MEETING OF THE FACULTY COUNCIL OF THE FACULTY OF SCIENCE

A regular meeting of the Faculty Council of the Faculty of Science will be held on Wednesday, March 18, 2015, at 1 p.m. in C-2045.

AGENDA

1. Regrets
2. Adoption of the Minutes of February 18, 2015
3. Business Arising from the Minutes
4. Correspondence: None
5. Reports of Standing Committees:
   A. Undergraduate Studies Committee:
      a. Department of Chemistry, calendar changes, amendment to the Chemistry major and honours programs: deletion of the language recommendations, paper 5.A.a (11 pages).
   B. Graduate Studies Committee:
      a. Grenfell Campus, new program proposal, Agriculture, Forest, and Environmental Science (MSc AFES), motion passed via email by Science Faculty Council, paper 5.B.a (76 pages), included for information only.
      b. Department of Psychology, calendar changes, comprehensive exam process, paper 5.B.b. (4 pages).
   C. Nominating Committee: None
   D. Library Committee: None
6. SGS new program proposal: Proposed regulations governing 4+1 Accelerated Master’s Programs, paper 6 (11 pages).
7. Reports of Delegates from Other Councils
8. Report of the Dean
9. Question Period
10. DELTS Professional Development Focus on Teaching, the teaching dossier: Allyson Hajek
11. Adjournment

Mark Abrahams
Dean of Science
FACULTY OF SCIENCE
FACULTY COUNCIL OF SCIENCE
MINUTES OF MEETING OF FEBRUARY 18, 2015

A meeting of the Faculty Council of the Faculty of Science was held on Wednesday, February 18, 2015, at 1:00 p.m. in room C-2045.

FSC 2321 Present
Biochemistry
Booth, V. Mulligan, M.

Biology
Innes, D.

Computer Science
Gong, M.

Mathematics & Statistics
Loredo-Osti, J.C. Radford, C. Sullivan, S.

Ocean Sciences
Fletcher, G.

Psychology
Martin, G.

Dean of Science Office
Abrahams, M. Foss, K. Rideout, J. Surprenant, A.
Zedel, L.

Geography
Catto, N.

DELTs
Todd, A.

FSC 2322 Regrets
David Pike Erin Alcock Donna Stapleton Katie Doyle

FSC 2323 Adoption of Minutes
Moved: Minutes of the January 21, 2015, meeting be adopted as amended. (Sullivan/Martin). Carried.
FSC 2324 Business Arising:
   a. Department of Ocean Sciences, updates to new Minor Program in Oceanography.
   b. Department of Ocean Sciences, updates to new Minor in Sustainable Aquaculture and Fisheries Ecology.

FSC 2325 Correspondence: None

FSC 2326 Reports of Standing Committees:
   A. Undergraduate Studies Committee: None
   B. Graduate Studies Committee:
      Report presented by J.C. Loredo-Osti, Chair, Graduate Studies Committee
      a. Moved: Grenfell Campus, new program proposal, Agricultural, Forest and Environmental Science (MSc AFES). Motion was tabled since the Faculty of Science Environmental Science Board was not consulted. Item will be added to a future Council agenda.
   C. Nominating Committee: None
   D. Library Committee: None

FSC 2327 Reports of Delegates from Other Councils: None

FSC 2328 Report of the Dean
Presented by Mark Abrahams, Dean.

A decision was made that the institutional application for the Canada First Excellence Research Fund to be submitted on March 2 will be from the Faculty of Engineering to pursue a naval engineering theme. This decision was based upon the state of preparation of their proposal relative to those originating from other faculties. The remaining proposals may be submitted in the second round.

Multiple applications have been received for the teaching chairs. These applications will be ranked and sent forward to the Provost’s office.

The Faculty of Arts and the Faculty of Science have pooled resources to support an application by the Chief Information Officer to add additional wireless routers to insure wireless access throughout the Science building. The outcome of this initiative will be known within the next few months.

Statoil has agreed to make a donation of used scientific equipment for use in our teaching laboratories. This instrumentation will benefit students in the departments of Biology and Biochemistry. Statoil will provide the equipment and ship it from Europe to St. John’s. The Faculty of Science will pay to make the
equipment compatible with North American power. Technical Services have reviewed the equipment and advises that in most instances technical resolutions should be minor.

There has been much discussion about the implication of declining oil revenues on the provincial budget and the ramifications for the university. The Dean’s expectation is that the university’s budget will likely remain flat for the next fiscal year and that the impact on future budgets will be determined by whatever political party takes power in the next provincial election in combination with the long-term trends in oil prices.

FSC 2329  Question Period

FSC 2330  Adjournment
The meeting adjourned at 1:14 p.m.
March 9, 2015

TO: All Members, Faculty Council of Science

FROM: Rob Nolan, Secretary
       Committee on Undergraduate Studies, Faculty of Science

SUBJECT: Calendar Changes and New Course Proposals

At a meeting held on March 6, 2015, the Undergraduate Studies Committee of the Faculty of Science agreed that the following new program proposals and Calendar changes be forwarded to Faculty Council for approval:

1. Department of Chemistry
   a. Amendment to the Chemistry major and honours programs: deletion of the language recommendations

Rob Nolan
Associate Registrar and
Secretary: Committee
on Undergraduate Studies,
Faculty of Science
Proposal

Amendment to the Chemistry major and honours programs: deletion of the language recommendations

Resource Implications: Instructional Costs

None. Language courses have been recommended and not required and have no effect on instructional costs in the chemistry department.

Resource Implications: Library Holdings and/or Other Resources Required

None.

Signature of Unit Head (if appropriate): ________________________________

Date: __________________________________________________________________

Signature of Dean/Associate Vice-President (Academic)/Vice-President: ________________________________

Date: __________________________________________________________________
RATIONALE FOR CHANGES

B.Sc. and B.Sc. (Hons) programs in chemistry have historically included a recommendation of six credit hours in French, German or Russian to give students going on to graduate school a working knowledge of at least two of these languages. Years ago, graduate students needed to be able to translate research papers into English sufficiently well to extract important information from them. Nowadays, this is no longer needed as essentially all important research is published in English. Students often feel that recommended courses are important enough to fit in their program. Dropping the language recommendations will increase flexibility of choice for program electives.

CONSULTATIONS

Grenfell
Marine Institute
Mathematics and Statistics
Computer science
Physics
Biochemistry
Biology
Psychology
Ocean Sciences
Earth Sciences
Pharmacy
Engineering
Human Kinetics
Library
Faculty of Arts
COURSE DELETIONS AND ADDITIONS

None

CHANGES TO CALENDAR REGULATIONS

None.

CALENDAR REVISIONS

9.3.4 General Degree - Major in Chemistry

Recommended courses: Biochemistry 2101, Mathematics 2051, Physics 2820 and/or 2750, and 6 credit hours in one of the following languages: French, German, or Russian.

9.3.5 Honours Degree in Chemistry

9.3.5.2 Other Information

1. Those courses in which a grade of B or an average of 75% or higher are required, as specified in Regulations for the Honours Degree of Bachelor of Science, Academic Standing, clause a., are the courses beyond first year used to satisfy clause 1. under Required Courses above.

2. Recommended courses: Biochemistry 2100, Biochemistry 2101, Mathematics 2051, Physics 2820 and/or 2750.

3. A thesis based on a selected research topic carried out under the supervision of a member of the Department is to be submitted in the final year.

4. Chemistry 490A/B will normally require the equivalent of nine hours per week for two semesters. Registration in Chemistry 490A/B is restricted to those students who have honours standing. The Honours dissertation will be assessed by a committee comprising the supervisor and one other faculty member.

5. With approval of the Heads of the Chemistry and Biochemistry Departments prior to registration, a number of courses in Biochemistry may be substituted for a like number of Chemistry courses.

6. Six credit hours in one language are recommended: French, German or Russian should be selected in consultation with the Department Head.

SUMMARY PAGE FOR SENATE
Approval Form

Program Title

General Degree - Major in Chemistry
Honours Degree in Chemistry

Summary of Changes

The recommended language courses for the General Degree - Major in Chemistry and Honours Degree in Chemistry (six credit hours in French, German or Russian) are to be deleted.

Consultations Sought From

<table>
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<tr>
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<th>Comments Received</th>
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<tr>
<td>Grenfell</td>
<td>yes</td>
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<td>Marine Institute</td>
<td>yes</td>
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<tr>
<td>Mathematics and Statistics</td>
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<td>Ocean Sciences Centre</td>
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<td>Earth Sciences</td>
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<td>Pharmacy</td>
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<td>Engineering</td>
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<tr>
<td>Human Kinetics and Recreation</td>
<td>no</td>
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<tr>
<td>Faculty of Arts (French/Spanish and German/Russian)</td>
<td>yes</td>
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</tbody>
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Library Report Received

yes

Approved by Dean, Associate Vice-President (Academic) or Vice-President

Yes/No

Name

------------------------------------------

FOR OFFICE USE ONLY

4
APPROVAL GRANTED BY SENATE COMMITTEE ON UNDERGRADUATE STUDIES

Chair: 

Secretary: 

Date: 

Initial consultation email sent by chemistry:

Date: Wed, 19 Nov 2014 14:41:48 -0330
From: Chris Flinn <cgflinn@mun.ca>
Reply-To: Chris Flinn <cgflinn@mun.ca>
Subject: Consultations on a minor change to the chemistry major andhonours programs trial #2
To: associatevpooffice@grenfell.mun.ca, miugconsultations@m mun.ca, mathconsult@mun.ca, cs-chair@mun.ca, Engineering Consultations <engrconsult@mun.ca>, Karen Morris <morrisk@mun.ca>, jhanchar@mun.ca, fletcher@mun.ca, Psychology.Head@mun.ca, pharminfo@mun.ca, bdeyoung@mun.ca, "Alcock, Erin" <ekalcock@mun.ca>, stacey m @mun.ca, dinnes@mun.ca, biochea d@mun.ca

Hello Everyone,
This is a request for consultations on deletion of the language
recommendations for the chemistry major and honours programs. Please respond as soon as you can. This is a very minor change. Sorry about the attachment!

Thanks,

Chris Flinn
Deputy Head, Undergraduate studies
MUN Chemistry Department

Consultation email responses

Department of biology

Hi Chris,
The Biology Undergraduate Studies Committee reviewed the proposed change of
removal of the language recommendations in the Chemistry major and honours programs and have no concerns with such a change.

Thanks
Karen

Karen Morris
Undergraduate Officer
Department of Biology
Memorial University of Newfoundland
St. John's, NL A1B 3X9
709-864-8021

Faculty of Engineering

Dear Dr. Flinn,

Unfortunately your consultation request arrived less than one hour after this month's regular meeting of our Committee on Undergraduate Studies. The next meeting is not scheduled until January.

As the Chair of the Committee I can inform you that I do not see any direct impact on the programs of the Faculty of Engineering and Applied Science from the proposed removal of the language courses in the list of recommended courses in the Chemistry programs.

Yours sincerely,

Dr. Glyn George, Chair
Committee on Undergraduate Studies
Faculty of Engineering and Applied Science
Memorial University of Newfoundland
St. John's NL A1B 3X5

Department of Biochemistry

Chris

Biochemistry has no issues with removing the language recommendations.

Mark

Mark D. Berry Ph.D.
Professor and Head
Dept. Biochemistry
Memorial University of Newfoundland
St. John's, NL, Canada A1B 3X9
Tel: (709) 864-8529  
E-mail: biohead@mun.ca; mterry@mun.ca

Grenfell

Dear Dr. Flinn,

Just a quick note to say I have received comments from several chemistry faculty in favour of this change.

Dr. R. Gallant  
Head of Division of Science, Grenfell Campus, Memorial University

Marine Institute

Chris,

Thank you for the opportunity to review the proposed changes to the Chemistry Programs regulations. The changes to the regulations will have no impact on the programs offered here at the Marine Institute.

All the best,

Derek

Derek Howse  
Chair, Undergraduate Studies Committee  
Marine Institute, Memorial University  
TEL: 709-778-0586  
FAX: 709-778-0394  
Derek.Howse@mi.mun.ca

Pharmacy

Hello Dr. Flinn  
I am writing to advise that the School of Pharmacy has no concerns or comments regarding your department's proposed calendar changes.  
Regards,  
Csop Glew

CSOP GLEW, Hon. B.A., M.U.P.  
MANAGER OF ACADEMIC PROGRAMS  
School of Pharmacy  
Memorial University of Newfoundland  
St. John's, NL  
A1B 3V6  
Health Sciences Centre  
Room H3435
French/Spanish and German/Russian

This email with attachment has been sent to you on behalf of Dr. John Buffinga (Department of German and Russian) and Dr. Anne Thareau (Department of French and Spanish).

The original of the letter has been mailed directly to Dr. Chris Flinn, Deputy Head, Undergraduate Studies, Chemistry Department.

Beverly

Beverly Evans-Hong

Administrative Secretary

Department of German and Russian

Department of German and Russian
St. John’s, NL Canada
A1B3X9 Tel: 709 864
8631 Fax: 709 864
4000 germruas@mun.ca
www.mun.ca

November 25, 2014

Dr. Chris Flinn
Deputy Head, Undergraduate
Studies MUN Chemistry
Department

Dear Dr. Flinn,

Thank you for requesting consultations on your proposal for the deletion of the language recommendations for the Chemistry Major and Honours programs.

As representatives of the Departments of French and Spanish and German and Russian, we do not feel that this proposal will affect us greatly in terms of numbers. However, we do want to register our discontent with this proposal and to explain to you some of our reasons for this.
First of all, the 6 credit hours in one of French, German or Russian are currently recommended for the Chemistry Major or Honours, along with courses in Biochemistry, Mathematics and Physics. They are not currently required courses. However, removing the language courses from the recommended list of courses does not really give the students increased flexibility in terms of their electives, but merely sends the signal that Chemistry does not really see any merit in language courses beyond the strictly utilitarian function of "extracting information from them," as it says in your Rationale. This "language-is-not-necessary" attitude underlines the misconception that being born a native speaker of English is the ultimate academic blessing, and since nowadays "all important research is published in English" (your Rationale) in any case, why should Chemistry students be encouraged to learn a second language at all?

To remove languages from your list of recommended courses constitutes agreement or surrender to the attitude that learning a second language is not useful, not beneficial, and ignores the ways in which learning languages can help open up a student's future economically, culturally and socially. Students who are competent in a language relevant to their professional field are more likely to be considered for employment in multi-national companies, as countless studies indicate. In the Canadian context, this means that many Canadian scientists are working abroad.

Aside from the practical applications of learning a language, however, we are even more disturbed by the denial of the intellectual dimension of learning another language and its cultural context, which is also implied by your Rationale. To ignore this aspect of education is tantamount to an intellectual shoulder-shrug. As a result
of your proposal. Chemistry students will have even less exposure to disciplines traditionally associated with the Humanities and the Arts whose primary mandate is to produce well-rounded students who can think critically, and who have the research, analytical and communications skills to succeed in our rapidly changing world.

Sincerely,

Dr. John O. Buffinga, Head
Department of German and Russian

Dr. Anne Thureau, Head
Department of French and Spanish

For these reasons, the language component for Chemistry Majors and Honours should

Library

Hi Chris,

Hoping an email will suffice on this one. No real influence on the library here.

Best,

Erin

Erin Alcock
Science Research Liaison Librarian
QE2 Library
Memorial University of Newfoundland
ekalcock@mun.ca
709-864-8316
As a follow-up to the email below, Dr. Abrahams wishes to advise that Science Faculty Council has passed the motion to approve the new program proposal at Grenfell campus in Agricultural, Forest and Environmental Science (MSc AFES) in principle on condition that Dr. Catto is given the opportunity to meet with the proponents of the Proposal and the Review Committee prior to the submission of their final report to the SGS, and before final presentation to the SGS Academic Council and Senate as stated below.

The message below from Dr. Abrahams, containing additional information re the above proposal, should replace the previous message. Again, please ensure votes are submitted by return email to deansci@mun.ca no later than 5 p.m. Wednesday, February 25. Apologies for any inconvenience.
Heads' Assistants – please distribute to all Faculty members in your unit.

Mary

At Science council on Wednesday, February 18 we tabled the motion regarding the new program proposal at Grenfell campus in Agricultural, Forest and Environmental Science (MSc AFES). The concern at the time was that there was insufficient time to thoroughly review the proposal.

Since that time, I have been advised by the Dean of Graduate Studies that they were not seeking approval of the specifics of the program, but support in principle for the proposal. The proposal will be subject to review by a committee appointed by the Dean of Graduate Studies that includes two internal reviewers, two external reviewers, and a registered graduate student.

The report of the review committee and the revised proposal will return to the School of Graduate Studies (SGS) Academic Council and Senate for final debate and approval.

Following consultation with Dr. Norm Catto and the Dean of the School of Graduate Studies, the motion to Science Faculty Council is to approve the program in principle, on condition that Dr. Catto is given the opportunity to meet with the proponents of the Proposal and the Review Committee prior to the submission of their final report to the SGS, and before final presentation to the SGS Academic Council and Senate. I am requesting that members of Science council vote on this motion by return email by 5 pm, Wednesday February 25 whether they do or do not support the proposal in principle. The proposal is available for viewing at [http://www.mun.ca/science/faculty_staff/faculty_council/2015/FSFC_Agenda_February_18_2015.pdf](http://www.mun.ca/science/faculty_staff/faculty_council/2015/FSFC_Agenda_February_18_2015.pdf)

You can include any commentary on the proposal with your vote that you wish to be forwarded to the School of Graduate Studies.

Sincerely,

Mark Abrahams, Professor & Dean
Faculty of Science
Memorial University of Newfoundland
St. John's, NL
A1C 5S7 CANADA

Phone: (709) 864-8153
FAX: (709) 864-3316
email: deansci@mun.ca
December 22, 2014

Dr. Len Zedel  
Associate Dean (Research & Graduate)  
Faculty of Science  
Memorial University of Newfoundland  
St. John’s, NL

Dear Dr. Zedel,

It is with pleasure that I am forwarding to you a copy of the proposed MSc in Agricultural, Forest and Environmental Science (MSc AFES) program being developed for the Grenfell Campus as a part of our Boreal Ecosystem Research Initiative (BERI).

The proposal has been developed with the assistance of the Divisions of Science and Social Science at Grenfell Campus, and the support of the Department of Natural Resources, Government of NL, the Canadian Forest Service, and Agrifoods-Agriculture Canada.

It is our hope that this program will be well regarded by the university community and external stakeholders as Grenfell Campus pursues increasing research capacity and graduate programming.

It would be very much appreciated if you could circulate this proposal to your faculty for feedback, and we would like to hear whether the Faculty of Science at Memorial University’s St. John’s Campus would be willing to support this program proposal as it progresses through the academic approval process. We would like to receive feedback as quickly as possible to assist in bringing this forward to Senate in January.

Thank you for considering this request, and if you have questions or would like to discuss this further, please feel free to contact me at your convenience.

Regards,

Robert Gallant, PhD  
Associate Professor  
Head, Division of Science

Attachment
New Graduate Program Proposal
Memorial University of Newfoundland

Master of Science in Agricultural, Forest and Environmental Science (MSc AFES)

Division of Science, Grenfell Campus
Dr. Robert Gallant, Head of Division
Email: rgallant@grenfell.mun.ca

Division of Social Science, Grenfell Campus
Dr. Sandra Wright, Head of Division
Email: swright@grenfell.mun.ca

Boreal Ecosystem Research Initiative, Grenfell Campus
Dr. Antony Card, AVP (Research), Grenfell Campus
Email: acard@grenfell.mun.ca

Date: December 22, 2014

Anticipated start of new program: Fall 2015
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1. Executive summary

Grenfell Campus is proposing to offer an inter-disciplinary graduate degree program: Master of Science in Agricultural, Forest and Environmental Science (MSc AFES), with study concentrations matched to the skills and expertise of faculty members and research collaborators.

With a long-standing reputation in the field of environmental studies and environmental sciences, Grenfell Campus has offered a variety of programs and degrees in the environmental field since 1995. Today, Grenfell Campus offers four bachelor-level environmental degree programs and a Master of Arts in Environmental Policy. The development of an additional Master program in the environmental field is recognition of both the maturity and capacity of Grenfell Campus' academic growth.

