education, Research and Innovation	*$ 112,000*
2022-2024	**NSERC MITACS Alliance Grant**, Government of Canada, Vancouver Fraser Port Authority	*$ 70,000*
2022-2023	**Environment and Climate Change Canada**, Canadian Wildlife Service	*$36,209*
2022	**MITACS**, Awarded to MSc student, J. Cormier, City of Port Moody	*$15,000*
2022-2023	**Ocean and Freshwater Science Contribution Grant**, Fisheries and Oceans Canada	*$ 70,000*
2021-2026	**NSERC Discovery Grant**, with Discovery Launch Supplement	*$ 152,500*
2021-2024	**NSERC DND Grant Supplement**, Department of National Defence	*$ 120,000*
2021	**Habitat Conservation Trust Fund**, BC Ministry of Environment and Climate Change	*$ 52,000*
2021	**MITACS**, MSc student K. Baril, Saturna Island Marine Research and Education Society	*$ 15,000*
2021	**MITACS**, MSc student A. Gheibi, Port of Vancouver ECHO Program	*$ 15,000*
2021	**MITACS**, MSc students M. Bouvier & V. Rani, CETUS Research and Conservation Society	*$ 30,000*
2020-2022	**Ocean and Freshwater Science Contribution Grant**, Fisheries and Oceans Canada	*$ 970,000*
2020	**Canadian Wildlife Service Equipment Grant**, Environment and Climate Change Canada	*$ 35,000*
2019-2022	**Ocean and Freshwater Science Contribution Grant**, Fisheries and Oceans Canada	*$ 1.1 million*
2019-2020	**Sea Mammal Research Unit Consulting and the Port of Vancouver**, MITACS	*$ 60,000*
2017-2020	**Habitat Conservation Trust Foundation**, Public Assistance Fund	*$ 7,000*
2016-2019	**National Geographic Society Waitt Grant**, Waitt Foundation	*$ 15,000*
2014-2016	**Elevate Post-doctorate Fellowship**, MITACS	*$ 120,000*
2006-2009	**Canadian Institute of Health Research Grant (R111)**, Health Canada	*$ 143,550*

Past and Present Post Doctoral Fellows

2024 +	**Peter Thompson**, School of Environmental Science	*SFU*
2023 +	**Bruno Padovese**, School of Environmental Science	*SFU*
2020 - 2023	**Paul Nguyen Hong Duc**, Co-supervised, School of Math and Statistics	*Carleton U*
2019 - 2022	**Marine Randon**, Department of Statistics	*SFU*
2020 - 2022	**Jennifer Wladichuk**, Co-supervised, Earth and Ocean Sciences	*UVic*

Current Graduate Students

2023 +	**Andrea Mendez Bye**, Co-supervised PhD, Marine Biology	*La Rochelle U*
2023 +	**April Houwelling**, MSc, Statistics	*SFU*
2023 +	**Lindsay Lalach**, MSc, Biological Sciences	*SFU*
2022 +	**Janine McNeilly**, MSc, Ecological Restoration	*SFU*
2022 +	**Sam Broadley**, MSc, Ecological Restoration	*SFU*
2022 +	**Mikayla Young**, MSc, Ecological Restoration	*SFU*
2022 +	**Rachel Fairfield Checko**, MSc, Ecological Restoration	*SFU*
2021 +	**Teng-Wei Lin**, MSc, Statistics	*SFU*
2021 +	**Fabio Frazao**, Cosupervised PhD, Computer Science Dept	*Dalhousie U*

CURRICULUM VITAE

Dr. Tara Holland, Lecturer

Department of Geography | School of Environmental Science
Simon Fraser University
8888 University Drive, Burnaby, BC, Canada V5A 1S6
tholland@sfu.ca | 604-880-9635

EDUCATION

2009 – 2014	**PhD Geography**, University of Guelph Thesis: "*Adaptation to climatic and socioeconomic change in rural regions: The case of the Prince Edward County wine sector*".
2003 – 2005	**MSc Geography**, University of Guelph Thesis: "*Landscape changes in a coastal lagoon system, Jalisco, Mexico: Implications for Barra de Navidad lagoon*".
2000 – 2003	**BA Environmental Studies and Geography**, Bishop's University
1992 – 1997	**BSc Biological Science** (Honours), University of Guelph

RESEARCH

CURRENT RESEARCH INTERESTS

- Pedagogy to encourage student motivation, engagement, and learning
- Climate change education
- Supporting multilingual learners in writing-intensive courses
- Curriculum and course-level decolonization and Indigenization
- Faculty teaching development; metacognition

PEDAGOGY RESEARCH PROJECT FUNDING

Grant	Start Year	End Year	Title	Funding Source	Total	Involvement	Collaborators
Amundsen Fellowship	2022	Current	Developing a Teaching Squares program: Impact on teaching practice in the Faculty of Environment	ISTLD	25000*	PI	
Teaching and Learning Development Grant	2021	2022	Assessing the impact of weekly low-stakes assessments on student motivation, engagement, and learning in two large-enrollment remote courses	ISTLD	3700	PI	

Teaching and Learning Development Grant	2020	2021	Measuring student improvement in climate literacy in a first-year interdisciplinary climate change course	ISTLD	5000	PI	Sharla Stolhandske, FIC
Teaching and Learning Development Grant	2018	2020	Effect of two-stage collaborative testing on student exam anxiety and performance	ISTLD	6000	Co-Investigator	Becky Cobb and Lara Aknin, Psychology, SFU

*Funding includes two course releases

PUBLICATIONS

(* = undergraduate student; ** = graduate student I supervised)

Refereed publications

Strubbe, L.E., Stang, J, **Holland, T**., Sherman, S.B., & Code, W. (2019). Faculty adoption of active learning strategies via paired teaching: Conclusions from two science departments. *Journal of College Science Teaching, 49*(1), 31-39

Holland, T. (2018). Impact of a departmental instructional skills course on graduate students' beliefs about science teaching and learning. *Journal of College Science Teaching, 47*(6): 57-65.

Holland, T., Sherman, S., & Harris. S. (2018). Paired teaching: a professional development model for adoption of evidence-based teaching practices. *College Teaching, 66*(3): 148-157.

Holland, T. and B. Smit. (2014). Recent climate change in the Prince Edward County, Ontario, Canada winegrowing region: Implications for a fledgling wine sector. *Regional Environmental Change*, *14*(3), 1109-1121.

Holland, T., Smit, B., and G.J.V. Jones. (2014). Toward a conceptual framework of terroir tourism: A case study of the Prince Edward County, Ontario wine region. *Tourism Planning and Development*, *11*(3), 275-291.

Cardille, J., White, J., Wulder, M., and **T. Holland**. (2012). Representative landscapes in the forested area of Canada. *Environmental Management*, *49(1),* 163-173.

Holland, T., Mariscal, J., Davidson-Arnott, R.G.D. and J. Cardille. (2011). Landscape Changes in a Coastal System Undergoing Tourism Development: Implications for Barra de Navidad Lagoon, Jalisco, Mexico. *Investigaciones geograficás 74,* 7-18.

Holland, T. and B. Smit. (2010). Climate change and the wine industry: Current research themes and new directions. *Journal of Wine Research 21*(2), 125-136.

Wulder, M., White, J., Hian, T., Coops, N., Cardille, J., **Holland, T**., and D. Grills. (2008). Monitoring Canada's forests—Part 2: National forest fragmentation and pattern. *Canadian Journal of Remote Sensing 34(6),* 563-584.

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 7: Feasibility Study

March 6, 2024

School of Environmental Science

Faculty of Environment

SFU OFFICE OF THE PROVOST AND VICE-PRESIDENT ACADEMIC

NEW PROGRAM FEASIBILITY STUDY (FS)

Name of Proposed Program:	Doctor of Philosophy (PhD) in Environmental Science
Date:	November 6, 2023
Name of Academic Unit:	School of Environmental Science
Date of Approval by SCUS/SGSC:	NOI approved on ____February 7, 2023__
Approval of FS by Faculty Dean:	
Contact Information:	Prof. Karen Kohfeld, sesdir@sfu.ca

HOW TO USE THE FS

New degree program approvals require a two-step process, which includes a Notice of Intent (NOI) and a Full Program Proposal (FPP). New certificate and diploma programs only require an FPP.

The NOI provides the rationale for the proposed program and a summary of key objectives and outcomes as they relate to curriculum. The NOI is intended to provide sufficient information so that others are able to comment constructively on the application.

The FPP provides full details of the proposed program, including an executive summary, credential recognition and nomenclature, program goals/objectives, curriculum/program content, operational resources, industry consultation, and evidence of student interest and labour market demand.

The FS is a planning tool to provide details on resource allocation and enrolment planning early in the process to ensure that consideration is given to how the proposed program will be resourced and become self-sustaining based on revenue and expenses, and how it fits into the Faculty's Strategic Academic Plan. The FS is used for internal purposes only and not for inclusion in final submissions to the Senate or Board of Governors.

STAGES

1. The NOI is developed (keep in mind the FS will be needed at the FPP stage).
2. The FS is developed at the same time as the FPP.
3. The FPP is reviewed and approved by SCUS/SGSC and the FS is reviewed by the Provost or delegate.
4. The FPP and FS are then both presented to SCUP for review.

Delete this box on the final copy.

NEW PROGRAM FEASIBILITY STUDY (FS)

RESOURCE ALLOCATION	COMMENTS	YEAR 1 (year of 1st enrolments)	YEAR 2	YEAR 3	YEAR 4	STEADY STATE
REVENUE						
Intended Tuition (domestic and international; additional for 200/300/400 division courses)		$8,604	$52,450	$75,600	$95,182	$117,890
Intended WIL, Co-op or Practicum Fees and Tuition		-	-	-	-	-
Intended Supplemental Course or Program Fees *(see note 1)*		-	-	-	-	-
TOTAL		$8,604	$52,450	$75,600	$95,182	$117,890
EXPENSES						
Faculty & Staff						
Anticipated Faculty (based on average academic expenditure per AFTE; indicate whether current or new faculty) *(see note 2)*		$24,000	$72,000	$102,000	$108,000	$108,000
Anticipated Teaching Assistants (FTE) *(see note 2)*		-	-	-	-	-
Anticipated Program Admin/ Coordinator (FTE; indicate whether current or new staff) *(see note 2)*		$5,334	$5,447	$5,559	$5,672	$5,672
Other Anticipated Staffing Resources (e.g. Advisors, Co-op Coordinator; indicate whether current or new staff) *(see note 2)*		-	-	-	-	-
Resources						
Anticipated Physical Space (indicate if different or new space is required; include comment on type of space and associated fees) *(see note 3)*		-	-	-	-	-
Anticipated Equipment and Software		-	-	-	-	-
Anticipated Library Resources		-	-	-	-	-
Anticipated Student Scholarships or Bursaries		-	-	-	-	-
Other Anticipated Operating Expenses (e.g. printing, advertising, recruitment, events, etc.)		-	-	-	-	-
TOTAL		**$29,334**	**$77,447**	**$107,559**	**$113,672**	**$113,672**
Surplus/Deficit *(see note 4)*		**-$20,730**	**-$24,997**	**-$31,959**	**-$18,489**	**$4,218**