The development of this new graduate program at Grenfell Campus has been spearheaded in part by the Grenfell Campus Strategic Plan, which includes increasing student enrolment at the graduate level. A fundamental part of the campus strategic plan has centered around the development of environmental programs and research at Grenfell as a basis to help increase enrolment, stimulate the regional economy, and develop a niche research area that would set Grenfell Campus apart from other small campuses. Existing partnerships with provincial and federal agencies provide context for the development of applicable and relevant research programs to meet key research objectives of local, provincial and national agencies, and the needs expressed by the environmental industry. Primary research areas include forest science, agricultural / agrifood science, and more broadly-based environmental science.

Since the initiation of program planning for the Master of Science in Agricultural, Forest and Environmental Science, Grenfell Campus has completed major steps toward the development of research and graduate programming: 1) construction of a $2M boreal ecosystem research facility, 2) hiring of 5 research professors for the research initiative, 3) the purchase and installation of over $5M in major research equipment, and 4) the hiring of 2 laboratory technicians to support the equipment and research requirements in the laboratories. The investment in facilities, equipment and human resources has prepared Grenfell Campus to conduct world-class research in agricultural, forest and environmental science.

Consultations within Memorial University to date, and with external agencies and industry have resulted in unanimously positive support for the initiative at the local, provincial and national level. The ability of the laboratories to not only support graduate research but also provide industrial support for the testing and analysis of environmental materials and processes will result in the reduction of analysis costs and time to corporate partners.

The MSc AFES program is intended to be "thesis only" format for the initial five-year period. This will allow time for the Campus to determine the success of the program in attracting suitable candidates and to determine their success in the academic or corporate sector. Non-thesis options may be considered after the initial five-year period where demand from industry would permit candidates to work with industry on specific projects that would provide suitable background and experience to supplement program course requirements.

Enrolment for the MSc AFES program would initially begin with five (5) students and an estimated enrolment cap of thirteen (13) students annually.

Although capital investments in the building and equipment have been made, heavy laboratory and field experience requirements for the degree require the addition of special fees to cover these resource requirements. Total fees (tuition and special fees) are proposed to be $5000/year for Canadian students, and $10,000/year for international students. See the Budget in Section 7 for details.

With the proposed fees, resources required for successful implementation and maintenance of the programs are available within Memorial University, and Grenfell Campus more particularly.
2. Program description

2.1 Degree: Master of Science in Agricultural, Forest and Environmental Science

2.2 Short Name: MSc AFES

2.3 Academic Unit: Division of Science, Grenfell Campus, Memorial University

2.4 Administrative Unit: Division of Science, Grenfell Campus, Memorial University

2.5 Study areas: Agricultural Science, Forest Science and Environmental Science

2.6 Intended learning outcomes: The Master of Science in Agricultural, Forest and Environmental Science (MSc AFES) program will provide graduate students with advanced knowledge and skills in theoretical and technical advances in environmental science, specifically related to sustainability in forestry, agriculture and climate change.

2.7 Overview: A recent Grenfell Campus environmental initiative, the Boreal Ecosystem Research Initiative (BERI), was created in July 2013 with the signing of the Collaborative Research Agreement (CRA) between Memorial University – Grenfell Campus, the Canadian Forest Service (CFS) of Natural Resources Canada, and more recently, the Forest and Agrifoods Division of the Government of Newfoundland and Labrador. The recommended courses for the program can currently accommodate graduate students with an interest in forest science, and the expectation is that the Canadian Forest Service will contribute to the MSc AFES as their resources permit.

The proposed MSc AFES has been initiated to expand into areas that are not evident in the existing MSc in Environmental Science at the St. John’s Campus. The MSc AFES is driven by need (provincial agricultural and forest research), the program utilizes the newly developed labs and hired expertise, and takes advantage of Grenfell Campus’ connection with federal forest science expertise on campus. BERI has been conceived and developed as a “boreal, environmental, natural science-based research institute” where multi-disciplinary researchers coordinate expertise in the forestry, agricultural and environmental science sector of academia and industry. BERI will provide the operating framework whereby Grenfell Campus and partnered researchers, organizations and industry leaders in the boreal ecosystem research sector can develop leading-edge research knowledge, projects and products. BERI will complement the existing social science-oriented Environmental Policy Institute (EPI), which facilitates debate, research and capacity building on critical environmental policy challenges relevant to Newfoundland and Labrador.

Integrated with the new Boreal Ecosystem Research Facility, this natural science-based graduate program will enhance the academic environment of Grenfell Campus, and provide opportunities for graduate students and experts in boreal science to develop new knowledge and applications to solve environmental problems. Grenfell Campus is proposing to offer a Master of Science in Agricultural, Forest and Environmental Science (MSc AFES) with study concentrations matched to the skills and expertise of faculty members.
3. Statement of Justification

The development of graduate programs at Grenfell Campus has been spearheaded, in part by the Grenfell Campus Strategic Plan¹, which includes increasing student enrolment at the graduate level:

“Strengthen our identity as an excellent small university with distinctive academic and research programs.

Goal 2: Introduce new undergraduate and graduate programs and expand opportunities for other learning experiences.

Goal 3: Promote Grenfell Campus’ research activities and programs and implement changes to ensure a productive research environment.”

In the development of a campus strategic plan, a great deal of consideration and discussion has centered around the development of environmental programs and research at Grenfell as a basis to help increase enrolment, stimulate the regional economy, and develop a niche research area that would set Grenfell Campus apart from other small campuses. The concept of creating an environmental cluster around our existing post-secondary institutions and resource base originated with academic and community leaders who saw an opportunity to grow the knowledge economy in the Western Region of the province. While much has changed since the original concept was first proposed, Grenfell Campus is now in a position to present a clear, focused and achievable approach to developing enhanced environmental programs and research, in particular at the graduate level.

Through existing partnerships with the Canadian Forest Service (Natural Resources Canada), and the addition of new partnerships with the provincial Forest and Agrifoods Agency (Department of Natural Resources), and Agriculture Agrifoods Canada (Government of Canada), Grenfell Campus has reinforced its relationship with these agencies in the development of applicable and relevant research programs. With the signing of an MOU between these partners in 2013, a research program is being developed using current expertise from all partners to meet key research objectives. Primary research areas include forestry, agriculture/agrifoods, and climate change. Additional opportunities for research and environmental services (i.e. municipal water testing / environmental assessments / mining research) applicable to regional, provincial or national environmental problems and solutions will emerge from existing research faculty, new research faculty hiring, industry partners, and graduate students.

In a study conducted for the Office of the President, Memorial University of Newfoundland, Goss and Harvey (2012) noted:

“as the [Grenfell] Campus moves to a culture of intensive research, means will have to be found to provide faculty with sufficient time to carry out research activity including the teaching and supervision of graduate students…. It would therefore be desirable to have a mechanism whereby the appointed faculty to this area plus other faculty who would like to have some input into the area could function together as a unit. We support the development of a graduate-level academic/research unit, perhaps an "Institute", based at the Grenfell Campus. This unit could contain as full time members the newly appointed and any seconded faculty and have as associate or part time members any faculty or outside researchers who can make a

¹ Grenfell Strategic Plan 2014 is available at: http://www.swgc.ca/administration/Pages/strategic-plan.aspx
contribution to its goals. The unit would then be responsible for appointments, assignment of duties and career development decisions as well as strategic planning for the area" (pp. 8-9)

Based on the advice of Goss and Harvey (2012), the signing of the 2013 MOU between Grenfell Campus and its partners was the initiation of program planning for the Master of Science in Agricultural, Forest and Environmental Science (MSc AFES). Since that period, Grenfell Campus has completed major steps toward the development of research and graduate programing in environmental science: 1) construction of a $4M boreal ecosystem research facility, 2) hiring of 5 research professors, 3) the purchase and installation of over $5M in major research equipment, and 4) hiring of 2 laboratory technicians to support the equipment and research requirements in the laboratories. The significant investment in facilities, equipment and human resources has prepared Grenfell Campus to conduct world-class research in agricultural, forest and environmental science.

3.1 Benefits to the Grenfell Campus and Memorial University

Grenfell Campus and Memorial University are growing, and along with the increase in the student base, programs that meet current and anticipated demand need to be rationalized, developed, and initiated. Grenfell Campus has graduated students in environmental science since 1998, and many of these graduates have moved into greater leadership and research-based positions. Many of these positions, and others which are on the market today, require a science-based Masters degree.

The environmental research demands in this country and globally are expanding as the world faces greater environmental challenges and demands. Climate change, food security, and the production of resource based products all have immediate challenges which the MSc AFES will serve to provide expertise to meet these challenges. The need for increased student enrollment at Grenfell Campus combined with the demand for specialized programs in environmental science is an opportunity knocking. With the addition of highly qualified personnel in the hiring of five research professors and two laboratory coordinators, Grenfell Campus is in a position to lead academic programming across Canada and North America in agricultural, forestry and climate change research.

The proposed MSc AFES graduate program will support Memorial University’s strategic plan².

i. Serve students by:

• Accessing and potentially providing financial support to graduate students collaborating on BERL research projects
• Giving access to a unique Master degree that is valuable both on the Canadian and on the international labour market
• Providing innovative, cutting edge ecological science experiences to graduate students that will assist them in transitioning to employment
• Facilitating student research by suggesting research priorities and key resources and by providing research support for graduate students
• Supporting the development of the future graduate programs at Grenfell Campus and within the Memorial University system

ii. Contribute to Memorial University’s research agenda by:

• Securing external funding for research formulation and dissemination
• Helping to build Grenfell Campus’ research profile by:
  o Creating and maintaining cross-disciplinary collaboration
  o Disseminating research findings within the university system
  o Collaborating with and sharing research findings with communities and industry in the province

² The 2014-17 Strategic Plan for Memorial University is available at www.mun.ca/CIAP/Planning/plans_and_annual.php
Supporting new research and new researchers
Helping secure funding for graduate researchers

- Filling a significant gap in environmental analysis needs in the province, particularly soil, plant, water and air analysis
- Building on Memorial University’s existing strengths in diverse environmental fields in the social sciences, humanities and sciences and honing these strengths toward environmental analysis and development

iii. Contribute toward institutional responsibility by:
- Supporting research and providing leadership on campus by linking with and supporting the President’s Advisory Committee on Sustainability (PACS) at Grenfell Campus and the Advisory Committee on Sustainability (ACS) and the Earth and Human Systems Sustainability Initiative (EHSSI) in St. John’s.

The proposed MSc AFES graduate degree program will benefit Grenfell’s students (goals 1 and 4 of the Grenfell Campus Strategic Plan³) by helping to connect graduate students to meaningful research experiences. The graduate program will strive to hire students to provide hands-on experience with research work that combines and develops skills in the sciences.

By contributing to and focusing on Grenfell’s current environmental programs, the MSc AFES graduate degree program will further strengthen Grenfell Campus’ appeal as a “destination of choice” (goal 5) for environmental research and studies. The presence of an environmental science master degree program at Grenfell Campus demonstrates it as a place where research is engaged with real-world problems, and this is greatly appealing to students.

Finally, as the MSc AFES graduate degree program develops within the Boreal Ecosystem Research Initiative, it will increasingly create connections to other universities and researchers (goal 6), as required by specific projects, conferences, retreats and summer schools.

3.2 Benefits to the Province of Newfoundland and Labrador
The MSc AFES graduate degree program is designed to provide a pool of talented and well-trained researchers. With the province of Newfoundland and Labrador’s expanding development in mining, oil and gas, and renewable energy, as well as the increased need for food production and secondary wood fibre production, many graduates will potentially work with environmental and natural resource-based companies and organizations in the province. Many graduate students in the program will likely choose local and national companies in which to conduct their research, further increasing their chances of obtaining employment in the province after graduation. Companies such as NALCOR, Anaconda Mining, AMEC, Vale Minerals, and an increasing number of members of the Newfoundland and Labrador Environmental Industry Association (NEIA) are growing, and with their growth comes the demand to increase their environmental programs and services.

The MSc AFES graduate degree program will address the needs of the province specifically by: 1) collecting data and studying environmental issues impacting Newfoundland and Labrador; 2) collaborating with government, local communities and other institutions to respond to provincial needs for environmental research; 3) collaborating with the Labrador Institute and Aboriginal communities to support environmental research relevant to Aboriginal communities, and 4) supporting the attraction and retention of out-of-province and international student researchers at both the undergraduate and graduate levels.

³ Grenfell Strategic Plan 2014 is available at: http://www.swgc.ca/administration/Pages/strategic-plan.aspx
3.3 Benefits to the Greater Academic Community, Including Potential Students

The Master of Science in Agricultural, Forest and Environmental Science program will meet the needs of students seeking a research-based graduate degree program in the environmental field in Newfoundland and Labrador. It is anticipated that student demand would come initially from graduates of undergraduate science programs at Memorial University, but as the program becomes known, it will attract students from North America and global markets. Matched with the existing Master of Arts in Environmental Policy (MAEP) at the Grenfell Campus, the MSc AFES graduate degree program will provide students with the option of pursuing a social science or natural science graduate degree in the environmental field. In the process of developing the graduate program, letters of support for the graduate program and the supporting research in agriculture, forestry and climate change were received from the following individuals and agencies:

- Mr. Frank Ricketts, Chair, Newfoundland Environmental Industries Association
- Dr. Brian Hearn, Acting Director, Canadian Forest Service, Corner Brook
- Dr. Christiane Delauriers, Director General, Agriculture-Agrifoods Canada
- Mr. James Evans, CEO, Forestry and Agrifoods Agency, Government of NL
- Dr. Richard Donald, Associate Dean, Faculty of Agriculture, Dalhousie University
- Dr. Susan Ziegler, Canada Research Chair in Environmental Science, Memorial University of Newfoundland
- Mr. Eugene Legge, President, NL Federation of Agriculture

To quote relevant comments from these letters of support:

**Newfoundland and Labrador Environmental Industry Association**

NEIA is a not-for-profit association of businesses that promotes the growth and development of the environmental sector in Newfoundland and Labrador. We represent firms operating in areas as diverse as waste management, sustainable resource development, green building and green transportation. The growth of this sector depends on qualified professionals. Several firms within the sector have identified "access to skilled human resources" as a barrier to growth. A recent report published by GLOBE Advisors and Earth & Environmental, "An Analysis of the Economic Development Opportunities Associated with the Green Economy in Newfoundland and Labrador", states that the environmental sector employs over 10,300 Newfoundlanders and Labradorians in over 1,100 private and public organizations. The report, even in its conservative estimates, predicts significant growth for the sector. The availability of qualified labour is a crucial factor in this growth. The current Grenfell (BERI) initiative helps address these workforce challenges within the environmental sector in a number of ways. The facilities will ensure the high quality of environmentally related education by complementing classroom teaching efforts and exposing students to the state of the art technology used within the sector. In addition, new facilities will assist Memorial in recruiting highly qualified faculty, laboratory technicians, graduate students, and postdoctoral fellows in environmental research. The presence of these skilled individuals not only contributes to an enhanced classroom experience, but also serves to establish Grenfell

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4 The full version of the letters of support can be found in Appendix F.
Campus and the Corner Brook region as a centre of excellence for environmental research. These measures, we hold, will further enhance the supply of qualified labour available to work in this growing sector.

Mr. Frank Ricketts, Chair
Newfoundland Environmental Industries Association

Faculty of Agriculture, Dalhousie University

... universities in Atlantic Canada should be more deliberate about working together to support agriculture through closer research and academic planning and coordination of resources. Following in that vein, the Faculty of Agriculture at Dalhousie University is eager to lend support to your initiatives at Grenfell Campus toward the development of agriculture-focused research and graduate programs.

Dr. Richard Donald, Associate Dean
Faculty of Agriculture, Dalhousie University

Agriculture-Agrifood Canada

I am pleased to express Agriculture and Agrifood Canada's (AAC) support for Memorial University's initiative in creating a graduate program with a focus on agricultural research at its Grenfell Campus. The new faculty and labs will also form the basis of future collaboration between our two organizations and contribute to industry and provincial government objectives of increasing the overall economic output of Newfoundland and Labrador's agricultural sector.

Dr. Christine Delauriers, Director General
Agriculture-Agrifoods Canada

Dr. Sue Ziegler

I am writing to express my strong support for the proposed Environmental Research Facility and graduate programs. This facility will provide an important platform for the development of a knowledge-based industry linked to the natural resources sector. The research supported through this facility will enable the province and Canada to gain the knowledge required to adapt and establish forward thinking policy relevant to those resources including forestry and agriculture. We are all keenly aware of our changing climate, which is the primary driver of ecosystem processes including forest and agricultural systems.

Dr. Susan Ziegler, Canada Research Chair in Environmental Science
Memorial University of Newfoundland

Canadian Forest Service, Natural Resources Canada

As you know, the CFS office in Corner Brook has had a strong working relationship with Grenfell Campus, its students, faculty, and administration over the last 15+ years. This is demonstrated by the fact that many CFS staff members serve as Adjunct Professors at Grenfell Campus and co-supervise graduate students. Further, Grenfell and CFS are actively working together, in collaboration with the Provincial Department of Natural Resources - Forest Service, in the development of a Collaborative Research Agreement for enhanced forest research capacity which will pave the way for the creation of the Boreal Ecosystem Research Institute (BERI). BERI will augment the forest sector research capacity by means of increased research infrastructure, the hiring of additional forest sector research positions, and increased graduate programming in Environmental Science and Environmental Policy - initiatives critical to the success of BERI.

Dr. Brian Hearn, Acting Director
Canadian Forest Service, Corner Brook
4. Market analysis

The Canadian Job Market
According to the Jobs Report: State of the Canadian Labour Market (2014), Canada's labour market has outperformed those of other Group of Seven (G-7) economies since 2006 with close to 1.6 million net new jobs created across the country. Despite the weak global economic environment, the Canadian economy has expanded at a faster pace than other G-7 economies and the labour market has been resilient, with over 1 million net new jobs created since the recovery began in July 2009 (See Table 4.1). This represents the strongest labour market performance among all G-7 economies. Moreover, high-wage, high-skilled, full-time and private-sector employment has been the main source of job creation over the recovery.

Table 4.1 Job creation in Canada since 2009

Also evident is the fact that Newfoundland and Labrador has experienced higher than average job creation across Canada, with over 11 percent employment gains since 2009 (Table 4.2).
Employment gains over the recovery have occurred in all provinces and territories

<table>
<thead>
<tr>
<th>Province</th>
<th>Percent change</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newfoundland and Labrador</td>
<td></td>
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<tr>
<td>Prince Edward Island</td>
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<td>Nova Scotia</td>
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<td>New Brunswick</td>
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<td>Ontario</td>
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<td>Manitoba</td>
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<td>Saskatchewan</td>
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<td>Alberta</td>
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<td>British Columbia</td>
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<td>Yukon</td>
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<tr>
<td>Northwest Territories</td>
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<tr>
<td>National average</td>
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</tbody>
</table>


Table 4.2 Provincial job creation in Canada since 2009

Canada also fares well compared to other countries with regard to post-secondary educational attainment. Overall, Canada enjoys a fairly mobile population that responds well to economic opportunities and regional differences in labour market conditions. Table 4.3 demonstrates the increasing demand for education at all levels, and shows that there are over 1.75 millions graduate students in Canada (2011) and increasing yearly.

Participation in post-secondary education in Canada has grown significantly over the past two decades

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Post-Secondary Education Enrolment in Canada, by Education Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thousands</td>
</tr>
<tr>
<td>Apprenticeships</td>
<td></td>
</tr>
<tr>
<td>Graduate Studies</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,250</td>
</tr>
</tbody>
</table>

Notes: Education levels based on the Post-Secondary Stratified Classification of Education. "College" includes all full-time post-secondary technical, vocational and professional programs. "Bachelor" includes all full-time degrees, diplomas and certificates. The data for recent years are based on the Post-Secondary Stratified Classification of Education. Source: Statistics Canada - Post-Secondary Enrolment by Field of Study and Level of Program. Department of Finance data collection.