NEW PROGRAM FEASIBILITY STUDY (FS)

ENROLMENT PLANNING	COMMENTS
If the proposed program will result in the redistribution of faculty, staff, space or other resources at steady state, how will this be achieved and how will existing programs be affected?	EVSC has sufficient faculty and staff to administer the proposed program but require support for space. EVSC currently has one office allocated to hold 12 people, for all postdocs, graduate students, and research assistants. It is currently fully occupied. We are projecting ~15 master's students and 8-12 PhD students at steady state, based on the current complement of faculty members. This would increase with additional faculty. This suggests that additional office space will be needed. Additionally, EVSC currently has one operational laboratory space that is being shared amongst three faculty members. Three additional laboratory spaces will come into operation over the next year. We hope, at a minimum, for university support so that these laboratory spaces will become operational and active, and that additional space for graduate students and postdocs will be identified so that we are able to support the research activities of incoming students.
Will the proposed program result in new and/or redistributed enrolment at steady state (e.g. new Provincially funded seats; new international students; redistributed enrolment from within the Faculty; redistributed enrolment from outside the Faculty)?	All enrollment in the program will be new enrollment.
How will students be recruited?	Students will be recruited from a wide range of external and internal advertisements, as is typical for research-based graduate programs. Additionally, students will be recruited from existing and growing collaborator faculty networks, which is also common for research-based graduate programs.
Where will students be recruited from (domestic or International, or predicted percentage of each)?	Domestic and international.
Other comments	The intended tuition calculations are based on an AFTE calculation for summer, fall and spring terms, and the anticipated steady-state headcount of PhD students is 10 (with the present faculty members). The anticipated Faculty costs are based on an Acad Exp/AFTE ratio value of $9,000. Anticipated Program Admin costs assume a CUPE grade 7 step 3 in the first year, then added step progressions in future years, realized at a proportion of 10% for the PhD program.

Notes:

1. Supplementary course fees must be approved by the Mandatory Supplementary Course Fee Advisory Committee per AD 3-12: https://www.sfu.ca/policies/gazette/administrative/ad3-12.html Submit request to the MSFC upon Senate approval.
2. Faculty and staff already in the academic unit are to be included as they would not be fully available to teach/work in other programs if they are teaching/working in the new program. For current faculty/staff, calculate their anticipated percentage dedicated to the proposed program. Also include new faculty and staff that would need to be hired to support the new program should current faculty/staff not exist or are fully subscribed.
3. For more information on SFU's Space Management Plan visit: http://www.sfu.ca/vpacademic/associate-vp-academic/space.html If you will require new space allocation beyond what can be provided by the department or Faculty submit a space request once FPP is approved at SCUP.
4. If there is a projected deficit, attach a memo outlining how it will be covered (i.e. Dean has agreed to cover the deficit).

SFU FACULTY OF ENVIRONMENT | OFFICE OF THE DEAN

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Burnaby BC Canada V5A 1S6
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www.sfu.ca/fenv

MEMORANDUM

Attention:	Dr. Dilson Rassier, Provost and Vice-President Academic
From:	Dr. Naomi Krogman, Dean, Faculty of Environment
Date:	February 6, 2024
Re:	School of Environmental Science funding for new MSc and PhD program
Pages:	1

Dear Dr. Rassier,

The Faculty of Environment's Dean's Office agrees to cover the funding shortfall in the shorter term for the School of Environmental Science's Graduate programs.

However, the School will make plans to cover any shortfalls in the medium and longer terms through increased undergraduate enrolment.

Sincerely,

Naomi J. Krogman

Naomi Krogman

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Doctor of Philosophy (PhD) in Environmental Science

Appendix 8: Sample Environmental Position Job Posting

March 6, 2024

School of Environmental Science

Faculty of Environment

Types of careers in science

Note

You may apply to job opportunities within Fisheries and Oceans Canada through a public service jobs account.

Fisheries and Oceans Canada (DFO) offers challenging career opportunities in many science streams in our Ecosystems and Oceans Science Sector.

The Treasury Board of Canada Secretariat's qualification standards for each of the occupational groups outline the mandatory minimum requirements. This includes the education necessary to perform the work in a given occupational group or classification. For example:

- researcher
- technician
- biologist
- chemist
- hydrographer

Most positions in the scientific and technical groups require a university degree and/or college diploma. Certain positions may also require:

- a professional accreditation, such as:
  - professional engineer (P. Eng)

    - clinical laboratory science (C.L.S.)
- membership in a professional regulatory body
- supervisory and management skills and experience

These specific requirements will be listed on job advertisements.