Table 4.3 Post-secondary enrolment in Canada (1992-2011)

Fuelling innovative growth in the shift to a knowledge-based economy in the Canadian job market requires a highly skilled workforce. In this respect, workers with science, technology, engineering and mathematics (STEM) degrees play an important role as they are at the leading edge of technological
progress. Canada’s college system produces a substantial number of graduates in STEM fields. In particular, Canada graduates relatively more students than the OECD average and the United States in the Environmental Science, physical sciences, and mathematics and statistics. Table 4.4 demonstrates that a university degree is becoming the skill requirement for successful employment in emerging labour markets, and graduate degree completion undoubtedly significantly increases the opportunity for employment.

![Graph showing employment growth by level of education in Canada, 1990-2012](image)

**Table 4.4 Skill requirements for emerging markets in Canada (1990-2012)**

Occupations related to natural and applied sciences have had persistently high job vacancy rates over the recovery, suggesting unfilled labour demand in this occupation group.

Alberta, Saskatchewan, and Newfoundland and Labrador have seen the largest increase in job vacancy rates since 2009, largely reflecting high labour demand in certain occupations in these regions, particularly skilled trades and science-based occupations.

**The Environmental Employment Market**

ECO (Environmental Careers Organization) Canada develops programs that help individuals build meaningful environmental careers, provides employers with resources to find and keep the best employees, and informs educators and governments of employment trends to ensure the ongoing prosperity of the Canadian environmental sector.

Since 1992, ECO Canada has established itself as the national, industry-initiated and led organization for environmental human resources issues. ECO Canada’s extensive labour market intelligence provides insight on the opportunities, challenges and solutions for building a world-leading environmental workforce. ECO Canada offers environmental career resources for professionals and employers.

Eco-Canada’s publication “Labour Market Research - Profile of Canadian Environmental Employment, 2013” summarizes the labour market statistics for environmental professional in Canada. It’s most recent report shows tremendous promise for job creation and emerging professions in environmental industries:

“As social awareness of the environment’s importance continues to grow, so does the impact that
environmental work has on the Canadian economy. This growth produces many important benefits, including the creation of new jobs, the reduction of economic costs, and the development of innovative business opportunities."

Labour Market Research - Profile of Canadian Environmental Employment, Eco Canada, 2013

According to their recent study (2013), over 730,000 environmental professionals are employed in Canada (Table 4.5), and spend at least 50% of their work time performing environmental activities. This represents just over 4% of the total Canadian labour force. Since 2010, the number of environmental professionals has grown by about 7%. Based on a general comparison of trends over the years, there is a continual increase in the demand for environmental skills. This growth has consistently outpaced that of the overall Canadian workforce.

![Graph showing the number of environmental professionals working in Canada from 1993 to 2013](image)

Table 4.5 Environmental professionals working in Canada (1993-2013)- Source: Eco-Canada (2013)

The study highlights the fact that more than 10% of all employed workers in Canada use environmental skills, underscoring the diversity and importance of environmental competencies in a wide range of industries. The following industries have the highest proportion of environmental employees: Administrative and Support, Waste Management and Remediation Services (25.1%), Professional, Scientific, and Technical Services (22.4%), Wholesale Trade and Retail Trade (13.9%), Other Services (13.8%), and Manufacturing (13.7%). With 22.4 percent of environmental workers employed in the "professional, scientific, and technical services" category, this amounts to over 163,000 professional (>50% of their work) workers employed in Canada in 2013.

However, the total number of environmental employees (Table 4.6) in Canada is over 1.7 million as many employees do other non-environmental work as a part of their job. The table also clearly shows the lack of environmental scientists specializing in agriculture and forestry.
Table 4.6 Environmental employees by sub-sector in Canada (2013) - Source: Eco-Canada (2013)

Demand for environmental employees
Eco-Canada also estimates that the demand for workers with environmental skills will increase over the near future. Their study found that most employers (74.5%) intend to hire new environmental employees over the next two years, both for newly created roles and replacement positions following staff departures and retirements. In addition to growth among current environmental employers, the number of environmental employees may also expand as regulatory requirements continue to evolve and a greater number of Canadian establishments adopt environmental practices.

New job openings will include technical roles, such as Forestry and Mining Workers, and Environmental Technicians, as well as specialist roles that require advanced education, such as Environmental Engineers, Marine Biologists, and Geoscientists. If recent trends hold, employers will need to hire recent graduates and transitioning workers from other industries to fill these positions. A notable proportion (13.1%) of job opportunities will be for past employees who have changed positions within the same establishment or changed employers.

Retirements will create many job openings in the near future. Nearly one-fifth (19.0%) of the environmental workforce is expected to retire over the next 10 years, creating openings for primarily intermediate- and senior-level roles. Employers will need to rely on existing junior- and intermediate-level employees to fill some of these senior roles. Transitioning workers from other sectors and industries may also help meet this increased demand for experienced practitioners.

Employers have had some difficulty filling a wide variety of different environmental occupations, including both technical occupations and specialist roles that require advanced education. Some employers found it especially difficult to fill positions for Environmental Engineers, Environmental Technicians or Technologists, Forestry or Mining Workers, and Remediation Specialists.

Summary of employment opportunities
Based on the Government of Canada’s job analysis and Eco-Canada's career opportunities, it is evident that the environmental industries are growing in Canada, and globally. This resulted in increased
graduate studies opportunities for students around the world. As an emerging provider of environmental graduate degree programs, Grenfell Campus has the opportunity to compete nationally and internationally for graduate students, faculty and staff. The proposal for the MSc in Agricultural, Forest and Environmental Science at Grenfell Campus will set forth tremendous opportunities for Canadian and international students in this growing field of study.

Analysis of competing graduate programs
As a component of the proposal for the MSc in Agricultural, Forest and Environmental Science at Grenfell Campus, a scan was undertaken (Table 4.7) to determine the competitive “marketplace” for graduate programs relevant in the broad field of the environment and environmental sustainability in particular, including disciplines in agriculture, forestry and Environmental Science. The scan is focused on graduate programs that are geographically close to Grenfell Campus – Memorial University, or that may compete in the graduate studies marketplace for students in the agricultural, forest science, environmental and life science fields. It is primarily comprised of interdisciplinary and applied programs focused on the environment that could feasibly produce graduates capable of working at the interface of environmental science, environmental studies and the social sciences, and the humanities. Programs with a pure, non-applied science focus, and arts programs lacking a clear link to BERI’s strategic research priorities, have been excluded.
<table>
<thead>
<tr>
<th>Title</th>
<th>Type</th>
<th>Threat</th>
<th>Institutions</th>
<th>Disciplines</th>
<th>Location</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSc. in Agriculture</td>
<td>Masters Degree</td>
<td>High Strong AG program</td>
<td>Dalhousie University</td>
<td>Agriculture</td>
<td>Truro, NS, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>Master of Environmental Studies (MES)</td>
<td>Masters Degree</td>
<td>High Strong ES program</td>
<td>Dalhousie University</td>
<td>Environmental Studies and Sciences</td>
<td>Halifax, NS, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>Master’s in Forestry and Environmental Management (MScF, MF, MScFE, MFE, MEM)</td>
<td>Masters Degree</td>
<td>Low No thesis option</td>
<td>University of New Brunswick</td>
<td>Other</td>
<td>Fredericton, NB, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>M.Env. in Environmental Assessment</td>
<td>Masters Degree</td>
<td>Low No thesis option</td>
<td>Concordia University</td>
<td>Environmental Studies and Sciences</td>
<td>Montreal, QC, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>MA, MSc, MBA, MEd, MEng, MFC, MI, MScF, MScPl in Environmental Studies (collaborative program with student’s “home” department)</td>
<td>Masters Degree</td>
<td>Medium Highly flexible programs</td>
<td>University of Toronto</td>
<td>Environmental Studies and Science</td>
<td>Toronto, ON, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>Master of Science in Sustainability Management (MScSM) (management or science stream)</td>
<td>Masters Degree</td>
<td>Low No thesis option Policy-based</td>
<td>University of Toronto</td>
<td>Sustainability Studies and Science</td>
<td>Toronto, ON, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>MA or MSc in Environmental Sustainability (Collaborative)</td>
<td>Masters Degree</td>
<td>Low Policy-based</td>
<td>University of Ottawa</td>
<td>Sustainability Studies and Science</td>
<td>Ottawa, ON, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>Master of Environmental Studies (MES)</td>
<td>Masters Degree</td>
<td>Medium-High Environmental Chemistry</td>
<td>Queen’s University</td>
<td>Environmental Studies and Sciences</td>
<td>Kingston, ON, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>Masters in Environment and Sustainability (MES)</td>
<td>Masters Degree</td>
<td>Low No thesis option</td>
<td>University of Western Ontario</td>
<td>Environmental Studies and Sciences</td>
<td>London, ON, Canada</td>
<td>Pr</td>
</tr>
<tr>
<td>Degree Area</td>
<td>Degree Type</td>
<td>Program Level</td>
<td>University</td>
<td>Field of Study</td>
<td>Location</td>
<td>Proc</td>
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<tr>
<td>M.Sc. in Food, Agriculture &amp; Resource Economics</td>
<td>Masters</td>
<td>Medium</td>
<td>University of Guelph</td>
<td>Agriculture</td>
<td>Guelph, ON, Canada</td>
<td>Proc</td>
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<tr>
<td>Master of Environment and Sustainability (MES)</td>
<td>Masters</td>
<td>High</td>
<td>University of Saskatchewan</td>
<td>Environmental Studies and Sciences</td>
<td>Saskatoon, SK, Canada</td>
<td>Proc</td>
</tr>
<tr>
<td>MA or MSc in Agricultural Studies</td>
<td>Masters</td>
<td>Medium-High</td>
<td>University of Lethbridge</td>
<td>Agriculture</td>
<td>Lethbridge, AB, Canada</td>
<td>Proc</td>
</tr>
<tr>
<td>MSc or MEng or MAg or MBA/MSc in Agricultural, Food &amp; Nutritional Science</td>
<td>Masters</td>
<td>High</td>
<td>University of Alberta</td>
<td>Agriculture</td>
<td>Edmonton, AB, Canada</td>
<td>Proc</td>
</tr>
<tr>
<td>Master of Forestry (MF), MSc or Master of Applied Science (MASc), Soil Science, Master of Sustainable Forest Management (MSFM)</td>
<td>Masters</td>
<td>High</td>
<td>University of British Columbia</td>
<td>Other</td>
<td>Vancouver, BC, Canada</td>
<td>Proc</td>
</tr>
<tr>
<td>M.S. in Ecology and Environmental Sciences</td>
<td>Masters</td>
<td>Medium</td>
<td>University of Maine</td>
<td>Environmental Studies and Sciences</td>
<td>Orono, ME, USA</td>
<td>Proc</td>
</tr>
<tr>
<td>M.S. in Sustainable Agriculture</td>
<td>Masters</td>
<td>High</td>
<td>Iowa State University</td>
<td>Agriculture</td>
<td>Ames, IA, USA</td>
<td>Proc</td>
</tr>
<tr>
<td>M.S. in Agroecology</td>
<td>Masters</td>
<td>High</td>
<td>University of Wisconsin-Madison</td>
<td>Agriculture</td>
<td>Madison, WI, USA</td>
<td>Proc</td>
</tr>
<tr>
<td>M.S. in Agriculture, Food and Environment</td>
<td>Masters</td>
<td>High</td>
<td>Tufts University</td>
<td>Agriculture</td>
<td>Medford, MA, USA</td>
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</tbody>
</table>
Sources


Various academic institution websites

NOTES:

Based on the scan of relevant Master of Science programs in Agricultural Science, Forest Science, and Environmental Science, competitors for graduate students are in the major agricultural and environmental science universities in Canada and the US.

In Canada these include Dalhousie University (Faculty of Agriculture and Faculty of Science), the University of Saskatchewan, the University of British Columbia, with secondary competition from Ontario universities Queens University and Guelph. Each of these universities has significant capacity in a range of overlapping research areas in agriculture, forest science, environmental science (soil science, plant and crop science, hydrology, water analysis and toxicology, resource economics, climate change, etc.).

In the US North Eastern region, Tufts University (Nova State University) and the University of Wisconsin-Madison appear competitive.

This scan provides a rough analysis of potential academic competitors in the Master of Science (MSc) graduate education agricultural science, forest science, environmental science, and sustainability disciplines. The scope of the proposed program at Memorial University is sufficiently diverse to attract graduate students from a wide background in natural and social sciences to study in a small university environment with world-class faculty and resources (laboratory and technical equipment, scientific resources). Grenfell Campus is in a unique position to create a research identity second to none in North America.
5. Projected enrolment

Although difficult to predict over a five-year period, projected enrolment is estimated to increase over the period, due in part to the increased exposure of the programs, and the strength of the faculty members in attracting graduate students in their specialization. The MSc AFES program steady-state enrolment is estimated to cap at approximately thirty (30) students in all aspects of the program (specialization, part-time, full-time, and returning students), and the balance of Canadian versus international students is expected to achieve a 2/3 – 1/3 ratio respectively after five years. Over a longer term, judging by the history of Grenfell's Master of Arts in Environmental Policy (MAEP), international enrolment may exceed Canadian enrolment. International student enrolment may also rise above expected numbers due to the increased demand for environmental scientists in the global labour market. To achieve this level of enrolment, MSc AFES annual student intake would initially begin with five (5) students and cap at thirteen (13). Table 5.1 below demonstrates the anticipated annual intake and continuing enrolments.

<table>
<thead>
<tr>
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</thead>
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<tr>
<td>New FT enrolment</td>
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<td>Annual New Enrolment</td>
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<td>3</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Canadian enrolment</td>
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<td>12</td>
<td>15</td>
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<tr>
<td>International enrolment</td>
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<td>5</td>
<td>7</td>
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<tr>
<td>Total</td>
<td>6</td>
<td>12</td>
<td>17</td>
<td>22</td>
<td>28</td>
<td>84</td>
</tr>
</tbody>
</table>

*Enrolment as of Fall semester of each year.

6. Resource Implications

6.1 Faculty complement and workload

Faculty expertise

Grenfell Campus currently has 15 faculty members and 17 staff specializing in environmental programs associated with the Division of Science. Another 17 faculty members deliver degree programs in the Division of Social Science, including Environmental Studies and Sustainable Resource Management, and faculty members from the St. John’s Campus of Memorial University may be involved with the delivery of the graduate program at Grenfell Campus. The list of potential expertise for the program, including CV’s, can be found in Appendix F.

Grenfell Campus has recently hired five (5) research professors for the Boreal Ecosystems Research Initiative. Individuals hired for these positions have strong research backgrounds in areas of soil analysis, water quality analysis and herbaceous plants. New faculty and staff will work with existing campus expertise to develop and oversee the implementation of graduate programs in environmental science, and will participate in the teaching and the supervision of graduate students in their respective fields. The
areas of faculty expertise associated with this environmental research agenda include Agronomy, Biology, Physics, Chemistry, Earth Science, Engineering, Soil Science, Plant / Crop Science, Natural Resource Economics and Hydrology.

Laboratory and technical personnel
Operating an environmental research laboratory for the purposes of soil, water quality and plant chemical analysis will require the assistance of fully trained, accredited and qualified personnel. Two (2) highly qualified laboratory coordinators / technicians were recently hired, and they will assist in the set-up and maintenance of the equipment, conducting tests, developing methods and analyses, as well as training graduate students in the use of the advanced research equipment.

Additional / potential research faculty
Western Newfoundland is becoming a hub for environmental research, and there are many people within the region to conduct research facilitated by BERI. Beyond faculty at Grenfell College, there are also environmental researchers within Natural Resources Canada (NRCan), Agriculture-Agrifood Canada (AAFC), Parks Canada (PC), provincial Departments of Natural Resources (DNR) and Environment and Conservation (DEC), and local non-governmental organizations. Many of these researchers are already working in environmental scientific research and many more are interested in developing this capacity within Grenfell and in the greater community. Furthermore, as the MSc AFES graduate program develops at Grenfell Campus, there will also be a local pool of graduate students specifically trained in this field. In addition, BERI will network with researchers currently working on relevant topics across the province and in other provinces. The institute will draw on faculty from St. John’s campus, the Labrador Institute, the partner agencies (CFS / NL Forestry & Agrifoods, Agriculture-Agrifood Canada) and other universities (Dalhousie’s Faculty of Agriculture) and institutes to support BERI through sabbatical replacements, post-doctoral appointments, and/or by serving as adjuncts on specific projects. Work is ongoing to continue expanding the list of collaborators who will participate and assist with BERI. The list of currently identified experts for the MSc AFES program can be found in Appendix F.

Support services for faculty and graduate students
The Master of Science in Agricultural, Forest and Environmental Science program will require the services of administrative support, including a Director for BERI, a graduate officer, and an administrative assistant. These services have been included in the budgetary requirements for the program (see Table 7.2).

6.2 Space, facilities, and student support
Grenfell Campus has recently completed the development of a 500 m² (5382 ft²) boreal ecosystems research facility, containing 3 separate laboratory spaces in which to conduct environmental research for the MSc AFES graduate programs. The facility houses a full complement of research space, equipment, and administrative workspaces to accommodate the proposed graduate programs.

i. Physical Plant - Extension of the Forest Centre building: Construction of the environmental research laboratories was completed in Fall 2013, attached to the current Forest Centre on the Grenfell Campus. This new facility has been designed to meet the needs of the environmental sciences research faculty, associate researchers and graduate students, including research space, workstations, high-speed internet access, and data transfer and storage.

ii. Equipment: A suite of research grade equipment with the capacity to analyze soils, water and plants valued at over $5M has been established at Grenfell Campus. As the development of the research
agenda expands over time, it is proposed that additional equipment will be added to the lab with the support of external research funding grants and that all such equipment will become part of the general pool of equipment available to all faculty and adjunct researchers at Grenfell Campus.

iii. Classroom Space: Classroom space is sufficient on the Grenfell Campus to accommodate class sizes up to 60 students. Due to the nature of the environmental graduate program being proposed, it is anticipated that classrooms suitable for up to 15 graduate students will be required, and that there is sufficient access to classrooms and meeting spaces for the proposed program.

iv. Graduate Study Space: Grenfell Campus has been expanding its building capacity and support for graduate research. Currently approximately 27 graduate students are enrolled in the MAEP program, and as students become enrolled in the MSc AFES program, graduate study space will be added.

6.3 Financial support

Graduate Student Funding

Eligible students will receive baseline fellowship funding through the School of Graduate Studies of approximately $6,800 per year (student must meet minimum academic requirements). MSc AFES students will also be eligible to receive support from the Research Office, Grenfell Campus for up to $3,150, and Graduate Assistantship support up to $3,553 annually, for a total potential graduate student funding of $13,553 annually. Scholarships and bursaries may also be available to graduate students as they progress through their program. The graduate student support funding is included in the program budget. Faculty members will also have access to competitive research grants through Tri-Council and commercialization activities and research contracts that will benefit graduate student funding opportunities.