The occupational group structure shows how work is organized in the core public administration of the federal public service. There are various levels within an occupational group, such as:

- BI-02
- BI-03
- BI-04
- BI-05

Description of jobs in science

The following are examples of some of the jobs available in science at DFO.

▼ Researcher or research scientist (SERES)

Researcher or research scientist (SERES)

Research scientists come from a broad range of scientific disciplines, such as:

- physics
- ecology
- geography
- biochemistry
- mathematics
- marine biology
- fisheries science

- modelling and/or statistics
- chemical, biological, or physical oceanography or limnology

Their dynamic and challenging work environment involves:

- providing expert scientific advice and recommendations
- writing, reviewing and publishing:
  - reports
  - manuscripts
  - scientific papers
  - authoritative reviews
- designing, planning and implementing complex scientific studies and research projects
- producing meaningful conclusions respecting new scientific knowledge derived from participating in the:
  - statistical analysis of research data
  - interpretation of research findings
- contributing to the collection, synthetization and interpretation of a broad range of complex univariate and/or multivariate data

A career in federal science and research might be for you if you:

- see a future in:
  - mapping the ocean floor
  - studying ocean and freshwater species':
    - ecology
    - genetics
    - behaviour
    - physiology
  - understanding the effects of climate change
  - monitoring and forecasting the state of the ocean and freshwaters

- believe that scientific research forms the foundation for:
  - sound decision making
  - management of our marine and freshwater ecosystems
- want to learn more about Canada's oceans and freshwater systems

The Science Sector of DFO carries out research on Canada's:

- oceans
- marine resources
- aquatic ecosystems

Our research helps us understand how these ecosystems:

- function
- are impacted by human activities
- respond to disturbances like climate variability

For a research scientist position, you'll need a doctorate (PhD) in a specialized scientific discipline. For other biologist and physical science positions, you'll need a bachelor's and master's degree.

We recommended that, during your post-secondary studies, you:

- enroll in internships
- find summer jobs in relevant scientific fields
- actively participate in aquatic research projects

▼ Aquatic science biologist or advisor (BI)

Aquatic science biologist or advisor (BI)

Aquatic science biologists and advisors are from scientific disciplines, such as:

- aquatic biology and ecology

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DHI teaches the next generation of water engineers

For the past three weeks, we've had the pleasure of hosting a group of engineer students from DTU - Technical University of Denmark – Technical University of Denmark. The students had all signed up for the course 'Computer modelling for marine and coastal engineering', which DHI holds every year in collaboration with DTU.

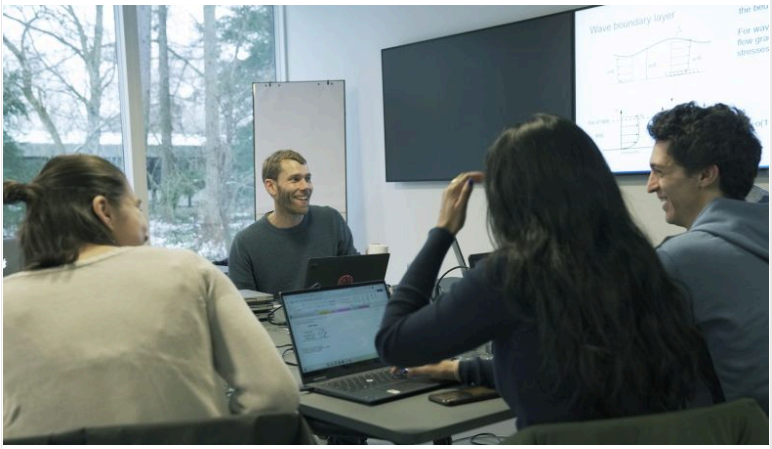
The students gained experience in using computer models to analyse phenomena such as flooding, dispersal of contaminants in the oceans and tsunamis. They also got the chance to work with DHI's renowned modelling tool MIKE Powered by DHI.

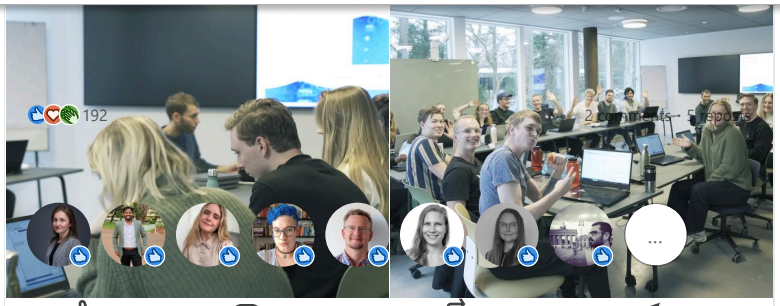
Students Marie, Peter and Dagmar were happy with how the course made the theory more tangible. 'It's been great to work with projects from the real world. We have for example studied currents and marine conditions around the construction project Holmene near Avedøre Holme in Denmark. The theory suddenly makes more sense.'