7. Budget

Although capital investments in the building and equipment have been made, heavy laboratory and field experience requirements for the degree necessitate the addition of special fees to cover the costs to operate the research laboratories and field units. Based on the anticipated costs of operating the MSc AFES graduate program, total (tuition and special fees) are proposed to be $5000/year for Canadian students, and $10,000/year for international students. Additional revenue is projected for the operation of the laboratories from faculty research grants, partner and industry opportunities for research projects, environmental sampling, testing and analysis. The projected enrolment for the program is noted below (Table 7:1).
Table 7.1 Graduate student enrolment and projected revenue

Student Enrolment & Fees

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>New FT enrolment</td>
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<td>Annual New Enrolment</td>
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<td>7</td>
<td>9</td>
<td>11</td>
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<td>45</td>
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<tr>
<td>Returning FT enrolment</td>
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<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Canadian enrolment</td>
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<td>7</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5</td>
<td>12</td>
<td>17</td>
<td>22</td>
<td>28</td>
<td>84</td>
</tr>
</tbody>
</table>

* Program Tuition (CDN) - $2159/year  
** Special Fees (CDN) - $5600 (total)  
* Program Tuition (INT) - $2855/year  
** Special Fees (INT) - $14300 (total)  
Annual Totals  
MSc Total Fees (5 years)  

* Program tuition fees are collected over 6 program semesters (2 years)  
** The full amount of special fees are collected at initial registration for the program

Based on the anticipated enrolment projections and costs associated with the MSc AFES program, it is anticipated that the programs will become self-supporting after the initial three-year period (see Table 7.2). With possible increases in enrolment or revenue from research grants or commercial applications of the laboratory services, this revenue balance may increase favourably.
Table 7.2 Program budget (Years 1-5)

<table>
<thead>
<tr>
<th>Type/Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
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<td>Revenue (Projected)</td>
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<tr>
<td>MSc Program fees (based on enrolment projections)</td>
<td>$30,000.00</td>
<td>$75,018.00</td>
<td>$110,033.00</td>
<td>$145,048.00</td>
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<td>PhD Program fees (based on enrolment projections)</td>
<td>$24,280.00</td>
<td>$72,840.00</td>
<td>$113,168.00</td>
<td>$161,728.00</td>
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<td>AES funding (Research Office)</td>
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<td>$831,435.00</td>
<td>$831,435.00</td>
<td>$831,435.00</td>
<td>$831,435.00</td>
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<tr>
<td>Internal revenue (research grants)</td>
<td>$150,000.00</td>
<td>$165,000.00</td>
<td>$181,500.00</td>
<td>$189,650.00</td>
<td>$219,615.00</td>
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<tr>
<td>External revenue (contractual lab work)</td>
<td>$150,000.00</td>
<td>$165,000.00</td>
<td>$181,500.00</td>
<td>$189,650.00</td>
<td>$219,615.00</td>
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<td>Total Revenue</td>
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<td>$1,309,293.00</td>
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<td>Instructional costs</td>
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<td>Regular faculty (2% increase annually)</td>
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<td>LUMUN appointments (2-6 courses annually)</td>
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<td>Total Instructional costs</td>
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<td>Lab coordinators</td>
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<td>$154,011.52</td>
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<tr>
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<td>$161,785.57</td>
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Appendix A. Library holdings evaluation

Introduction
An assessment of the Ferriss Hodgett Library collection was conducted to determine its ability to support the proposed Master of Science in Agricultural, Forest and Environmental Science (MSc AFES). While the program will benefit from the existing print and electronic collections at both the Ferriss Hodgett Library and the Queen Elizabeth II Library, additional funds will be required to further develop and provide ongoing support for these programs on the Grenfell Campus. These funds will come from the existing library materials budget. As well, funds will be required to refurbish existing library space to meet the unique needs of this student group.

Monographs
Erin Alcock, Science Research Liaison Librarian at the QEII, was consulted on the course list associated with this program and has confirmed that the library system has strong print and electronic book collections in crop production and nutrition, climate change and global food security, sustainable agriculture, soil functions, plant biochemistry and physiology, organic farming, functional food and lipid metabolism. She did note that there are fewer more limited sources for soil as bioreactor and metagenomics for environmental science.

Kathryn Rose, History and Economics Liaison Librarian at QEII, was also consulted on the course list and has confirmed that the library has strong print and electronic book collections in the areas of production economics and commodity marketing, ecological economics, natural resource economics, environmental economics, and applied economic methods.

CNS is a special research collection of books, government documents, periodicals, newspapers, theses, microforms, and historic maps reserved for the study of all aspects of Newfoundland and Labrador. The Centre holds the largest collection of published Newfoundland in the province. It is a non-circulating collection but due to our distance, the Grenfell Library has an agreement with CNS that allows material to be sent here for use by our researchers in our library.

As a branch of Memorial University Libraries, the Grenfell Library is able to provide faculty and students with prompt access via InterCampus Loan to the extensive research collections especially of the Queen Elizabeth II Library, including the Centre for Newfoundland Studies.

The Library also provides a collection on demand service. If a book is requested for loan, but it is a recent publication and relatively inexpensive, the library will purchase the title instead of borrowing the book. The process is more effective as it can be cost saving to the Library, but more importantly, gets the material to the student or faculty faster. The Library also provides a rush order service for faculty. Material that is needed immediately for a course or a research project can be obtained for that individual by the library within a few days.

Journal Literature
The library system has an extensive collection of online journals in all subjects areas included in the proposed programs. Access to the journal literature is available via the following databases: AgEcon Search, Agricola, Agricultural & Environmental Biotechnology Abstracts, Agris, Biological Abstracts, EconLit, Scopus, and Web of Science. Full database descriptions can be found at: www.library.mun.ca/eindex/index.php

Select potential faculty were consulted concerning database access to the journal literature and all required databases are included in current library subscriptions.

Facilities
Over the past few years the Library has created diverse study spaces, designed primarily to suit the needs of the undergraduate students. Currently, there is one small room in the library specifically for graduate students. This room has already exceeded its capacity, so should additional graduate programming be added to the Campus, more library space directed to the needs of this student
population group will need to be developed prior to program commencement.

Library Hours
One of our primary services is providing access to our facility and ensuring we have qualified staff on the ground to answer user queries at all times. Since 2008 we have reworked the library staff schedules to ensure that a trained library assistant is working with the students during evening and weekend shifts. We have also extended library hours since 2008. The library is now open Monday to Thursday from 8:00am to midnight throughout the regular semester. Friday hours have been extended to 6pm, Saturday hours are now 10am to 8pm (previously 11am to 5pm) and Sunday hours are now 12pm to 10pm (previously 2pm to 10pm).

Louise McGillis
Associate University Librarian, Grenfell Campus, MUN
Ferriss Hodgett Library
November 12, 2014
Appendix B. Calendar regulations

1.0 Regulations Governing the Degree of Master of Science in Agricultural, Forest and Environmental Science
Associate Professor and Division Head (Grenfell Campus)

R. Gallant

1.1 Qualifications for Admission

To be considered for admission, applicants shall normally hold a Bachelor's (Honours) degree in Science, Forestry, Agriculture, Engineering, Geography, or Environmental Science with at least second class standing, or equivalent, from an institution recognized by the Senate or shall have qualifications and/or experience in environmental science acceptable to the Dean of Graduate Studies and the Grenfell Campus BERI graduate committee. The Grenfell Campus BERI graduate committee makes recommendations on admission to the Dean of Graduate Studies for this program.

The Degree is offered to full-time and part-time students in three areas of concentration: (1) Agricultural Science; (2) Forest Science; (3) Environmental Science.

Admission is limited and competitive, and will follow the general qualifications for admission to Masters Programs at Memorial University of Newfoundland as set out under General Regulations, Qualifications for Admission. All applicants found academically acceptable to the MSc AFES program are required to have a faculty supervisor before final acceptance can be offered.

As well, if a student is accepted for admission and is required to demonstrate English proficiency by submission of a minimum score in TOEFL, IELTS, or another acceptable language test, that applicant is required to take the English Placement Test (EPT) upon arrival. Details on this requirement can be found in the University Calendar (General Regulation 3.1.7).

1.2 Program of Study and Research

1. The program of study for the MSc AFES degree shall consist of the successful completion of a program of courses and a thesis embodying original research.
2. Every candidate shall successfully complete at least 12 credit hours as per program requirements (see 1.3 below). One undergraduate course at the 4th year level may, if necessary, be taken, with the approval of the Supervisor and the course instructor.
3. Every candidate shall submit a thesis (see General Regulation Theses and Reports) on an approved subject in which systematic research has been conducted under the direction of the Supervisor recommended by the academic unit concerned and approved by the Dean.
4. In addition to courses and thesis research, graduate students are expected to participate in Grenfell Campus graduate student seminars.

1.3 Program Requirements

Students admitted to the program must complete a research thesis under the supervision of a faculty member, and a minimum of four (4) courses (12 credit hours) as determined by the thesis supervisor.

All students must complete the following three courses:

ENVS 6000 – Environmental Science and Technology

BERI 6000 – Advanced Quantitative Research Methods OR BERI 6001 - Sampling and Analysis
BERI 6002 – Research Focus Group Seminar and Communication Skills (as per the guidance of the thesis supervisor)

Plus one graduate course related to the student's research speciality from the list below.

1.4 List of Optional Courses

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<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BERI XXXX: Advanced Groundwater Management</td>
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</tr>
<tr>
<td>BERI XXXX: Analytical Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BERI XXXX: Applied Bioinformatics and Metagenomics for Environmental Sciences</td>
<td>3</td>
</tr>
<tr>
<td>BERI XXXX: Applied Economic Methods Laboratory</td>
<td>1.5</td>
</tr>
<tr>
<td>BERI XXXX: Applied Hydrology</td>
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<tr>
<td>BERI XXXX: Chemical Separations</td>
<td>3</td>
</tr>
<tr>
<td>BERI XXXX: Climate Change and Global Food Security</td>
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<tr>
<td>BERI XXXX: Climate Change and Sustainable Development</td>
<td>3</td>
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<tr>
<td>BERI XXXX: Controlled Environment Crop Production</td>
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1.5 Evaluation

1. In order to continue in the School of Graduate Studies and in order to qualify for a Master's Degree, a candidate shall obtain an A or B grade in each program course. (See General Regulation Evaluation Evaluation of Graduate Students).

2. When it has been determined, on the basis of consultation with the candidate, the instructors in graduate courses, and the thesis Supervisor, that a candidate's work has fallen below a satisfactory level, the Supervisor or the Head of the appropriate academic unit may recommend to the Dean that such a candidate be required to withdraw from the program.

1.6 Study Options

Students are able to study in a full-time or part-time capacity.
Appendix C. Course Calendar Descriptions

BERI XXXX: Advanced Groundwater Management: 3 credits

This course intends to provide students the background and opportunity in understanding and solving real field problems related to groundwater rather than derivation of theory. The main idea is to expose students to understand groundwater as a resource in agriculture, forestry and environment of which development and management is essential for the sustainability of the ecosystem. Topics will include groundwater flow, aquifers, resource evaluation, field methods, and sustainable management. Case studies will provide students in depth understanding of issues with respect to groundwater development and management and developing sustainable solutions.

BERI 6000: Advanced Quantitative Research Methods: 3 credits

This course will introduce students to the basic concepts of experimental design and data analysis in Environmental Sciences. The course will focus on statistical analysis of quantitative data, using the R programming environment. Specific topics will include data exploration and plotting, basic statistical tests, linear regression, statistical model selection, non-parametric tests and mixed effects models.

BERI XXXX: Analytical Ecology: 3 credits

Assessment of environmental impacts on higher-level ecological systems requires a critical analysis of scientific reports, along with the ability to evaluate ecological terminology and concepts and associated statistical methodologies. Students in this course will critically read and analyze recent scientific literature in Environmental Science, with selected topics at the community, ecosystem and landscape level, and examine related univariate and multivariate statistical procedures.

BERI XXXX: Applied Bioinformatics and Metagenomics for Environmental Sciences: 3 credits

Tremendous advances in the collection of genetic information via cheaper and rapid sequencing techniques allows users to produce huge amounts of genetic information. To deal with this informational deluge a number of data analysis techniques, generally covered by the term "bioinformatics" also became available. The course aims at making sense of such large datasets though the use of several bioinformatics packages that allow for sequence visualization, alignment, and assembly, and phylogenetic and taxonomic analysis. Applications for microbial ecology will be specifically targeted. Open source software such as QIIME and mothur, and the integrative Geneious package will be employed.

BERI XXXX: Applied Economic Methods Laboratory: 1.5 credits

This laboratory class provides students with the opportunity to conduct an economic or financial analysis of an environmental sciences problem. Examples might include a cost-benefit analysis, an enterprise budget, or a sensitivity analysis. It is highly recommended that students enroll in the laboratory currently with or immediately following the completion of the applicable course in environmental sciences.

BERI XXXX: Applied Hydrology: 3 credits

This course will provide students an understanding of the interpretation techniques used in the computation of water flows from hydrological processes in agriculture, forestry and environmental perspectives. The course covers all physical processes in the hydrological cycles and their influence on the eco-systems. Effect of snow, fog and land use changes on hydrological processes and water yield will be discussed. In depth understanding of hydrological processes, measurements and interpretation in spatial and temporal scales that are affected by land use changes under managed and natural ecosystems will be highlighted.

A complete list of course descriptions will be available in the final draft of the proposal.
BERI XXXX: Chemical Separations: 3 credits

Material to be covered will be drawn from the topics outlined below:

Separation in engineering and analytical processes; Unit processes (Distillation, Extraction, Membrane Separation, Intermolecular Interactions); Sample preparation techniques: LLE, SPE, SPME, SAFE; Membrane separations; Chromatographic techniques; Gas (GLC), liquid (LLC, LSC, GPC, IEC, Affinity), supercritical fluid; Physiochemical application of chromatography; Electrophoresis techniques (Gel, Capillary, Moving boundary, Zone, Isotachophoresis); Capillary separations; Detection methods; GC-MS, LC-MS, CE-MS; Multidimensional separations.

BERI XXXX: Climate Change and Global Food Security: 3 credits

This course examines the challenges and implications of climate change on agriculture and crop productivity; Focus will be on impact, adaptation and mitigation strategies of climate change, effects on food security an overview, climate models and their projections of future changes, Connections between Climate Change, Drought and Agricultural Production; Global climate changes and agricultural production, Direct effects of rising atmospheric CO2 and Ozone on crop yield, Food security and adaptation strategies to mitigate climate change, Economy-wide impacts of climate change on agriculture- a case study for adaptation strategies of sub-Saharan Africa.

BERI XXXX: Climate Change and Sustainable Development: 3 credits

This seminar course examines the interface between human-driven global climate change, and the demands and challenges of developing sustainable human societies. Class discussions cover topics such as how the potential impacts of climate change affect sustainable development efforts, as well as the need to develop sustainable energy sources that do not further degrade the global climate system. The course also includes an overview of current literature in the fields of climate science and environmental sustainability.

BERI XXXX: Controlled Environment Crop Production: 3 credits

This course will introduce students to the technical aspects of greenhouse design, environmental control, interaction between plants and microenvironment, lighting, hydroponics crop production, plant nutrient requirements, plant nutrient delivery systems, plant productivity, post-harvest handling and storage of crops.

BERI XXXX: Crop Management: 3 credits

The course aims at giving an exposure to students about the occurrence of different stresses under field conditions, and how these can be tackled for successful crop production. Topics may include: Introduction of abiotic stresses; Classification of abiotic stresses; Morphological and physiological effects of moisture, heat, cold, pollutants, chemicals and salt stresses; Physiological, molecular and genetic basis of stresses; Plant resistance mechanisms at the whole plant, organ, cellular and molecular levels; Candidate genes for stress tolerance induction; Mitigation of stress tolerance though physiological enhancements; Agro- management practices for successful crop husbandry under different types of stresses.

BERI XXXX: Ecological Economics: 3 credits

This course reflects the theoretical distinction between ecological economics and classical approaches. The course familiarizes students with the scientific study of ecosystem services, non-market valuation methods, and payment for ecosystem service programs. Successful examples of provincial, national, and international payment for ecosystem service programs are provided.
BERI XXXX: Environmental Economics and Policy: 3 credits

This course familiarizes students with policy tools that can be used to assess the efficient and equitable management of scarce environmental goods. The interface between property rights, law, and economics is also discussed. Topics include air and water quality, public lands, land-use transitions, water use, waste management, and global climate change.

BERI XXXX: Environmental Soil Physics: 3 credits

This course will cover topics which may include flow of water in saturated and unsaturated soils, movement of solutes, movement and exchange of gases in the soil, soil temperature and heat flow, soil compaction, entry and redistribution of water in soil, groundwater drainage and pollution, uptake of soil moisture by plants, water and energy balance in the field, and water-use efficiency. Spatial variability and applications of soil physics to soil and groundwater remediation also will be discussed.

BERI XXXX: Lipid Metabolism and Environmental Stress Physiology: 3 credits

This course will introduce students to the diverse roles of lipids in organism survival. Areas covered will include lipid nomenclature, biochemistry and metabolism, role of lipids in human health and nutrition, disease diagnosis/prevention/treatment, pollution, environmental stress response/survival, organism identity, food spoilage, energy metabolism, and cell membrane architecture. Techniques for lipid analysis such as mass spectrometry, photometric, and chemical ion imaging will also be covered.

BERI XXXX: Functional Food Analysis: 3 credits

This course will introduce students to the concept of functional foods. Areas covered will include nomenclature for functional foods, nutraceuticals, natural health products and food based bioactives; identify and describe functional foods and associated health benefits, health policies relating to functional foods, functional lipids and roles in health and disease, production of foods with functional capacity; extraction, identification and analysis of bioactives in functional foods.

BERI XXXX: Management of Crop Nutrition: 3 credits

This course focuses on the management and physiological aspects of macro and micronutrients in crops. Topics may include: Introduction and scope of crop nutrition; principles of mineral nutrition in crops, Nutrients and their classification, Biological membranes, Mechanisms of nutrients absorption, Nutrient translocation, Micronutrients, absorption, translocation and metabolism, Novel sustainable nutrient management approaches for optimum crop productivity with minimum impact on environment.

BERI XXXX: Modeling Chemical Speciation in Environmental Matrices: 3 credits

This is a course aimed at exposing students to the use of applied speciation models. The course aims to achieve understanding of environmental processes through hands-on modeling of chemical phenomena in aqueous environments, including soil water. Particular attention is given to reactions involved in environmental pollution and management of wastes. Modeling of chemical environmental processes through use of the PHREEQCII model. Sections may include: Flow and Transport of chemical species; Minerals and water – chemical speciation modeling; Carbonates and carbon dioxide in water and soils (dissolved carbonate equilibria); Surface interactions; Redox processes; Weathering processes; Complexation to humic acids; Pollution by organic chemicals.

BERI XXXX: Natural Resource Economics: 3 credits
This course applies microeconomic theory to the management and economic modeling of renewable and non-renewable resources. Examples include forestry, agriculture, fisheries, mineral and energy extraction, and alternative energy.

**BERI XXXX: Organic Farming for Sustainable Agriculture: 3 credits**

This course will cover the topics which may include overview of organic agriculture, opportunities and challenges, Principles of organic farming, soil fertility and crop agronomy in organic agriculture, crop protection in organic agriculture, organic plant breeding and seed production; ecological and ethical aspects, organic standards and certification, environmental impacts of organic farming, food quality, Nutrient cycling, Rotation design for organic system with examples, special topics will be included like biodynamic agriculture today, Regulatory and management issues, contradictions of principles in organic farming.

**BERI XXXX: Plant Biochemistry: 3 credits**

This course will introduce students to concepts in plant biochemistry and cover areas such as plant metabolism, plant-specific biochemical pathways, processes, and their regulation. Storage carbohydrates, cell wall biosynthesis, lipid metabolism, nitrogen fixation and assimilation, and photosynthesis, biochemical ecology of secondary plant metabolites such as lipids, isoprenoids, phenolics and alkaloids will also be covered.

**BERI XXXX: Plant Physiology: 3 credits**

This will introduce students to concepts in plant cell biology, physiology and biochemistry. Specifically areas such as plant nutrient metabolism, photosynthesis, respiration, water relations, plant response to environmental stress, plant-pathogen interaction, plant hormones, signal transduction, and plant biotechnology will be covered.

**BERI XXXX: Production Economics and Commodity Marketing: 3 credits**

This course incorporates classic microeconomic production models and regional commodity examples to illustrate the firm and operator decision-making process to produce and sell agricultural and forest products. Specific topics include production and cost analysis, decision-making under risk and uncertainty, price forecasting, and commodity marketing.

**BERI 6002: Research Focus Group Seminar and Communication Skills**

This seminar provides an opportunity to extend, deepen, and apply the conceptual and methodological frameworks presented in the core and elective courses, through a combination of classroom discussions and attendance in research seminars. Students are taught research and presentation skills and are guided through the process of preparing their thesis research proposals. Presentation of the student's proposed research to their committee members is a requirement for successful completion of this course.