Over 80% of DHI people have a master's or PhD degree, and several of our colleagues at the Danish DHI offices also teach at DTU. 'By working with our computer models, the students get a chance to see theory applied in practice and also get a sense of what it means to work in an advisory engineering company. And we make contact with skilled students who are passionate about water,' explains Asger Bendix, Senior Coastal Engineer at DHI and one of the lecturers of the course.

It's all about enabling a sustainable future for water.

#academia #innovation #engineering #waterengineering #MIKEPoweredbyDHI





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Md. Rafiqul Alam • 3rd+ 2mo
Ex. Director General River Research Institute Faridpur,Bangladesh. Senior Consultant Laboratory Expert, CEGIS,Bangladesh

Congratulations for such a computer modelling course.

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Gabriela Mudrová • 3rd+ 2mo
Learning Specialist ve společnosti DHI

Asger is a great teacher! :)

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ESSA Technologies Ltd.

Climate Risk and Adaptation Specialist - Vancouver, BC or Ottawa, ON

Ottawa

The Opportunity

Climate change is fast becoming part of everything we do at ESSA. If you are a quantitative-minded individual interested in applying and growing your advanced knowledge of climate analytics, environmental, or earth sciences to increase the speed, scale, and thoughtfulness of adaptation then this posting is for you!

As a climate risk and adaptation specialist, you will work on projects at the nexus of climate change adaptation and fisheries/aquatic resource management, ecosystem conservation/restoration, cumulative effects assessment, adaptive management, nature-based solutions, and decision support system development.

To be considered, your training and skills will include analysis and interpretation of statistical models, analysis and modelling of climate change impacts, vulnerabilities, and risks (including programming/coding), and geospatial analysis blended with strong written and verbal science communication. We are particularly interested in someone with experience in at least two of the following: (1) indicator and modelling-based analysis of interactions between climate hazards and valued components (e.g., fish and/or wildlife and their habitats), (2) climate change vulnerability and risk assessment to inform adaptation planning, (3) nature-based approaches to climate adaptation, and (4) outreach and training delivery on 1-3. Experience developing (coding/programming) related decision support tools, including spatial user interfaces for these tools is a significant asset (e.g., R/Shiny, and preferably others).

This is a full-time opportunity based in either Vancouver or Ottawa. You will have access to our staff benefits, which offer competitive compensation, medical benefits, flexible working arrangements (hybrid workplace and opportunities for future home office placement), support for professional development, interoffice travel support to visit colleagues outside of Vancouver and Ottawa, and three weeks of paid vacation plus paid time off between Christmas and New Year's Day.

About Us

ESSA Technologies Ltd. (ESSA) is an employee-owned Canadian environmental consulting company

ecosystems and human communities". We achieve this mission by helping clients deal with tough, emerging problems, applying a neutral, thorough evaluation of evidence, encouraging diverse participatory processes, and collaboratively guiding our clients to make informed decisions that are designed to learn over time. Learn more about us at www.essa.com.

At ESSA, we are passionate about what we do and enjoy working with professionals who share our values and mission. ESSA's staff are purpose-driven problem solvers, big-picture critical thinkers, evidence-driven and motivated by an aspiration to become trusted advisors to our clients and make a difference in the world. In pursuing our corporate mission, we are inclusive of a diversity of perspectives and ways of knowing that may vary depending on experience, race, gender identity, age, disability status, sexual orientation, and religion amongst others.

You will be surrounded by a rich intellectual inheritance, and colleagues committed to collaboration and team-building that are:

· Working on wide-ranging interdisciplinary problems focused on complex interactions in socio-ecological systems, taking a holistic rather than reductionist perspective in organizing and understanding knowledge and data,

· Delivering rigorous and clear advice to our clients and internally to our own staff, and

· Resolving scientific uncertainty by combining analytical methods and technical facilitation, often with an Adaptive Management mindset.

Your Responsibilities

This position will involve playing supporting roles in both project work and business development. We outline some example responsibilities below:

Project support:

o Working on projects spanning a range of human contexts and ecosystems.

o Collaborating with clients and project contributors to understand, develop, and apply models, tools, and approaches to support climate resilient outcomes.

o Processing and analyzing statistically sound climate change projections across a wide range of climate indicators using large climate data sets, with the ability to downscale climate data and generate spatially explicit results.

o Integrating climate change indicators into other models of biophysical and/or socio-ecological systems (e.g., bioclimatic envelopes, stream temperature/hydroclimatic models, etc.).

o Conducting climate change vulnerability and risk assessments, with an emphasis on aspects of the natural environment (e.g., biodiversity, landscapes, waterways, natural assets, natural resources, and ecosystem services).

o Undertaking assessments of adaptation options for public and private-sector audiences that emphasize nature-based approaches.

o Developing, implementing, and presenting climate-informed geospatial analysis, across broad spatial scales from landscape to local scale (e.g., for predictions of habitat suitability, assessment of cumulative effects, or risk assessments, among many others).

o Providing technical leadership and direction in project design, including scoping and defining methods.

o Reporting on project progress and results during workshops and client meetings using strong written and verbal science communication.

o Mentoring other ESSA staff working on complex technical projects, enabling other individuals to do their best and grow.

o Occasionally travelling to attend and participate in client meetings, workshops, and site visits in

proposed project).
o Contributing to the development of training materials.
o Developing business opportunities through networking (e.g., by attending conferences) as you advance.

Requirements

· You possess or are about to complete a Master's or Ph.D. degree in environmental sciences, climate sciences, earth science, ecology, biology, resource management.
· You have real-world experience (i.e., non-course-based) applying quantitative methods and frameworks in natural resource and environmental stewardship.
· We envision that these responsibilities can be handled by and will be rewarding to an intermediate climate risk and adaptation specialist (i.e., **3-5 years** of prior relevant work experience following a Master's degree and/or a PhD). In light of our teaming needs (successful candidate will be reporting to other project leads and assigned intermediate level tasks), we are unlikely to consider candidates with more than 12 years' experience following obtaining their Master's or Ph.D.

Your differentiating skills may include the following:
· Prior experience (at least 3-5 years) in a private consulting environment or research institute.
· Registration or eligibility for registration with the College of Applied Biologists or other equivalent professional designation within six months.
· Work experience on climate change risk assessment, adaptation planning, vulnerability reduction, and capacity strengthening in developing nations.
· Software development / coding knowledge beyond R/Shiny.
· Proficiency in Spanish or French.

Applying

We offer a welcoming, inclusive workplace and commit to working with staff to help them thrive and prosper. Our total rewards program for employees provides competitive compensation, medical benefits, flexible working arrangements, and vacation, plus support for ongoing professional development.

Please email a cover letter and résumé to **careers@essa.com** by **February 23, 2024** with **"Climate Risk and Adaptation Specialist"** in the subject line. We will review applications and contact selected candidates by **February 27, 2023**. Interviews will be conducted between **March 4-7, 2024**. The target start is **March 25, 2024**.

All applicants must be eligible to legally work in British Columbia and/or Ontario at the time of applying.

Salary range: $75,000-$110,000.

Job Type: Full-time

Benefits:

- Casual dress
- Dental care
- Extended health care
- On-site parking
- Paid time off
- Vision care

Schedule:

- Monday to Friday

- Ottawa, ON K1S 1V7 (required)

Ability to Relocate:

- Ottawa, ON K1S 1V7: Relocate before starting work (required)

Work Location: In person
Expected start date: 2024-03-25

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Base pay range

$75K – $110K /yr (Employer est.)

$93K /yr Median

Ottawa

If an employer includes a salary or salary range on their job, we display it as an "Employer Estimate". If a job has no salary data, Glassdoor displays a "Glassdoor Estimate" if available. To learn more about "Glassdoor Estimates," see our FAQ page.

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OPPORTUNITIES

Join the **NumerixS Quant team.**

Joining our team means you'll be working with a complex, self-motivated, intelligent group of individuals. No matter where you're from, we welcome exceptional applicants of all types to join our team.

VANCOUVER, BC CANADA

Quantitative Analyst **(PhD** Required)

We are a data-driven company with a collegial atmosphere looking for team members who can do great work for application in the algorithmic trading industry.

Our ideal candidate is a recent (or soon-to-be) PhD graduate with experience in an academic or post-doc research workplace looking to apply their capabilities to the real world. Our approach is to train successful candidates about our industry, markets and products, as such we are looking for people seeking their initial foray in the financial markets.

About you

You are motivated by intellectual challenges, curiosity, and solving problems. You are performance and results driven. You continuously seek to understand new and better approaches to analyze and interpret 'dirty' data to improve investment results. You enjoy coding. You love to see your work put into practice. For individuals currently living outside of Vancouver, we offer relocation assistance.

What You'll Do

- Drive projects to completion that will contribute to an existing trading strategy
- Write code to automate every aspect of the trading system
- Code in Python and use relational time-series databases (kdb+)
- Analyze 'dirty' data sets to identify possible investment signals
- Develop predictive quantities to improve existing trading strategy
- Take charge of your own projects, while collaborating with

WHAT YOU BRING

- Mandatory: Ph.D. in mathematics, physics or related fields in quantitative disciplines with a Masters in the hard sciences (including if you will be graduating with a Ph.D. within the next 12 months)
- Highly analytical, keen attention to detail
- Innate curiosity and an exceptional critical thinker who is results-oriented
- Ability to implement your ideas in code
- Programming experience in Python
- Demonstrated expertise in statistics and mathematical modeling
- Strong communications skills (both verbal and written)
- Thrive in a performance-based environment
- Require excellence of yourself and in the work you produce

NICE TO HAVE

- Experience participating in national or international math, physics or computer science competitions is strongly preferred
- Strong experience with C++, Rand kdb+ and working in a Unix environment
- Legally entitled to work in Canada (however for exceptional candidates we can provide immigration assistance)

HOW TO APPLY

Apply online today to see if you're our newest Quantitative Researcher!

APPLY TODAY

Join Our Talent Community

If you are unable to complete this application due to a disability, contact this employer to ask for an accommodation or an alternative application process.

Spatial Fisheries Mgmt Modeling Support

Seattle, WA, US

30+ days ago
Requisition ID: 1599

Salary Range:
$28.00 To 38.00 Hourly

Spatial Fisheries Management Modeling Support

If you are unable to complete this application due to a disability, contact Ocean Associates at 703-388-9548 to ask for an accommodation or an alternative application process.