**BERI 6001: Sampling and Analysis: 3 credits**

Sampling of environmental matrices is the first step for any experimental and monitoring effort. Inaccurate sampling protocols can easily introduce errors that cannot be easily corrected at analysis stages. The course will introduce students to:

1. Project planning: Relevant and valid data; data quality objectives; The sample and the error; total error and its sources; Regulatory overview and action levels; Quality control and quality assurance; Planning documents; Cost estimates; Strategies for sampling and project coordination
2. Sampling: Sampling process overview; Chain of custody; Soil Sampling; Water Sampling; Air sampling; Surface sampling techniques; Field measurements; Records

3. Analysis of Environmental Contaminants (What, where and how to analyze your samples): Commercial analytical laboratories; Analytical techniques; QA/QC in the lab; Understanding and interpreting lab results

BERI XXXX: Soil and Groundwater Remediation: 3 credits

This course will cover topics which may include an overview of principles of flow and contaminant transport in porous media and site characterization, soil and groundwater remediation technologies such as pump-and-treat method, air sparging, electrokinetic remediation, bioremediation, phytoremediation, reactive wells and barrier technology. Remediation technology development — past experience and future directions will be discussed. Topics such as constructed wetlands and vegetative filters for effluent treatment, and assessing the impact of remediation will be covered.

BERI XXXX: Soil and Water Conservation: 3 credits

In this course, land degradation issues and management practices of land and water resources disturbed by human activities are reviewed. In depth understanding of soil erosion process, causes of erosion and prediction of erosion will be provided. It intends to provide a holistic understanding of soil and water conservation in the perspective of watershed management. Emphasis is placed on technical, agronomic and biological approaches to soil and water conservation, conservation methods and the design of terraces, waterways and water control structures. Special emphasis will be given to Boreal and Agricultural Eco-systems, case studies will be varied from temperate to tropical climate systems.

BERI XXXX: Soil Functions: Soil as a Bioreactor: 3 credits

Microbes carry out most soil functions. The regime of water, gaseous and heat flows will control microbial activity. Management activities that affect these regimes will affect microbial activities and thus nutrient and contaminant kinetics in soil. The course aims to offer an integrated approach to numerical modeling of the chemical, physical and biological processes relevant for nutrient availability and contaminant risk and transport through soils. The course is aimed at a wide range of students interested in soil sciences, water quality, bioengineering systems, and agricultural sciences.

BERI XXXX: Solid Waste Management: 3 credits

This course will cover topics which may include categories of wastes and waste management, characterization, components, chemical and physical properties of municipal solid waste, collection and recycling of solid wastes, solid waste processing including material recovery. Disposal methods such as composting, incineration, and sanitary landfill including potential for soil and groundwater contamination will be covered. Handling of electronics waste also will be discussed.

ENVS 6000: Environmental Science and Technology: 3 credits

This course is the common denominator, first course for the interdisciplinary Graduate Program in Environmental Science and as such needs to lay some groundwork for subsequent coursework in this program. This course, however, is primarily designed to introduce the breadth or scope, approaches, and interdisciplinary nature of the field of environmental science. Further, this course will serve to introduce students in the program to the breadth of their colleagues in the program as well as some of the faculty members participating in this program across campus as well as other research professionals in the region (e.g. industry, federal and provincial departments).
Appendix D. Consultations

During the development of the Boreal Ecosystems Research Initiative, an in-depth consultation process proceeded regarding the initiative, as well as the need for graduate programming at Grenfell Campus. Consultations were held widely within Grenfell Campus and across the Province. The initial phase of consultations, completed in 2011, surveyed representatives from both the federal and provincial levels of government, non-governmental institutions and universities across Canada regarding the suitability of a Boreal Ecosystem Research Institute and its complementary graduate program at Grenfell Campus. A list of these consultation meetings is included below. This phase of consultations demonstrated a very positive response for the establishment of BERI and graduate programs at Grenfell Campus, in particular the development of forestry, agriculture and climate change research initiatives.

The second phase of consultations focused on the Grenfell Campus and MUN community, and took place from Sept 2012-May 2013. A list of these meetings is also included below. This phase was designed to consult with interested faculty and staff on the details of the BERI proposal, graduate programs, and to identify individuals interested in the project. Strong support for the development of a research institute and graduate programs was heard across all divisions within the university.

Phase three of consultations regarding the proposed MSc APES program occurred during the Fall 2014 semester. These consultations were held within the Grenfell Campus and Memorial University communities, with representatives from both the federal and provincial levels of government, non-governmental institutions and Atlantic Canadian universities, and the environmental industries in the Atlantic region. The purpose of the consultations was to provide a draft outline of the Master of Science in Agricultural, Forest and Environmental Science graduate program; to seek advice and recommendations from the internal and external stakeholders regarding the focus and design of the program.

Consultations with Federal Government, Provincial Government, NGO and Academic Institutions

Participants

Conducted by:
Michael J. Goss and Bryan Harvey – September 2011
Greg Wood – Sept 2012 – May 2013
Greg Wood – May 2014 – October 2014

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<tr>
<th>Name</th>
<th>Department / Division / Agency</th>
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<tbody>
<tr>
<td>Crystal Anderson-Baggs</td>
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<td>Bill Dawson</td>
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<td>Mark Tierney</td>
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<td>Katie Temple</td>
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<td>Susanne Dawe</td>
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<tr>
<td>Jocelyn Noseworthy</td>
<td>Prov. Human Resources Labour and Employment</td>
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<td>Chris Freake</td>
<td>Employment preparation</td>
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<tr>
<td>Gordon Hancock</td>
<td>Humber Economic Development Board</td>
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<td>Dmitry Sveshnikov</td>
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<td>Mark Lambswood</td>
<td>Red Ochre Economic Development Board</td>
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<td>Susan Pottle</td>
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<td>Louis MacDonald</td>
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<td>Danny Brock</td>
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<tr>
<td>Carolyn Wheeler</td>
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<td>Dave Jennings</td>
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<tr>
<td>Rhea Hutchings</td>
<td>Supervisor of Sustainable Development, City of Corner Brook</td>
</tr>
<tr>
<td>Paul Mills</td>
<td>Vice President, ACOA</td>
</tr>
<tr>
<td>Sheila Earle</td>
<td>Regional Planning Specialist, Innovation, Business and Rural Development</td>
</tr>
<tr>
<td>Name</td>
<td>Title and Organization</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Robert Otto</td>
<td>Director, IBES, Department of Environment and Conservation</td>
</tr>
<tr>
<td>Sheldon Peddle</td>
<td>Executive Director, ACAP, Corner Brook</td>
</tr>
<tr>
<td>Jeff Whalen</td>
<td>ADM, Dept. of Natural Resources</td>
</tr>
<tr>
<td>Wayne Kelly</td>
<td>Director of Ecosystem Sustainability and Research, Forestry and Agrifoods Division</td>
</tr>
<tr>
<td>Cyril Organ</td>
<td>VP Academic &amp; Learner Services, College of the North Atlantic</td>
</tr>
<tr>
<td>Darren Pike</td>
<td>Deputy Minister, Department of Education</td>
</tr>
<tr>
<td>Bruce Belbin</td>
<td>ADM, Advanced Education and Skills</td>
</tr>
<tr>
<td>Dennis Waterman</td>
<td>Associate Vice President (Administration and Finance), Grenfell</td>
</tr>
<tr>
<td>Javis Hulan</td>
<td>Manager, Facilities Management, Grenfell</td>
</tr>
<tr>
<td>Hon. Ross Wiseman</td>
<td>Minister, Department of Environment and Conservation</td>
</tr>
<tr>
<td>Keith Hiscock</td>
<td>Facilities Management, MUN</td>
</tr>
<tr>
<td>Karen Skinner</td>
<td>Director, Enterprise Development, ACOA</td>
</tr>
<tr>
<td>Chad Butt</td>
<td>Account Manager, ACOA</td>
</tr>
<tr>
<td>Paul Barnable</td>
<td>Director of Community Services, City of Corner Brook</td>
</tr>
<tr>
<td>Marion McCahon</td>
<td>Regional Partnership Planner, Office of Public Engagement, Gov. NL</td>
</tr>
<tr>
<td>Sandy Todd</td>
<td>Research Manager, Atlantic Cool Climate Crop Research Centre, Agriculture Canada</td>
</tr>
<tr>
<td>Peter Duinker</td>
<td>School for Resource and Environmental Studies (SRES), Dalhousie University</td>
</tr>
<tr>
<td>Sean St. George</td>
<td>Executive Director, Red Ochre Economic Development Board</td>
</tr>
<tr>
<td>Valerie Simms-Anderson</td>
<td>Executive Director, Humber Economic Development Board</td>
</tr>
<tr>
<td>Eugene Legge</td>
<td>President, NL Federation of Agriculture</td>
</tr>
<tr>
<td>Debra Coughlin</td>
<td>Economic Development Officer, Long Range Economic Development Board</td>
</tr>
<tr>
<td>Andrea Meyers</td>
<td>Economic Development Officer, Nordic Economic Development Corporation</td>
</tr>
<tr>
<td>Marie Ryan</td>
<td>Provincial Environment and Conservation - Policy and Strategic Planning</td>
</tr>
<tr>
<td>Wayne Turpin</td>
<td>Soiltec - NL Environmental Remediation Business</td>
</tr>
<tr>
<td>Ken Martin</td>
<td>ACOA - Director General - Regional Operations</td>
</tr>
<tr>
<td>Bill Grandy</td>
<td>ACOA - Director - Community Development</td>
</tr>
<tr>
<td>Name</td>
<td>Affiliation</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td>Bruce Pike</td>
<td>Canadian Forest Service - Deputy Director</td>
</tr>
<tr>
<td>Tom Rosser</td>
<td>Canadian Forest Service - Assistant Deputy Minister</td>
</tr>
<tr>
<td>Susan Ziegler</td>
<td>MUN - Dept. of Earth Science, MUN</td>
</tr>
<tr>
<td>Darrin Sooley</td>
<td>Fisheries and Oceans - Area Habitat Coordinator</td>
</tr>
<tr>
<td>Keith Clarke</td>
<td>Fisheries and Oceans - Science Branch, St. John's</td>
</tr>
<tr>
<td>Carl Noseworthy</td>
<td>Provincial Forestry Division - Center for Forest Science &amp; Innovation</td>
</tr>
<tr>
<td>Chris Power</td>
<td>Department of Municipal Affairs - Regional Engineer</td>
</tr>
<tr>
<td>Derrick Maddocks</td>
<td>Director - Pollution Prevention, Water Management, Dept of Env and Cons</td>
</tr>
<tr>
<td>Ian Bell</td>
<td>Environmental Scientist - Dept. of Env and Cons</td>
</tr>
<tr>
<td>Leonard House</td>
<td>Aquaculture Development Officer - Dept. of Fisheries and Aquaculture</td>
</tr>
<tr>
<td>Daryl Whalen</td>
<td>Director, Provincial Aquaculture Veterinarian, Dept of Fisheries and Aquaculture</td>
</tr>
<tr>
<td>Lourens Robberts</td>
<td>Director of Provincial Public Health Laboratory, Department of Health and Community Services</td>
</tr>
<tr>
<td>Don Downer</td>
<td>Independent Chair, Western Regional Waste Management Authority</td>
</tr>
<tr>
<td>Ed Evans</td>
<td>Manager, Central Newfoundland Waste Management Authority</td>
</tr>
<tr>
<td>Ted Lomond</td>
<td>Executive Director, Newfoundland and Labrador Environmental Industry Association</td>
</tr>
<tr>
<td>Glenn Sharpe</td>
<td>Abydcoz Environmental Inc</td>
</tr>
<tr>
<td>Rob Whelan</td>
<td>Maxxam Analytics</td>
</tr>
<tr>
<td>Paul Staeben</td>
<td>Regional Manager - Pinchin LeBlanc Environmental</td>
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</table>
### Appendix E. Consultation Plan

<table>
<thead>
<tr>
<th>Group/Organization</th>
<th>Contact Person</th>
<th>Position</th>
<th>Anticipated Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSc AFES Consultation Plan</td>
<td>Dr. Robert Gallant</td>
<td>Division Head</td>
<td>15-Oct-14</td>
</tr>
<tr>
<td>Division of Science, Grenfell Campus</td>
<td>Dr. Sandra Wright</td>
<td>Division Head</td>
<td>15-Oct-14</td>
</tr>
<tr>
<td>Division of Social Science, Grenfell Campus</td>
<td>Dr. Todd Hennessey</td>
<td>Division Head</td>
<td>15-Oct-14</td>
</tr>
<tr>
<td>Division of Fine Arts, Grenfell Campus</td>
<td>Dr. Ken Abrahams</td>
<td>Division Head</td>
<td>15-Oct-14</td>
</tr>
<tr>
<td>School of Science, St. John's MUN</td>
<td>Dr. Feve Murm</td>
<td>Dean</td>
<td>16-Nov-14</td>
</tr>
<tr>
<td>Canadian Forest Service</td>
<td>Dr. Brent Nordin</td>
<td>Deputy Minister</td>
<td>30-Nov-14</td>
</tr>
<tr>
<td>Acadia University of Nova Scotia</td>
<td>Mr. James Frees</td>
<td>Dean</td>
<td>30-Nov-14</td>
</tr>
<tr>
<td>Acadia University of Prince Edward County</td>
<td>Mr. James Groves</td>
<td>Deputy Minister</td>
<td>30-Nov-14</td>
</tr>
<tr>
<td>Acadia University of the Atlantic</td>
<td>General Office, Dartmouth, NS</td>
<td>Dean</td>
<td>30-Nov-14</td>
</tr>
<tr>
<td>Labrador Institute</td>
<td>Mr. Martha MacBean</td>
<td>Acting Director</td>
<td>30-Nov-14</td>
</tr>
<tr>
<td>NL Office of Agriculture, Faculty of Agriculture</td>
<td>Dr. Paul Connors</td>
<td>Executive Director</td>
<td>30-Nov-14</td>
</tr>
<tr>
<td>Dalhousie University of the Atlantic</td>
<td>Elizaith Smyth</td>
<td>Dean</td>
<td>15-Dec-14</td>
</tr>
<tr>
<td>University of Toronto, Graduate Studies</td>
<td>Dr. Robert Gordon</td>
<td>Vice-Dean, Programs</td>
<td>15-Dec-14</td>
</tr>
</tbody>
</table>
Appendix F. Potential Faculty and Academic CVs

Faculty who may potentially contribute to the Master of Science in Agricultural, Forest and Environmental Science program are listed below, and their CVs are provided immediately following the list.

<table>
<thead>
<tr>
<th>Dr. Sudhir Abhyankar</th>
<th>Environmental Science, Grenfell Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Andre Arsenault</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
<tr>
<td>Dr. Gary Bishop</td>
<td>Agriculture-Agrifoods Canada (AAFC)</td>
</tr>
<tr>
<td>Dr. Wade Bowers</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Christine Campbell</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Muntaz Cheema</td>
<td>BERI, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Samir Debnath</td>
<td>Agriculture-Agrifoods Canada (AAFC)</td>
</tr>
<tr>
<td>Dr. Peggy Dixon</td>
<td>Agriculture-Agrifoods Canada (AAFC)</td>
</tr>
<tr>
<td>Dr. Julian Dust</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Kate Edwards</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
<tr>
<td>Dr. Erin Fraser</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Lakshman Galagedara</td>
<td>BERI, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Brian Hearn</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
<tr>
<td>Dr. Gary Kachanoski</td>
<td>President, Memorial University</td>
</tr>
<tr>
<td>Dr. Vanessa Kavanagh</td>
<td>Agrifoods Div., Dept of Natural Resources, Gov't of NL</td>
</tr>
<tr>
<td>Dr. Catherine Keske</td>
<td>BERI, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Mano Krishnapillai</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Allan Kwabiah</td>
<td>Agriculture-Agrifoods Canada (AAFC)</td>
</tr>
<tr>
<td>Dr. Chen Lui</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Joan Luther</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
<tr>
<td>Dr. David McKenzie</td>
<td>Agriculture-Agrifoods Canada (AAFC)</td>
</tr>
<tr>
<td>Dr. Don-Roger Parkinson</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Reg Parsons</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
<tr>
<td>Dr. Bruce Pike</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
<tr>
<td>Dr. Harunur Rashid</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Geoff Rayner-Cannam</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Robert Scott</td>
<td>Sustainable Resource Management, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Julie Sircom</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Dmitry Sveshnikov</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Raymond Thomas</td>
<td>BERI, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Adrian Unc</td>
<td>BERI, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Ian Warke / warke</td>
<td>Environmental Science, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Barry Wheeler</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
<tr>
<td>Dr. Jianghua Wu</td>
<td>Sustainable Resource Management, Grenfell Campus</td>
</tr>
<tr>
<td>Dr. Susan Zeigler</td>
<td>Geography, Memorial University</td>
</tr>
<tr>
<td>Dr. Xinbiao Zhu</td>
<td>Canadian Forest Service, NRCAN, Corner Brook</td>
</tr>
</tbody>
</table>

*A complete list of academic CV's will be available in the final draft of the proposal.*
R. Gary Kachanoski, PhD

Education:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Discipline</th>
<th>University</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.Sc. (honors)</td>
<td>Biology</td>
<td>University of Saskatchewan</td>
<td>1976</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saskatoon, Saskatchewan, Canada</td>
<td></td>
</tr>
<tr>
<td>M.Sc.</td>
<td>Soil Science</td>
<td>University of Saskatchewan</td>
<td>1980</td>
</tr>
<tr>
<td>Ph.D.</td>
<td>Soil Physics</td>
<td>University of California</td>
<td>1984</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Davis, California, USA</td>
<td></td>
</tr>
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</table>

Academic Experience:

<table>
<thead>
<tr>
<th>Position</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>President and Vice-Chancellor</td>
<td>2010 to</td>
<td>Memorial University of Newfoundland</td>
</tr>
<tr>
<td>(85%) Professor and Bentley Research Chair (soil, water &amp; environment)</td>
<td>2007 to 2010</td>
<td>Department of Renewable Resources, Univ. of Alberta, Edmonton, AB, Canada</td>
</tr>
<tr>
<td>(15%) Executive Director: Folkwaysalive!</td>
<td>2007 to</td>
<td>Faculty of Arts, Univ. of Alberta, Edmonton, AB, Canada</td>
</tr>
<tr>
<td>Vice-President (Research)</td>
<td>2001 to 2007</td>
<td>Univ. of Alberta, Edmonton, AB, Canada</td>
</tr>
<tr>
<td>Dean, College of Graduate Studies and Research</td>
<td>1996 to 2001</td>
<td>Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada</td>
</tr>
<tr>
<td>Department Chair and Professor</td>
<td>1995 to 1996</td>
<td>Dept. of Land Resource Science, Univ. of Guelph, ON, Canada</td>
</tr>
<tr>
<td>Director (Envir &amp; Natural Resources Program)</td>
<td>1994 to 1995</td>
<td>Office of VP (Research), Univ. of Guelph, ON, Canada</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>1990 to 1994</td>
<td>Dept. of Land Resource Science, Univ. of Guelph, ON, Canada</td>
</tr>
<tr>
<td>Adjunct appointment as Research Professor</td>
<td>*1990 to 1996</td>
<td>Dept. of Earth Science, Univ. of Waterloo Centre for Groundwater Research (ON Centre of Research Excellence)</td>
</tr>
<tr>
<td>Assistant Professor (Granted Tenure 1987)</td>
<td>1985 to 1990</td>
<td>Dept. of Land Resource Science, Univ. of Guelph, ON, Canada</td>
</tr>
</tbody>
</table>

RESEARCH AND SCHOLARLY ACTIVITIES

Editor, Canadian Journal of Soil Science, 2009-2010;

Scientific Journals Committee, 2009-2010
(Policy for Canadian Journals of Plant Science, Animal Science, Soil Science);

President – Canadian Society of Soil Science, 2000

Associate Editor of Canadian Journal of Soil Science, 1993-1996;

Associate Editor of Soil Science Society of America Journal, 1992-1997;
Associate Editor European Journal of Soil Science, 1994-1999;

Associate Editor Vadose Zone Journal, 2008 - present;

Natural Sciences and Engineering Research Council of Canada (NSERC) Environmental Earth Sciences Grant Selection (09) Committee, 1997-2000;

NSERC Chair – Major Equipment /Major Installation Committee GSC (09), 2000;

NSERC Environmental Earth Sciences Re-Allocation Steering Committee, 2000;

Soil Science Society of America Kirkham Award Committee Member, 1998-2001;

Professional Agrologist (P.Ag.) 1998-present.

GRADUATE STUDENT SUPERVISION

a. Current Graduate Students
   1 Ph.D.

b. Students who have graduated
   8 M. Sc. Students
   11 Ph.D. Students

c. Past Ph.D. Students

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Occupation After Graduation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>Dr. E. Gregorich</td>
<td>Senior Research Scientist, Agriculture Canada (Ottawa)</td>
</tr>
<tr>
<td>1993</td>
<td>Dr. J. Van Wesenbeeck</td>
<td>Senior Research Scientist, Dow Elanco Indianapolis, U.S.A.</td>
</tr>
<tr>
<td>1994</td>
<td>Dr. A. Ward</td>
<td>Senior Research Scientist (Nuclear Waste), Batelle Pacific Northwest Lab. (U.S.A. Department of Energy National Research Lab.) (Hanford, Washington)</td>
</tr>
<tr>
<td>1994</td>
<td>Dr. G. Parkin*</td>
<td>Professor, Department of Land Resource Science, University of Guelph</td>
</tr>
<tr>
<td>1997</td>
<td>Dr. D. Lobb</td>
<td>Professor, Department of Soil Sciences, University of Manitoba</td>
</tr>
<tr>
<td>1997</td>
<td>Dr. C. Hamlen</td>
<td>Consulting Firm (Environmental)</td>
</tr>
<tr>
<td>1998</td>
<td>Dr. B. Si</td>
<td>Associate Professor, Department of Soil Science, University of Saskatchewan</td>
</tr>
<tr>
<td>1999</td>
<td>Dr. D. Goorahoo</td>
<td>Associate Professor, Fresno State University</td>
</tr>
<tr>
<td>1999</td>
<td>Dr. F. Zhang*</td>
<td>Research Scientist: Batelle Pacific Northwest Lab (U.S.A. DOE National Research Lab)</td>
</tr>
</tbody>
</table>
2006  Dr. S. Woods  Research Scientist (Irrigation), Alberta Agriculture Food and Rural Development, Lethbridge, Alberta

2008  Dr. M. Dyck  Assistant Professor Department of Renewable Resources, University of Alberta.

*co-supervisor

**RESEARCH GRANTS AND CONTRACTS**

*Projects as Principal Researcher (University)*

<table>
<thead>
<tr>
<th>Titles of Research Projects</th>
<th>Funding Source</th>
<th>Duration/Date</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Spatial variability of transport processes in soil</td>
<td>NSERC (Discovery)</td>
<td>5 yrs. (2006-2011)</td>
<td>$213,500</td>
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<tr>
<td>Transport processes in soil</td>
<td>NSERC (Research)</td>
<td>4 yrs. (2001-2005)</td>
<td>$184,000</td>
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<tr>
<td>Spatial relationships of transport processes in soil</td>
<td>NSERC (Research)</td>
<td>4 yrs. (1997-2001)</td>
<td>$152,000 (30,000/yr.)</td>
</tr>
<tr>
<td>Spatial relationships of transport processes in soil</td>
<td>NSERC (Research)</td>
<td>3 yrs. (1994-1997)</td>
<td>$101,325 (33,775/yr.)</td>
</tr>
<tr>
<td>Time domain reflectometry multiplexing system</td>
<td>NSERC (Equipment)</td>
<td>1 yr. (1995)</td>
<td>$6,900</td>
</tr>
<tr>
<td>Tillage effects on transport processes in soil</td>
<td>NSERC (Research)</td>
<td>3 yrs. (1991-1993)</td>
<td>$96,117 (32,039/yr.)</td>
</tr>
<tr>
<td>Tillage effects on spatial and temporal variability of soil properties</td>
<td>NSERC (Operating)</td>
<td>3 yrs. (1985-1988)</td>
<td>$67,623 (22,541/yr.)</td>
</tr>
<tr>
<td>Non-containing electro-magnetic probe for soil EC</td>
<td>NSERC (Research)</td>
<td>1 yr. (1985)</td>
<td>$12,000</td>
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<tr>
<td>Time domain reflectometry cable tester</td>
<td>NSERC (Equipment)</td>
<td>1 yr. (1987)</td>
<td>$12,500</td>
</tr>
<tr>
<td>Prevention of nitrate contamination of groundwater from fertilizer</td>
<td>NSERC /Agric. Canada</td>
<td>3 yrs. (1990-1993)</td>
<td>$120,000</td>
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<tr>
<td>Project Description</td>
<td>Funding Body</td>
<td>Duration</td>
<td>Cost</td>
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<tr>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>---------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Variable rate technology for N fertilizer application</td>
<td>Agri. Canada (Green Plan)</td>
<td>4 yrs. (1994-1997)</td>
<td>$170,000</td>
</tr>
<tr>
<td>Water and chemical management systems for turf grass</td>
<td>Agri. Canada (Green Plan)</td>
<td>3 yrs. (1994-1996)</td>
<td>$129,000</td>
</tr>
<tr>
<td>Variable application technology for increased fertilizer-use efficiency</td>
<td>NSERC/Agric. Can</td>
<td>3 yrs. (1990-1993)</td>
<td>$135,000</td>
</tr>
<tr>
<td>Tillage and surface infiltration</td>
<td>Agric. Can.</td>
<td>1 yr. (1989)</td>
<td>$37,000</td>
</tr>
<tr>
<td>Effect of management on surface hydraulic properties.</td>
<td>Agric. Can.</td>
<td>1 yr. (1990)</td>
<td>$75,000</td>
</tr>
<tr>
<td>Tillage effects on quantity and quality of tile drainage water</td>
<td>Agric. Can.</td>
<td>3 yrs. (1989-1991)</td>
<td>$150,000</td>
</tr>
<tr>
<td>Field scale crop response to fertilizer</td>
<td>Potash Phosph. Inst.</td>
<td>2 yrs. (1993-1994)</td>
<td>$14,000</td>
</tr>
<tr>
<td>Impact of manure and fertilizer on nitrate contamination of groundwater</td>
<td>Ont. Min. Environ.</td>
<td>3 yrs. (1991-1994)</td>
<td>$210,000</td>
</tr>
<tr>
<td>Multi-channel, high efficiency gamma-spectroscopy equip. for 137 Cs analysis</td>
<td>Agric. Can.</td>
<td>1 yr. (1987)</td>
<td>$45,000</td>
</tr>
<tr>
<td>Additional high efficiency Li-Ge crystal for gamma spectroscopy system</td>
<td>Agric. Can.</td>
<td>1 yr. (1991)</td>
<td>$30,000</td>
</tr>
<tr>
<td>Application of 137 Cs as an erosion tracer in Ontario</td>
<td>Agric. Can.</td>
<td>1 yr. (1985)</td>
<td>$2,000</td>
</tr>
<tr>
<td>Management of field variability Tillage effects on event based soil and phosphorus losses</td>
<td>Agric. Can.</td>
<td>4 yrs. (1988-1992)</td>
<td>$244,678</td>
</tr>
<tr>
<td></td>
<td>Ont. Min. Environ.</td>
<td>3 yrs. (1988-1991)</td>
<td>$201,000</td>
</tr>
<tr>
<td>Quantification of tillage translocation of soil</td>
<td>Agric. Can.</td>
<td>3 yrs. (1991-1993)</td>
<td>$76,000</td>
</tr>
<tr>
<td>Soil loss by tillage</td>
<td>Agric. Can.</td>
<td>1 yr. (1991)</td>
<td>$35,000</td>
</tr>
<tr>
<td>Nitrogen conserving farming systems</td>
<td>Ont. Min. Agric.</td>
<td>2 yrs. (1990-1992)</td>
<td>$160,000</td>
</tr>
<tr>
<td>Field scale fertilizer recommendations</td>
<td>University Saskatchewan College Agric.</td>
<td>3 yrs. (1997-2000)</td>
<td>$54,000</td>
</tr>
</tbody>
</table>
### Projects as Co-Researcher (University)

<table>
<thead>
<tr>
<th>Titles of Research Projects</th>
<th>Funding Source</th>
<th>Duration/Date</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe secure water supplies</td>
<td>Alberta Water Research Institute</td>
<td>3 yrs. (2009-2012)</td>
<td>$4,009,800 ($300K personal)</td>
</tr>
<tr>
<td>Toxic elements (drinking water)</td>
<td>Canadian Water Network (NCE)</td>
<td>4 yrs. (2008-2012)</td>
<td>$626,440 ($79K personal)</td>
</tr>
<tr>
<td>Discrete Water Chemistry Analyzer (S. Quideau Pl)</td>
<td>NSERC (equipment)</td>
<td>1 yr. (2008)</td>
<td>$58,997</td>
</tr>
<tr>
<td>Alternate management and N contamination of groundwater in sandy soils</td>
<td>Agric. Can.</td>
<td>4 yrs. (1988-1992)</td>
<td>$420,000</td>
</tr>
<tr>
<td>Field scale modelling of water and solute transport</td>
<td>NSERC Strategic</td>
<td>3 yrs. (1990-1992)</td>
<td>$390,000</td>
</tr>
<tr>
<td>Remediation of contaminated drinking water wells</td>
<td>Agric. Can.</td>
<td>4 yrs. (1993-1997)</td>
<td>$173,000</td>
</tr>
<tr>
<td>Efficiency of flush and pump remediation technologies</td>
<td>Industrial solvents consortium</td>
<td>2 yrs. (1993-1994)</td>
<td>$30,000</td>
</tr>
<tr>
<td>Movement of chemicals and bacteria off/out of the rooting zone</td>
<td>Agric. Can. (Green Plan)</td>
<td>4 yrs. (1993-1997)</td>
<td>$593,200</td>
</tr>
</tbody>
</table>

### LIST OF PUBLICATIONS: (Since 2000)

Papers published in refereed journals:


**Titles of Books and Chapters in Books Which Have Been Published (Total = 13)**


Technical Reports:


tillage implement, slope gradient, and tillage direction on soil translocation by tillage. Agric.


manure and fertilizer application on nitrate contamination of groundwater. Ont. Min. of Envir. And

1993. Alternate Crop management practices and nitrate contamination of groundwater with sandy soils
used for tobacco production. Final Report
Catherine M. H. Keske, Ph.D.

EDUCATION
2006         Doctor of Philosophy, Agricultural and Resource Economics, Colorado State University
2003         Master of Science, Mineral Economics, Colorado School of Mines
1994         Master of Science, Hearing and Speech Sciences, Vanderbilt University
1992         Bachelor of Science, Communication Disorders, magna cum laude, Bowling Green State Univ.

ACADEMIC/RESEARCH POSITIONS
2014-present  Memorial University of Newfoundland, Grenfell Campus
               Associate Professor
               Division of Social Sciences (Economics) and Boreal Ecosystem Research Institute (BERI)

2011-present  University of Colorado-Boulder
               Senior Research Scientist and Affiliate, Institute of Arctic and Alpine Research (INSTAAR)

2008-present  Denver University Sturm School of Law,
               Adjunct Professor, Natural Resource & Environmental Law

2004-2012     Colorado State University
               2012         Associate Professor, Special Appointment, Dept. Of Soil and Crop Sciences
               2006-2012     Assistant Professor, Special Appointment, Dept. Of Soil and Crop Sciences
               2004-2006     Graduate Research Assistant, Dept. Of Agricultural and Resource Economics

2003-2006     Colorado School of Mines
               Adjunct Economics Professor

PUBLICATION AND GRANT SUMMARY (October 2014)
•    Referred journal articles, either published or accepted and in press: 31
•    Referred, published books and book chapters: 15
•    Referred, published technical and extension reports: 49
•    Non-referred, published scientific, technical, and extension bulletins: 71
•    Externally funded grants:
  More than $11,000,000 as PI or Co-PI, 2005-2014
  More than $27,000,000 as Collaborator/Senior Personnel, 2005-2014
  34 Total (PI: 6; Co-PI: 15; Collaborator/Senior Personnel: 3)
•    PI/Co-PI of funded workshop, workshop, and mini-grants (eg. NSF, university internal): 11

SELECTED JOURNAL ARTICLES (Refereed)


Loomis, J.B. and C.M. Keske, 2009, Mountain substitutability and peak load pricing of high alpine peaks as a


**SELECTED AGRICULTURAL EXPERIMENT STATION BULLETINS (Referenced)**


**RESEARCH STATEMENT AND WORK IN PROGRESS**

I am an agricultural and forestry economist who studies contemporary resource issues. I incorporate a number of different economic methods into my research program and I frequently engage in interdisciplinary collaboration. Several of my recent research papers focus on forest recreation and tourism, energy pricing, soil conservation and nutrient management, community sense of place, and ecosystem service valuation. I am currently working on projects that involve the coupling of natural and human systems in the wildland urban interface (WUI); trade-offs between economic development and soil degradation at high elevations; and, the relationship between oil and gas development on home values. I enjoy international research and I have worked on projects in the U.S., China, West Africa (Mali), East Africa, and Costa Rica.

**SELECTED EXTERNAL CONTRACTS & GRANTS**


**PRINCIPAL INVESTIGATOR (Past)**


CO-PRINCIPAL INVESTIGATOR (Past)

STUDENT ADVISING/GRADUATE SUPERVISION

Ph.D. Independent Study/Project Supervision:
Paul Tanger, CSU IGERT Rotation Adviser CSU Spring 2010
Patrick Bixler, Independent Study Adviser CSU Spring 2011
Adam Mayer, Independent Study Adviser CSU Spring 2012
Andrew Brandess, CSU Spring 2012
Greta Lohman, CSU Spring 2011, Fall 2011 and Spring 2012

Master of Science:
2012: Andrew Brandess, Major Adviser CSU 2010-2012 (M.S. in Ag and Resource Economics 5/2012), USDA AFRI NIFA Fellow
    Jeffrey Lasker, Committee Member (Master of Engineering 5/2013)
    Cristian Robbins, Committee Member (Master of Engineering 5/2012)
    Andrew Arrell, Major Adviser (Master of Agriculture 12/2012)

2011: Shannon Clark, Major Adviser CSU (Master of Agriculture 12/2011)
    Stephen Goodwin, Committee Member (Master of Engineering 12/2011)
    Christopher Henry, Committee Member (Master of Science in Forestry 8/2011)

2010: Greta Lohman, Major Adviser CSU (Master of Science in Soil and Crop Sciences 12/2010)
    Morgan Davis, Committee Member CSU (Master of Engineering 12/2010)
    Benjamin Geller, Committee Member CSU (Master of Engineering 12/2010)
    Eric Cropper, Committee Member University of Wyoming (Master of Science in Agricultural and Resource Economics 5/2010)

2008: Rebecca Goldbach, Major Adviser, CSU (M.S. in Agricultural and Resource Economics (12/2008)
2007: Michael Verdone, Advising Committee Member, CU-Denver (M.S. in Economics 12/2007)

Bachelor of Science Honors Committees:
2008: Cassie Fiscus, CSU Honors Thesis Committee Member (B.S. 12/2008)

Clubs: University of Northern Colorado Snowboarding Club Faculty Adviser (2006/07)
       UNC Outstanding Club President Nate Giska (Spring 2007)
Julie Sircom

Environmental Science Unit, Biology
Grenfell Campus, Memorial University
Corner Brook, NL A2H 6P9
(709) 639-6515
jsircom@grenfell.mun.ca

Home address
PO Box 232
Corner Brook, NL A2H 6C9
(709) 632-7978
jsircom@dal.ca

Education

Dalhousie University 2003 – 2009 Ph.D. Biology

*Thesis title:* Determinants of the biodiversity and composition of stream insect communities.

*Supervisor:* Dr Sandra Walde

Dalhousie University 1996 – 1999 M.Sc. Biology


*Supervisor:* Dr Sandra Walde

Acadia University 1985 – 1989 B.Sc. Biology

*Thesis title:* Recolonization by the amphipod Corophium volutator of mudflats in the Minas Basin.

*Supervisor:* Dr Graham Daborn

Additional post-secondary education

<table>
<thead>
<tr>
<th>Location</th>
<th>Year(s)</th>
<th>Program</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carleton University</td>
<td>2000 – 2002</td>
<td>Ph.D. Biology</td>
<td>Withdrew; funding problems</td>
</tr>
<tr>
<td>Simon Fraser University</td>
<td>1991</td>
<td>No degree program</td>
<td>Taking courses of interest</td>
</tr>
</tbody>
</table>

Awards
<table>
<thead>
<tr>
<th>Awarding body</th>
<th>Description of award</th>
<th>Year(s) held</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government of Ontario</td>
<td>Ontario graduate scholarship</td>
<td>2001</td>
</tr>
<tr>
<td>Carleton University</td>
<td>Graduate scholarship</td>
<td>2000</td>
</tr>
<tr>
<td>NSERC</td>
<td>Summer research fellowship</td>
<td>1987, 1988</td>
</tr>
<tr>
<td>Acadia University</td>
<td>Dean’s List scholarship</td>
<td>1987</td>
</tr>
<tr>
<td>Acadia University</td>
<td>Dean’s List</td>
<td>1987 – 1988</td>
</tr>
<tr>
<td>Acadia University</td>
<td>Entrance scholarship (renewable)</td>
<td>1985 – 1989</td>
</tr>
</tbody>
</table>

Teaching experience

Assistant professor

<table>
<thead>
<tr>
<th>Course title</th>
<th>University</th>
<th>Year(s)</th>
<th>Format and content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater Ecology ENVS 3130</td>
<td>Grenfell Campus, MUN</td>
<td>Winter 2012-2015</td>
<td>Lecture and lab*, student-led journal club style discussions. Water properties, chemistry, nutrients, organisms and ecosystems.</td>
</tr>
<tr>
<td>Principles of Ecology BIOL 2600</td>
<td>Grenfell</td>
<td>Fall 2012-2014</td>
<td>Lecture and lab*, several computer tutorials. Distributions, population models, communities and ecosystems.</td>
</tr>
<tr>
<td>Principles of Biology BIOL 1001</td>
<td>Grenfell</td>
<td>Fall 2011-2013</td>
<td>Lecture and lab†. History of life, phylogeny, survey of diversity, life chemistry, basic cellular processes †.</td>
</tr>
<tr>
<td>Principles of Biology BIOL 1002</td>
<td>Grenfell</td>
<td>Winter 2012</td>
<td>Lecture and lab†. Basic cellular processes, DNA, Mendel, population genetics, evolution †.</td>
</tr>
<tr>
<td>Biology of Vertebrates BIOL 2210</td>
<td>Grenfell</td>
<td>Fall 2011</td>
<td>Lecture and lab*. Survey of vertebrate taxa, evolutionary relationships and ecological importance.</td>
</tr>
<tr>
<td>Behavioural Ecology BIOL 495</td>
<td>Cape Breton University</td>
<td>Winter 2011</td>
<td>Lecture and lab†. Survey of behavioural ecology, including social behaviour, foraging, habitat and mate choice.</td>
</tr>
<tr>
<td>Ichthyology BIOL 485</td>
<td>CBU</td>
<td>Winter 2011</td>
<td>Lecture and lab†. Survey of fish diversity and evolution, their ecological and economic importance.</td>
</tr>
</tbody>
</table>
Chordate Zoology
BIOL 235      CBU      Winter 2011
Lecture and lab. Survey of chordate taxa, evolutionary relationships and ecological importance.

Population Ecology
BIOL 3059       Dalhousie University  Fall 2009
Lecture and tutorial delivered by teaching assistant. Selection of population models including competition and disease.

*Present in laboratory, content and schedule developed in collaboration with an instructor.
†Laboratory taught by instructors; consultation with faculty on scheduling and content.
‡Biology 1001 and 1002 have been under revision since 2011; the apparent overlap in content is due to material being moved from one course to the other.