Ocean Associates Inc. (OAI) is seeking an applicant to provide Spatial Fisheries Management Modeling support to the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Northwest Fisheries Science Center (NWFSC), Conservation Biology (CB) Division in Seattle, WA. OAI is a Virginia corporation established in 2003 that provides consulting and technical services to the U.S. government, non-governmental organizations, international organizations, and the private sector. We specialize in scientific program and project management, strategic planning, professional and technical services, and stakeholder engagement, supporting government contracts.

Background

NOAA's National Marine Fisheries Service (NMFS) is responsible for the conservation and management of our Nation's living marine resources and their habitats. By developing high quality science and supporting an ecosystem-based approach to management, NMFS provides important services to the Nation,

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including sustainable fisheries, healthy ecosystems, safe seafood, and protected species recovery. In the Pacific Northwest Region of the US, the Northwest Fisheries Science Center (NWFSC) provides science in support of managing living marine resources along the US West Coast, including those that use interior watersheds that support anadromous fish such as salmon and steelhead.

The development of the offshore wind energy sector promises to create an entirely new use of the ocean and coastal ports along the US West Coast. The Federal government and the states of California and Oregon are pursuing an ambitious schedule for development of offshore wind. The Biden-Harris Administration set a goal of tackling the climate crisis by deploying 30 gigawatts (GW) of offshore wind energy nationwide by 2030 “while protecting biodiversity and promoting ocean co-use”, and this is intended to be a pathway to developing 110 gigawatts by 2050.

The Bureau of Ocean Energy Management (BOEM) is the lead federal agency for offshore energy development and leasing. BOEM seeks consultation from NMFS under the Endangered Species Act (ESA) and under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act or MSA) for essential fish habitat. Developers seek incidental take authorizations from NMFS under the Marine Mammal Protection Act (MMPA). Given their unique expertise in fisheries, living marine resources and their habitats, and the ecosystems in which they live, NMFS also may review and provide comments on potential impacts to our trust resources included in BOEM’s Environmental Assessments and Environmental Impact Statements prepared under the National Environmental Policy Act (NEPA).

Development of the offshore wind energy sector creates the need for a unique set of scientific research objectives to support NMFS’ management mandates and inform responsible and sustainable development of this new ocean-use sector. One of the groups best poised to support this research is the California Current Integrated Ecosystem Assessment (CCIEA), an interdisciplinary research effort led by NMFS and fueled by many staff at NWFSC. The CCIEA program’s goal is to provide science support for ecosystem-based management of the California Current, the productive large marine ecosystem along the US West Coast. Because the effects of offshore wind development will change over time, cross-cut multiple sectors, and span the full social-ecological system there is a need for strategic, ecosystem-scale science to inform decision makers and proactively deconflict ocean uses. The CCIEA provides a framework and delivery system for co-developed, integrative science products to inform management decisions that intersect ocean-use communities.

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At NMFS, a major question emerging from offshore wind development is: how will the population dynamics of commercial fisheries species change due to fisheries

closures associated with wind energy areas? More to the point, there is concern about how changes in population and ecosystem dynamics caused by wind energy development will affect the reliability of decision support tools such as stock assessments, which underpin harvest advice to fisheries managers. The focus of this position is to address these questions and concerns by improving knowledge around how offshore wind (OSW) development will affect fisheries stocks and ecosystem dynamics, including fisheries and fishing communities.

Description

The scope of this work is to lead activities and development of products that will improve our understanding of how offshore wind (OSW) development will affect fisheries stocks, in collaboration with CCIEA scientists. These activities and deliverables should result in better service to the public through analyses that inform stock assessments and harvest management advice. Focal activities will include: 1) identifying species most likely to be affected by OSW development through the displacement of commercial fishing; 2) developing population, multispecies and/or ecosystem models for species-of-interest; 3) developing spatial scenarios of current and likely areas for OSW development across the U.S. West Coast; and 4) simulating population, multi-species and/or ecosystem dynamics using the OSW development scenarios to identify how, and at what spatial scale, species' demographic parameters may change as a result of newly-closed fishing grounds. Parameters or measures of interest will likely include density, abundance, size- and age-structure, which are all important data used to inform and conduct NMFS stock assessments.

The main objective of this project is to lead development of an analytical framework to assess potential impacts to NMFS stock assessments and the rest of the ecosystem that could arise due to the displacement of commercial fishing effort from areas being developed by new ocean-use sectors such as OSW. This framework will enable more informed advice on the impacts of OSW development to NMFS stock assessments, commercially-important species and species interactions. This scientific advice will contribute to the responsible and sustainable development of OSW and other ocean-use sectors in the future, while simultaneously ensuring current fisheries management advice is well-informed of the potential risks of future spatial management scenarios.

Tasks

Task 1: Identify species of interest.

1. Organize discussion with CCIEA and NMFS stock assessment biologists on which species would most likely experience demographic changes due to displacement of commercial fishing effort in and around OSW development areas.
2. Narrow species list to subset compatible with selected models chosen in Task Two.

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3. Discuss and identify parameters of interest for reporting results.

Task 2: Develop population, multi-species and/or ecosystem models.