Supervisory experience

Co-supervisor for ENVS 4950 Independent Project, fall semester 2012
Supervisor for ENVS 4950 Independent Project, fall semester 2013
Currently supervising a Masters student through Environmental Science in St John’s

Research interests

My research focuses on pollinators, primarily native bumble bees in commercial cranberry fields. This research is intended to provide growers with low-cost approaches to increasing yield by encouraging native pollinator populations, to reduce reliance on imported, non-native bumble bees. These have the potential to spread diseases and parasites to native bees, and to our currently healthy honey bee colonies. There are also opportunities to examine plant-pollinator interactions, pollinator behaviour at local and landscape scales, and pollinator diversity. With the help of BER, researchers, I plan to examine the nutritional content of the pollen and nectar of common forage plants to determine the optimal species composition to enhance native bee populations. Other projects include assessment of honey bees as cranberry pollinators, measuring the nutritional properties of honey produced by honey bees foraging on cranberry and other native crops, and a pilot study of clearcuts as transitory native bee habitat, in collaboration with Corner Brook Pulp and Paper.

Research funding

<table>
<thead>
<tr>
<th>Project title; collaborators</th>
<th>Funding agencies</th>
<th>Amount</th>
<th>Period</th>
</tr>
</thead>
</table>
| Enhancing native pollinators in commercial cranberry fields for increased yield  
Collaborator: Dr Barry Hicks, CNA | Research & Development Corporation, NL | $100,000 | January 2014 – December 2015 |
| Pollination of commercial Cranberry (Vaccinium macrocarpon Ait.) in Newfoundland by native and introduced bees  
Collaborator: Dr Barry Hicks, CNA | Regional Collaboration Research Initiative  
NL Department of Natural Resources | $37,020 | June 2013 – April 2014 |
Detritus processing and priming effects in boreal forest streams: potential links to climate change  
Collaborator: Dr Kate Edwards, CFS

Detritus breakdown in boreal forest streams: Potential links to climate change  
Vice President Grenfell Campus Research Fund $1,500 January 2013 – December 2013

CNA: College of the North Atlantic, Carbonera campus  
CFS: Canadian Forest Service, Corner Brook office

Publications

Referred publications – published


Technical reports


Dr. Adrian Unc
Curriculum Vitae

APPOINTMENTS

09/2013 -
Associate Professor of Soil Science (tenured), Memorial University of Newfoundland, Boreal Ecosystems Research Institute, Grenfell Campus, Corner Brook NL, Canada.

01/2015-12/2015
Visiting Research Fellow, University of Leeds, School of Geography, Faculty of Environment, Leeds, UK.

07/2014-12/2014
Senior Cheney Fellow, University of Leeds, School of Earth and Environment, Faculty of Environment, Leeds, UK.

08/2013 -
Affiliated Associate Professor, New Mexico State University, College of Agriculture, Consumer and Environmental Sciences, Department of Plant and Environmental Sciences, Las Cruces NM, USA.

07/2013-08/2013
Associate Professor of Environmental Sciences (tenured), New Mexico State University, College of Agriculture, Consumer and Environmental Sciences, Department of Plant and Environmental Sciences, Las Cruces NM, USA.

02/2007-06/2013
Assistant Professor of Environmental Sciences (tenure track), New Mexico State University, College of Agriculture, Consumer and Environmental Sciences, Department of Plant and Environmental Sciences, Las Cruces NM, USA.

05/2013-03/2014
Adjunct Associate Professor (2013-2014), Adjunct Assistant Professor (2009-2013), New Mexico State University, Molecular Biology Program (Interdepartmental Program), Las Cruces NM, USA.

2010 - 2014
Adjunct Faculty member, Energy Research Laboratory, New Mexico State University, Las Cruces NM, USA.

09/2012 - 09/2013
Invited Associate Professor (2012-2013), Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture and Forestry, Timisoara, Romania.

07/2005 - 01/2007
Research Scientist (July 2005 to January 2007), Centre for Research on Environmental Microbiology, Department of Biochemistry, Immunology and Microbiology, Faculty of Medicine, University of Ottawa, Ottawa ON, Canada.

09/2006 - 12/2006
Lecturer (Sept. 2006 to Dec. 2006), University of Guelph, Kemptville Campus, Kemptville ON Canada.

05/2003 - 09/2006
Special Graduate Faculty Member, Graduate Faculty, University of Guelph, Guelph, ON Canada.

07/2002 - 06/2005
Postdoctoral Fellow (July 2002 to June 2005), Centre for Research on Environmental Microbiology, Department of Biochemistry, Immunology and Microbiology, Faculty of Medicine, University of Ottawa, Ottawa, ON Canada.

01/2002 - 05/2002 Teaching Assistant (Jan. 2002 to May 2002), Crop Sciences Department, University of Guelph, Guelph ON, Canada.

09/1999 - 12/2001 Teaching Assistant (nine semesters in the period Sept. 1999 to Dec. 2001), Land Resource Science, University of Guelph, Guelph ON, Canada.

05/1996 - 06/2002 Research Assistant (May 1996 to June 2002), Department of Land Resource Science, University of Guelph, Guelph ON, Canada.


SCIENTIFIC EXPERTISE


International co-operation for research activities (co-authors and collaborators from NAFTA region, EU region, Middle East)

FUNDING SOURCES (career):

Research and Development Corporation, University of Leeds; US Department of Energy; US National Parks Services; US National Institute of Health; US National Science Foundation; US Department of Agriculture; Health Canada; Agriculture and Agrifood Canada; Ontario Ministry of Agriculture; Food and Rural Affairs; Ontario Ministry of Environment; Water Resources Research Institute; International Arid Land Consortium; International Science and Technology Center; BHP Billiton; WCI Environmental Solutions Inc.; Gang Gen, Inc.; Dairy Farmers of Ontario; New Mexico Dairy Producers; New Mexico State University; University of Ottawa.

FUNDING (last 2 years):

1. PI, Understanding soil fertility under land-use change scenarios; implications for land management and introduction of novel crops, Research & Development Corporation Newfoundland and Labrador. $100,000 (2015-2016).

2. PI, Senior Chene Fellowship, University of Leeds, (NOTE: awarded as one year salary & benefits, housing allowance, return flight, and £1000 conference costs, equivalent to about £85,000 or CAD $156,000; accepted at 6 months) (2014).

3. Co-I (consortium including multiple Co-I’s from the University of New Mexico, New Mexico State University, New Mexico Institute of Mining and Technology, Eastern New Mexico University, Santa Fe Community College and Santa Fe Institute with collaborators from the Los Alamos National Laboratory and the Sandia National Laboratory), Energize New Mexico, National Science Foundation (NSF) award #IIIA-1301346, $20,000,000 (2013-2018).


5. PI, Inventory of Soil Microbial and other Soil Faunal Ecosystem Components at the White Sands National Monument (WHSA) and Guadalupe Mountains National Park (GUMO). US National Park
Services, $120,497 (2011-2014).

PEER REVIEWED PUBLICATIONS (last 2 years)
1. Unnithan, VV*, Unc, A, Joe, V**, Smith, GB. 2014. Short RNA indicator sequences are not completely degraded by autoclaving. Scientific Reports, 4, 4070; DOI: 10.1038/srep04070
5. Unnithan, VV*, Unc, A, Smith GB. 2014. Role of Nannochloropsis salina for the recovery and persistence of MS2 virus in wastewater. Algal Research, Published online, 4, 70-75; (online Dec. 5, 2013) DOI: 10.1016/j.algal.2013.11.009

15. Sigala, J*, Unc, A, Stringham, B. *Submitted*. In vitro examination of the application of saline concentrate to septic tank wastewater. Water Science and Technology


17. Potter, A*, vanLeeuven, D, Unc, A. *Submitted*. Effects of varying harvest and feeding regimes on productivity of *Nannochloropsis salina* grown in municipal wastewater. Algal Research

**Popular or trade publications (last 2 years)**


**TEACHING AND ADVISING (last 2 years)**

**Academic advising (Advisory committee chair)**

**Post-doctoral scientists (NMSU):** Dr. Mark Seger - from 2011

**Doctoral students (PhD) (NMSU):**

Lori-Kae Schwab Uchanski: "Soil microbial diversity in grazed arid grasslands following natural gas drilling", graduated 2014

Mohammad E.W. Tahtamoui: "Functional and genetic diversities of soil and plant associated microbial communities across variable spatial scales in semi-arid ecological regions", graduated 2014

Veena V. Unnithan: "Role of *N. salina* in controlling wastewater microbial diversity in biofuel production systems", graduated 2013

Andrew Potter: "Effects of varying harvest and feeding regimes on productivity of *Nannochloropsis salina* grown in municipal wastewater" (current)

**Master students (MSc) (NMSU):**

Helena Deswood: "Analysis of the microbial community in bladder cells of *Atriplex canescens* (Pursh) Nutt. through microscopy and metagenomics" - graduated 2014

Jessica Gregson: "Wastewater Metagenomics in a wastewater lgal System; Laboratory scale evaluations" - graduated 2014 (Molecular Biology Department)

Conrad Nelson: Course based MSc - graduated 2014

**Academic advising (PhD, Advisory committee member):**

Mohammad Farhangi - advised by Dr. S. Sinegani, Bu-Ali Sina University, Iran - graduated 2014

Jennifer Smith - advised by Dr. W. Boeing, NMSU- Range Science (current)

**TEACHING (last 2 years):**

Survey of Environmental Chemistry (MUN, Grenfell); Environmental Impacts of Land Use (NMSU); Topics in Agronomy (NMSU);
OTHER ACTIVITIES (last 2 years):
Professional societies:

Editorial Board member, Algal Research (impact factor 4.10), 2014-2017

Session Chair: Integrated modelling of contaminants in the vadose zone; Source, Fate, and Impact at ELS 2014 - the Earth Living Skin: Soil, Life and Climate Changes organized by the Soil System Sciences (SSS) Division of the European Geosciences Union, September 22-25, 2014, Bari, Italy.


Grant reviewer:
The United States - Israel Binational Agricultural Research and Development Fund (BARD, 2013/2014)
South African Medical Research Council (2013, 2014)
The California Department of Food and Agriculture (CDFA), Fertilizer Research and Education Program (FREP) (2012, 2013, 2014).


Patents: Provisional patent (Photosynthetically oxygenated waste to energy recovery apparatus and method of use; (POWER), 2014

HONORS (last 2 years):
Visiting Research Fellow (2015), Univ. of Leeds, School of Geography, Faculty of Environment,
Senior Cheney Fellow (2014), Univ. of Leeds, School of Earth and Environment, Faculty of Environment,
Inducted into Sigma Xi, The Scientific Research Society (2013)
Inducted into Gamma Sigma Delta, The Honor Society for Agriculture (2012)
Appendix G. Letters of Support

November 6, 2012

Dr. Antony Card
Associate Vice-President (Grenfell Campus) Research
20 University Drive
Grenfell Campus
Corner Brook, NL A2H 6P9

Dr. Card,

The Newfoundland and Labrador Environmental Industry Association (NEIA) is pleased to support Grenfell Campus, Memorial University in its efforts to establish an Environmental Research Facility in Corner Brook. It is NEIA’s understanding that this project is part of a wider effort to develop greater research capacity and teaching supports within Memorial’s environmental science and environmental studies programs.

NEIA is a not-for-profit association of businesses that promotes the growth and development of the environmental sector in Newfoundland and Labrador. We represent firms operating in the areas as diverse as waste management, sustainable resource development, green building and green transportation. The growth of this sector depends on qualified professionals. Several firms within the sector have identified access to skilled human resources as a barrier to growth. A recent report published by GLOBE Advisors and Earth & Environmental, “An Analysis of the Economic Development Opportunities Associated with the Green Economy in Newfoundland and Labrador”, states that the environmental sector employs over 10,300 Newfoundlander and Labradorians in over 1,100 private and public organizations. The report, even in its conservative estimates, predicts significant growth for the sector. The availability of qualified labour availability is a crucial factor in this growth. The current Grenfell initiative helps address these workforce challenges within the environmental sector in a number of ways. These facilities will ensure the high-quality of environmental related education by complimenting classroom teaching efforts and exposing students to the state of the art technology used within the sector. In addition, new facilities will assist Memorial in recruiting highly qualified faculty, laboratory technicians, graduate students, and postdoctoral fellows in environmental research. The presence of these skilled individuals not only contributes to an enhanced classroom experience, but also serves to establish Grenfell campus and the Corner Brook region as a centre of excellence for environmental research. These measures, we hold, will further enhance the supply qualified labour available to work in this growing sector.

The proposed facilities will also increase the capacity of Memorial faculty, staff and students to undertake the academically focused interest-based research which underpins private sector research and innovation. This has a two-fold effect. First, the research directly contributes to the information available to guide businesses, municipalities, non-governmental associations, and other groups in their decision making. This is particularly true for stakeholders in renewable resource sectors such as agricultural and forestry. Second, enhanced local research will serve as a catalyst for public discourse, contributing to better public awareness of environmental issues and ultimately, more effective public policy. The facilities will also support climate change research in Newfoundland and Labrador.
Improved academic environmental research will provide opportunities for private industries, and enhance public education on environmental issues. NEIA therefore supports the efforts of Grenfell Campus to establish enhanced environmental research facilities.

If you require any additional clarification or information, please do not hesitate to contact Ted Lomond, Executive Director at NEIA, at ted@neia.org or by phone at 709.772.3336.

Sincerely,

Frank Ricketts
Chair
February 18, 2013

Dr. Antony Card
Associate Vice President (Research)
Grenfell Campus, Memorial University
University Drive
Corner Brook, NL

Dear Antony:

Thank you for the opportunity to meet with Grenfell faculty last week to provide an overview of the Natural Resources Canada (NRCan) - Canadian Forest Service (CFS) research program, to discuss the research needs in the forest sector of the country and province, and ways that we can collaborate with Grenfell Campus to increase forest research capacity.

As you know, the CFS office in Corner Brook has had a strong working relationship with Grenfell Campus, its students, faculty, and administration over the last 15+ years. This is demonstrated by the fact that many CFS staff members served as Adjunct Professors at Grenfell Campus and co-supervised graduate students. Further, Grenfell and CFS are actively working together, in collaboration with the Provincial Department of Natural Resources – Forest Service, in the development of a Collaborative Research Agreement for enhanced forest research capacity which will pave the way for the creation of the Boreal Ecosystem Research Institute (BERI). BERI will augment the forest sector research capacity by means of increased research infrastructure, the hiring of additional forest sector research positions, and increased graduate programming in Environmental Science and Environmental Policy – initiatives critical to the success of BERI.

Accordingly, the Canadian Forest Service strongly supports your application for funding for BERI infrastructure. The CFS looks forward to increased research collaboration with Grenfell as we move forward with the creation of BERI.

Sincerely,

[Signature]

Dr. Brian Heath
A/Director, CFS

Canada
February 8th 2013

Greg Wood, PhD
Consultant to the Vice President (Grenfell)
Grenfell Campus - Memorial University of Newfoundland
Corner Brook, NL Canada A2H 6P9

Dear Dr. Wood:

Res. Environmental Research Laboratory at Grenfell Campus - MUN

This letter is to confirm the support of the Forestry and Agrifoods Agency for the development of an environmental research laboratory at Grenfell Campus. An increased research capacity on the west coast of Newfoundland would be an asset to the region.

The analysis equipment proposed for the research facility will allow for the study of soil and water samples which could link with analysis requirements of the Wooddale Provincial Tree Nursery as well as other divisions within the Agency. These laboratories will increase Grenfell Campus research capabilities helping to attract highly qualified faculty. The proposed environmental research laboratory at Grenfell Campus offers great potential to grow local capacity on the west coast in forestry and agriculture related research.

The Agency looks forward to future partnerships with Grenfell Campus to address our research requirements.

Sincerely,

James Evans, RPF
CEO – Forestry and Agrifoods Agency
February 12, 2013

Dr. Antony Card
Associate Vice President (Research)
Grenfell Campus, Memorial University
University Drive
Corner Brook, NL

Dear Dr. Card:

Re: Support for Agricultural Initiatives at the Grenfell Campus

Thank you for the opportunity to meet with you and other Grenfell Campus and Memorial University faculty at the Agricultural Symposium in Corner Brook in November. Being invited to be the keynote speaker at your symposium was an honour and I trust that my talk met with your expectations. An important point I raised in my presentation was that universities in Atlantic Canada should be more deliberate about working together to support agriculture through closer research and academic planning and coordination of resources.

Following in that vein, the Faculty of Agriculture at Dalhousie University is eager lend support to your initiatives at Grenfell Campus toward the development of agriculture-focused research and graduate programs.

As you know, the Faculty of Agriculture has over one hundred years of experience in research and academic training in agriculture and food, and we would welcome ways to share our expertise and capacity to assist Grenfell Campus in the development of complementary and cooperative research and training projects in the future.

The construction of your new research facilities and the new faculty hiring with which you are currently engaged, provides outstanding opportunities for collaborative research projects between Dalhousie, Grenfell faculty and graduate students. The Faculty of Agriculture strongly supports these initiatives, and we look forward to strengthening our collaborative relationship with Grenfell Campus in the future.

Sincerely,

R. G. Donald, Ph.D., P.Ag.
Associate Dean, Research & External Relations
Faculty of Agriculture

CC: Dr. Harold Cook, Principal and Dean
Dr. Claudie Caldwell, Associate Dean Academic
Dear Dr. Card,

I am pleased to express Agriculture and Agri-Food Canada’s (AAFC) support for Memorial University’s initiative in creating a graduate program with a focus on agricultural research at its Grenfell Campus.

We thank you for sharing your plans to hire five new faculty members and to build and equip research laboratories that will support their research. We appreciate the opportunity to provide feedback on the strategic direction and the scientific capacities which you intend to staff.

These discussions have helped ensure that the new faculty and labs will complement the capacity that AAFC has at its Atlantic Cool Climate Crop Research Centre in St. John’s and the capacity that exists more broadly throughout the region. The new faculty and labs will also form the basis of future collaboration between our two organizations and contribute to industry and provincial government objectives of increasing the overall economic output of Newfoundland and Labrador’s agricultural sector.

AAFC is also pleased by your proposal to create a Research Chair in Sustainable Agriculture which should attract a senior scientist to lead the research at Grenfell. It is well understood that the environmental conditions, especially as they relate to managing soil and water, affecting agricultural activity in the province continue to provide challenges which can be overcome through additional research and development. The proposed environmental laboratories will be central in unlocking the potential in the province.

On behalf of AAFC, I would like to express support for the strong research program being proposed by Memorial University. We look forward to establishing strong partnerships with the University and the agriculture industry over the years to come.

Regards,

[Signature]

Dr. Christiane Deslauriers
Director General
Atlantic and Coastal Ecorone
Science and Technology Branch
Agriculture and Agri-food Canada

Canada
December 21, 2012

Dear Dr. Card:

I am writing to express my strong support for the proposed Environmental Research Facility Business and Sustainability Plan. This facility will provide an important platform for the development of a knowledge based industry linked to the natural resources sector. The research supported through this facility will enable the province and Canada to gain the knowledge required to adapt and establish forward thinking policy relevant to these resources including forestry and agriculture. We are all keenly aware of our changing climate which is the primary driver of ecosystem processes including forest and agricultural systems.

The Grenfell Campus in Corner Brook is strategically located and has successfully implemented programs to facilitate environmental research aimed at understanding the impacts of climate change on resources and the resource industry. The Newfoundland and Labrador Boreal Ecosystem Latitudinal Transect (NL-BELT) was established in 2010 as part of an agreement between the Forest Service of the NL Department of Natural Resources, Corner Brook Pulp and Paper, and the Canadian Forest Service. This transect is one of five such transects established as part of the CFN National Network of Latitudinal Transects and is made up three established and instrumented terrestrial and stream sites located within each of four major river watersheds spanning almost 5.5° latitude and mean annual temperature. The watersheds include the Grand Codroy, Humber River, Salmon River, and Eagle River in Labrador. Ongoing collaborative research is funded through multiple federal and provincial partners including NSERC, HRBP, CFST, and CFI which have supported equipment, infrastructure, personnel, other research costs, and student support. Our ability to continue to expand this research hinges upon our ability to conduct experiments, analyses, and facilitate more complex field experimentation from Corner Brook. Too much of our current resources go to traveling and shipping large amounts of samples across the island. The proposed facility would reduce that burden and thereby enable better use of resources for conducting climate change and forestry related research. More importantly, it also would provide unique analytical capabilities relevant to this research and useful to the training of students who reside in Corner Brook.