1. Review spatial fisheries management (e.g., marine protected area) literature for best-practices analyses and models capable of identifying changes in species' population demographics inside and outside areas closed to extractive activities, such as fishing.
2. Organize discussion with CCIEA team to finalize selected model(s).
3. Lead and coordinate development of population, multi-species and/or ecosystem models.

Task 3: develop spatial scenarios of OSW development.

1. Create spatial data layers that include all known West Coast BOEM lease areas and estimated energy to be derived from each area (in order to anticipate additional lease areas that may be needed in the future to meet state and federal OSW goals).
2. In collaboration with the NMFS West Coast Offshore Wind Energy Coordination (OWEC) team, identify areas across the US West Coast that will most likely be areas of future OSW development.
3. In collaboration with the NMFS West Coast Offshore Wind Energy Coordination (OWEC) and CCIEA teams, create scenarios of OSW development based on results from Tasks 3.1 and 3.2 and state and federal goals and timelines (i.e., < stated federal and state goals, equal to goals, or > goals).
4. If timing allows, consider spatial-closure scenarios that vary substantially in spatial coverage and configuration across the U.S. West Coast in order to understand the magnitude and spatial arrangement of development that would be required to alter population demographics or ecosystem dynamics.

Task 4: Simulate and report model dynamics using the OSW development scenarios.

1. Simulate model dynamics across scenarios from Task 3.
2. Summarize prioritized demographic parameters for species-of-interest across each OSW scenario.
3. In collaboration with the CCIEA team and NWFSC stock assessment biologists, develop final figures and text for a manuscript reporting the results.

Deliverables

Deliverables shall relate to the above tasks and will include, but not necessarily be limited to, the following:

1. Develop a prioritized list of targeted fisheries species or other ecologically-important species according to the importance of understanding how OSW will affect their demographics.
2. Organize and summarize the pros and cons of various models that can be used

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to identify changes in demographic parameters related to the displacement of fishing effort inside and outside closed areas.
3. Develop well-documented and shareable code for selected models.
4. Develop metadata and spatial data layer files that organize the identified OSW development scenarios.
5. Produce a manuscript that summarizes the results of the selected model(s) under each OSW development scenario.

Start Date: As soon as possible. Preference will be given to candidates who apply before January 15, 2024.

Location: Northwest Fisheries Science Center Seattle, WA. Remote work will be considered for the right candidate, but periodic on site, in person, work may be needed.

Travel: Travel is anticipated and authorized for this order. Domestic travel may be required for regional meetings and conferences to discuss and present project related work and objectives.

Salary and Benefits: This is a full-time position with benefits. Salary, commensurate with experience, between $34.00 - $38.00 per hour.

Requirements

Applicants must have the following minimum requirements:

- PhD degree from an accredited college or university with a major directly related in a field of study as related to the requirements of this position with emphasis in marine science, fisheries, quantitative ecology, oceanography, data science, or similar fields; or, equivalent relevant experience.
- Demonstrated proficiency and experience with data management and statistical analysis, with statistical software such as R, MATLAB, etc. and/or programming languages such as Python.
- Demonstrated proficiency and experience working with and developing spatial population, multi-species, or ecosystem modeling frameworks.
- Demonstrated proficiency and experience working with spatial software tools such as GIS or spatial packages in R.
- Good communication, coordination, and collaboration skills, and a willingness to learn new skills, update existing skills, and share skills with colleagues in the CCIEA team.
- Basic computer skills (MS Office, etc.).
- Excellent verbal and written communication skills.
- Ability to work effectively both individually and collaboratively in a team/group setting.
- Ability to receive constructive feedback and implement appropriate action.

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If you are interested in being considered for this position, please APPLY THROUGH OUR ADP WEB PORTAL, AT THE LINK AT THE TOP RIGHT OF THIS PAGE.

Only qualified applicants that meet minimum experience or background requirements stated above need apply. When applying for this position you will be asked to upload your resume at the end of this online application.

Applicants should submit a resume that includes the following:

- Cover letter that briefly describes how you meet the required and preferred qualifications listed.
- Work history for past 10 years or since last full-time education.
- Education.
- Previous experience or training with similar requirements.
- Three professional references.
- Include your name in the document file name.
- Upload your resume in readable, not scanned, PDF or Word format (PDF is preferred).

In compliance with federal law, all persons hired will be required to verify identity and eligibility to work in the United States, complete the required employment eligibility verification document form upon hire, and successfully complete a federal government background check. Ocean Associates Inc. is an Equal Opportunity Employer and does not unlawfully discriminate on the basis of any status or condition protected by applicable federal or state law.

OAI is a government contractor and is required by law to invite applicants to self-identify their race, gender, national origin, disability status and veteran status. OAI is required to use the information it collects as part of its future affirmative action efforts in hiring. The information is collected anonymously by computer and is not connected to your application. You will see a place to check certain boxes in OAI's online application. Even though the information is anonymous, self-identification is voluntary. You can always check the box that says you decline to self-identify.

Note: If you are not selected, your materials may be retained for present or future opportunities. We may use your resume in bidding on a project and if we are awarded the work, we will contact you before seeking further applicants. If you do not wish us to retain or use your resume to seek work for you, please let us know in the "Notes" section on the second page of the online application.

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