The proposed five new faculty for the Grenfell campus are each in strategic areas that are sorely needed, representing major gaps in expertise in NL, and critical to the development of a knowledge based industry around natural resources. I am very
excited about the prospect of collaborators in hydrology, soil, forestry and agricultural sciences. I also think that these natural resource based experts would nicely complement the current expertise at Grenfell and in St John’s enabling a more well-rounded graduate and undergraduate program in Environmental Science. Though already offered at the St John’s and Grenfell campuses, respectively, the development of this new facility will add a tremendous boost and needed component to both of these programs. Collaborative teaching across the campuses will enable the building of the already strong MSc and PhD programs in environmental science. Such collaboration has already been facilitated through the use of the new video conferencing link in the new research building at Grenfell to provide exchange of lectures and student interaction in my ENVS6000-Environmental Science and Technology course.

The established Humber River Basin Project is another example of the successful implementation of environmental research relevant to the province. The HRBP has supported co-supervised research by graduate and undergraduate students spanning faculty at Grenfell, St John’s and researchers within the provincial and federal government. The range of natural science and socioeconomic research projects conducted under the HRBP have stimulated new research funding through agencies including NSERC, AIF, CFI, CPSF, MITACS, US-NSF and stimulated important long lasting collaborations across the campuses, with federal agency researchers (CFSC, Environment Canada), and with international researchers (US, Germany, Australia). This initiative represents an important example of the potential for environmental research that can be stimulated and supported through this new facility.

The proposed research facility will further support ongoing research in environmental monitoring technologies. Research developing microfluidic devices coupled with analytic detection, initiated through HRBP support, is currently ongoing in St John’s but could be expanded through the establishment of this new facility. Such analytical capabilities have important applications to environmental research and benefit most through coupled analytical and field infrastructure both in the laboratory and field. So again, this unique combination of a state-of-the-art laboratory facility with easy access to well established and active research sites would greatly facilitate this “lab on a chip” research.

The proposed new facility and facility juxtaposed with the well established environmental research expertise, collaborations (federal, provincial and international), and field infrastructure in place along the west coast of NL will generate an important knowledge-based center. Such a center in Corner Brook will stimulate important research relevant to policies that will enable Canada and the province of NL to adapt to climate change in a way that assures the sustainability of agriculture and forestry. In doing so this research will also undoubtedly stimulate new technologies related to environmental monitoring relevant to agriculture, forestry and water quality. I am very excited about the prospects of the proposed Environmental Research Facility Business and Sustainability Plan and I hope you will give it your utmost consideration.
Please do not hesitate to contact me as I would be happy to provide further details regarding my support of this initiative.

Best regards,

Susan Ziegler
Associate Professor
Canada Research Chair in Environmental Science
709.864.2669
sziegler@mun.ca
Dr. Greg Wood, Environmental Advisor  
Grenfell Campus, MUN  
1 University Drive  
Corner Brook, NL A2H 6P9

May 23, 2013

Dear Dr. Wood:

The Newfoundland and Labrador Federation of Agriculture (NLFA) would like to express its support for Memorial's Grenfell Campus to carry out the research outlined in the proposal to the Atlantic Canada Opportunities Agency (ACOA) for new facilities.

If the application is successful, we will be provided greater research expertise, allowing for benefits to our industry and members, including improved on-farm competitiveness and profitability, better environmental sustainability, and an overall improvement in our local industry's competitiveness in the national and global marketplace.

It has been indicated to the NLFA that our organization could serve in an advisory role with Grenfell related to research needs and directions. This level of input from industry demonstrates that the university is interested in industry's research requirements and further strengthens our interest in seeing this project completed.

If you require any further information or would like to discuss in more detail, please do not hesitate to contact me.

Regards,

Eugene Legge
President

"Farmers Helping Farmers"
Hi Gail,

this request has been approved with 6 votes in favour (Kapil, Christina, Kareem, Ratana, Minglun and myself) and none against.

-j

On 11/03/15 02:11 PM, Kenny, Gail wrote:
> Hi JC,
> 
> Has this been approved by the committee? Julie is working on the agenda and she'd like to have it out this afternoon. Thanks.
> 
> Gail
> 
> From: MathStat Graduate Officer [mailto:mathgrad@mun.ca]
> Sent: February-14-15 12:50 PM
> To: Kapil Tahlan; Fleming, Ian; Christina Bottaro; JC Loredo-Osti;
> Todd Andrews; Kenny, Gail; Sukhinder Kaur Cheema; Len Zedel; Brent
> Snook; Ratana Chuenpagdee; Minglun Gong; Kareem Azmy
> Subject: Fwd: PSYC Calendar changes
> 
> Hello All,
> 
> attached are changes regarding the comprehensive examination for the PhD in psychology.
> Review and let me know your opinion at your earliest convenience.
> 
> -j
> 
> 
> 
> ----------- Forwarded Message -----------
> Subject:
> 
> PSYC Calendar changes
> 
> Date:
> 
> Fri, 13 Feb 2015 18:04:11 +0000
> 
> From:
> 
> Kenny, Gail <gkenny@mun.ca>
> To:
> JC Loredo-Osti <jcloredoosti@mun.ca>,
> MathStat Graduate Officer <mathgrad@mun.ca>
> Hi JC,
> I have attached proposed calendar changes from the Department of Psychology for review/approval.
> Gail
> Hi Gail,
> The psychology department recently approved (Departmental Meeting, Feb 11, 2015) changes to the Calendar description regarding our comprehensive exam process.
> Please find attached a Word document that details the changes.
> Cheers,
> Brent
> Brent Snook, PhD
> Professor of Psychology
> Memorial University
> 709.864.3101
31.31 Psychology

31.31.2 Program of Study
1. An applicant must hold either a Master's Degree or an Honours Bachelor's Degree with first class standing to be considered for admission. The program of study will be specified at the time of admission. Decisions on (a) whether to include courses in the program, and if so, (b) which specific courses are to be included will be based on the student's background and the proposed thesis topic.

2. Comprehensive Examination. The Ph.D. comprehensive in Experimental Psychology shall be taken during the first year of the student's program. The examination will consist of two parts. Part I consists of a broad review of the literature that normally pertains to the topic of the thesis area. The literature review should incorporate theoretical, methodological, and empirical findings. Part II consists of an oral defense of the literature review. The comprehensive exam aims to ensure that the student is knowledgeable about the range of theories, methodologies, and empirical findings that are fundamental to the chosen field of study. (1) an essay, the topic of which is different from the subject of the thesis, and (2) an oral examination which tests the candidate's ability to integrate the essay into the broad area of Psychology. The essay topic will be assigned by the Examining Committee in consultation with the student and Supervisor. The essay should not be a précis of the literature, but a critical appraisal of a subject. This should identify important unresolved issues, and where possible suggest solutions to them.
A reminder that the deadline for comments to the Faculty of Science undergraduate studies committee (shannon@mun.ca) and Faculty of Science Graduate studies committee (mathgrad@mun.ca) is Friday, January 16.

May

Good afternoon,

SGS has requested Faculty Council's approval on the attached. It is being forwarded to you for review and comment by your undergraduate and graduate studies committees. Comments should be forwarded to the Faculty of Science undergraduate and/or graduate studies committees by Friday, January 16, 2015.

Thanks,
Mary
Hi Mary and Darlene:

I have attached a document that SGS would appreciate having vetted through your Faculty Council. Can you ensure it gets to the right person for your Council agenda, and when it is approved, let me know. Also, if you could let me know when your Council next meets, that would be appreciated.

Thanks
Annette

Annette Williams
Secretary to the Deans
School of Graduate Studies
Memorial University of Newfoundland
St. John's, Newfoundland
Canada  A1C 5S7
Tel: 709-864-2478
Fax: 709-864-2358
email: awilliam@mun.ca

www.mun.ca/sgs

Facebook
TO: Academic Council
FROM: Dr. Faye Murrin, Dean pro tempore
DATE: September 26, 2014
RE: Proposed regulations governing 4+1 accelerated master's programs

From 2008 to 2012, grad enrolment has increased by 40%, yet NL enrolment decreased by 2%, Arts enrolment decreased by 5%, and Science (Canadian) enrolment was flat. We assume many top local students in Science and Arts are going elsewhere for graduate work or considering professional degree options. Literature suggests students with high academic ability start the college choice process earlier than their peers (Litten, 1982). Further, large amounts of financial aid are needed to move a second-choice school up to a first-choice school (Jackson and Chapman, 1984). MUN needs to find a way to target local students in Arts and Science, recruit them early, and include competitive financial aid packages as part of the process.

Accelerated master's programs are common in the US (NYU College of Arts and Science¹, Duke University's Pratt School of Engineering², Vanderbilt College of Arts and Sciences³). At Memorial, the fast-track Master of Engineering program serves a similar purpose, allowing MEng students to finish 1-2 semesters early by starting graduate research in their final work term of the co-op BEng program. A pilot offering of the 4+1 in 2013-14 suggested there is meaningful interest among excellent senior undergraduate students. Through Memorial's accelerated master's programs, students will be able to fast track completion of MA and MSc (faster time to labour market or PhD, lower opportunity costs), gain larger-than-average fellowship amounts for one year, and gain early acceptance to graduate school. MUN better able to retain top undergraduate talent in Arts and Science, reduce time to MA/MSc completion, offer augmented funding packages, and increase overall enrolment in Arts and Science.

The attached is a proposal to formalize the rules around a 4+1 program at Memorial.

Dr. Faye Murrin, Dean pro tempore
School of Graduate Studies

¹ http://cas.nyu.edu/obect/bachelorsmasters
² http://meeng.pratt.duke.edu/plus
³ http://as.vanderbilt.edu/academics/graduateprograms/plus/
Guidelines for 4+1 accelerated master’s programs at Memorial University of University

Approved by Memorial University Senate on XXXX, 2014.

The School of Graduate Studies (SGS) in collaboration with the Faculties of Arts and Science offer students an opportunity to earn both a bachelor’s and master’s degree in a shorter-than-normal period of time through a unique pathway: a 4+1 accelerated master’s. Memorial requires the following guidelines be met when arranging such programs.

1. Academically strong students will be selected for this program in their third or fourth year of undergraduate study. Individual academic units will determine whether students are qualified to take on the accelerated program. Academic units are under no obligations to recommend students or participate in this program.

2. All students selected must meet the normal requirements for entry into MA or MSc.

3. Students should submit a graduate application in the third year of their BA or BSc program. SGS will offer early conditional admission to the MA or MSc at that time.

4. Academic units recommending students for the accelerated master’s program will note “4+1 program” on the program of study form and an augmented funding amount.

5. Students may complete graduate courses while in their third or fourth year of undergraduate studies. The exact courses and the semester they are taken will be determined by the individual academic units.

6. Students taking graduate courses while in undergraduate studies will be required to pay for those courses at the current undergraduate per course rate.

7. Upon finishing the BA or BSc and being fully admitted to the MA or MSc, students may complete any remaining courses and/or research/thesis and complete the graduate program in one year.

8. SGS will allow for 150% of normal fellowship allocation over one year (maximum) of the MA or MSc after students are fully admitted to a graduate program.

9. Students will be responsible for all program fees under the appropriate payment plan selected at the time of admission.

10. Students must satisfy all academic requirements of both BA/BSc and MA/MSc to earn both degrees. There will be no double counting of credits.
Changes to General Regulation 3.3.11

3.3.11 Collaborative Program Agreements

3.3.11.1 Integrated Pathway Agreements

1. Memorial University of Newfoundland supports the establishment of agreements with partner institutions that may lead to the completion of multiple degree programs through an integrated pathway.

2. Examples of such agreements include but are not exclusive to 3+1+1 and 3+1+2 arrangements whereby an undergraduate degree is awarded by the partner institution and the graduate degree is awarded by Memorial University of Newfoundland.

3. In the 3+1+1 arrangement, a student would complete 3 years of the undergraduate studies at the partner institution, finish the 4th year at Memorial University of Newfoundland, and earn the bachelor’s degree at the partner institution. The student would then enroll in and complete a 1-year master’s program and earn a master’s degree at Memorial University of Newfoundland.

4. In the 3+1+2 arrangement, a student would complete 3 years of undergraduate studies at the partner institution, finish the 4th year at Memorial University of Newfoundland, and earn the bachelor’s degree at the partner institution. The student would then enroll in and complete a 2-year master’s program and earn a master’s degree at Memorial University of Newfoundland.

5. All such agreements must comply with the general regulations governing undergraduate and graduate programs at Memorial University of Newfoundland.

6. Memorial University of Newfoundland’s Guidelines for Integrated Pathway Agreements provide details on the method of establishing such an agreement. The Guidelines are available from the School of Graduate Studies.

3.3.11.2 4+1 Accelerated Master’s Programs

1. Memorial University of Newfoundland offers students in the Faculties of Arts and Science an opportunity to earn both a bachelor’s and master’s degree in a shorter-than-normal period of time through a unique pathway: a 4+1 accelerated master’s.

2. All students must meet the normal requirements for entry into the MA/MSc, and fulfill the academic requirements of both BA/BSc and MA/MSc to earn both degrees.

3. Information on fees, funding, and process for this program may be found in the Guidelines for 4+1 accelerated master’s programs at Memorial University of Newfoundland. The Guidelines are available from the School of Graduate Studies.

3.3.11.2-3 Cotutelle Agreements

1. Memorial University of Newfoundland offers graduate students the opportunity to carry out a joint research project through a cotutelle agreement between Memorial University of Newfoundland and another recognized institution. The student would be expected to participate in research and fulfill degree requirements at both institutions. Students who successfully complete all program requirements would earn doctoral degrees from both institutions. Memorial University of Newfoundland’s Guidelines for Cotutelle Agreements, approved by the Academic Council of the School of Graduate Studies, provides information on the details on the method of establishing such an agreement and program. The Guidelines are available from the School of Graduate Studies.

2. Upon successful completion of the program, Memorial University of Newfoundland and the cooperating institution will each issue its own doctoral degree certificate. On the certificate and subsequently on the university transcript, the following notation will be added: "This Ph.D. was awarded within a cotutelle agreement. The student was jointly enrolled at University XYZ and Memorial University of Newfoundland and successfully completed the degree requirements of both institutions."

3. Graduate students interested in this type of program should contact the School of Graduate Studies for further information.
Hi everyone,

At its meeting on Friday, the Faculty of Science Undergraduate Studies Committee considered the proposal for a 4+1 Accelerated Master's program.

It was the unanimous decision of the Committee not to endorse this proposal. Concerns raised included:

* there was no clear cohort of students to whom this program would appeal

* since many Masters programs in the Faculty of Science require (or at least encourage) completion of an Honours degree, it was unclear how this proposal would be feasible in such cases; however, it was suggested that an amended version of this proposal might target students who complete an Honours degree in the Fall semester and would like to begin a Masters program in the Winter semester

* there was concern that this proposal would have a negative impact on registrations in, or completion of, Honours and Joint Honours programs

* it was felt that it was inadvisable to encourage students to complete a Masters under the accelerated conditions described by the proposal

Regards,
Shannon

--
Dr. Shannon Patrick Sullivan
Dept. of Mathematics & Statistics
Senior Faculty Advisor, Faculty of Science
Memorial University of Newfoundland
St. John's · NL · Canada
shannon@mun.ca · www.ucc.mun.ca/~shannon
Hello Gail,

I have forwarded some of the comments by the committee members. In general the committee appreciates that a lot of effort has been put in this proposal, however the support is evenly divided.

-j

---
JC Loredo-Osti, Professor
Department of Mathematics and Statistics Memorial University
Phone: +(709) 864 8729

"Wisdom comes to us when it can no longer do any good."
--Gabriel Garcia Marquez (Love in the time of cholera).
---------- Forwarded Message ----------

Subject: Re: Proposed Regulations Governing 4 + 1 Accelerated Master's Programs
Date: Fri, 12 Dec 2014 10:36:31 -0330
From: Kareem Azmy <kazmy@mun.ca>
To: JC Loredo-Osti <jcloredoosti@mun.ca>
CC: Kapil Tahan <ktahan@mun.ca>, Ian Fleming <ifleming@mun.ca>, Christina Bottaro <cbottaro@mun.ca>, Todd Andrews <tandrews@mun.ca>, Gail Kenny <gkenny@mun.ca>, Sukhinder Kaur Cheema <skaur@mun.ca>, Len Zedel <zedel@mun.ca>, Brent Snook <bsnook@play.psych.mun.ca>, Ratana Chuenpagdee <ratanac@mun.ca>, Minglun Gong <gong@mun.ca>

This has been just sent to me by our department and replied them

The issue is that students usually apply for graduate studies in universities different from that from which they graduate to gain more experience better knowledge and learn new strategic way of thinking, which is in fact very beneficial for them.

According to rules, regular MSc student can upgrade to PhD if he is doing very good and qualified, will MSc student who already upgraded from third year (undergrad) to MSc be allowed also to re-upgrade again to PhD? If this happens, the level of research will certainly be negatively affected after a while.

The time which the student spend in research and learning is, to some extent, related to the knowledge, experience and qualifications s/he builds. If the student is moved fast to higher levels of research program, the produced science will become poorer on the long run unless the student is exceptionally genius.

However, if the rules do not allow those students to re-upgrade, then it is possible for 3rd year student to upgrade to MSc (no problem) although I do not think that will increase the number of undergrad students significantly.

Upgrade to MSc program seems to something good for those who are looking for careers in industry rather than in academia. I know in some European countries (e.g., Germany) they still offer a diploma (some where in between BSc. and MSc) rather than BSc and their student move to PhD directly but some of those universities are now switching to our regular N. American systems and also their PhD holder still need to do "Habilitation" (something like another PhD work) to qualify for academic positions.

I tried just to share my few humble thoughts, hoping that that they may help.

Karem
Quoting JC Loredo-Osti <jcloredoosti@mun.ca>:

> Hello All,
> 
> the SGS has requested approval of the attached proposal. The Dean of
> Science's office has sent the attachment to Heads of departments for comment
> and review by the departmental undergraduate and graduate studies committees.
> If any, these comments will be forwarded to us by Friday, January 16, 2015.
> This committee has been asked to provide a decision by January 30, 2015.
> 
> Regards,
> -j
> 
> --
> JC Loredo-Osti, Professor
> Department of Mathematics and Statistics
> Memorial University
> Phone: +(709) 864 8729
> 
> "Wisdom comes to us when it can no longer do any good."
> --Gabriel Garcia Marquez (Love in the time of cholera).
> 
> --

Karem Azmy, PhD.
Professor
Department of Earth Sciences
Memorial University of Newfoundland
300 Prince Philip Drive
St. John's, NL, Canada A1B 3X5
tel: 709 864 6731
fax: 709 864 2599
e-mail: kazmy@mun.ca
http://www.mun.ca/earthsciences/fac_pages/Azmy.php
Draft Department of Chemistry Comments on 4+1 B.Sc./M.Sc Guidelines

Summary
While there is some interest in the Department of Chemistry in a 4+1 degree, we will need clarification and possible adjustment of the proposed guidelines to implement this kind of program. The requirement to complete all the B.Sc. and M.Sc. requirements in only 5 years under the proposed guidelines would be extremely difficult. To provide a desirable and valuable degree to students, would likely need to offer these degrees only as new, specialized M.Sc. programs.

Challenges in Implementing 4+1 Programs
Currently, our B.Sc. programs require 120 credit hours. These requirements cannot be completed in less than 4 years, especially because many courses have laboratory components and most 4000-level courses have 3000-level prerequisites. Our M.Sc program requires two 6000-level courses, a seminar, and a thesis of original work. The typical length between the time the student enters the M.Sc. program and their degree is awarded is roughly 3 years. The guidelines state that all the requirements of a B.Sc. and an M.Sc. must be satisfied without any "double-dipping." This would make it very difficult to complete a 4+1 B.Sc./M.Sc. without lowering our expectations for the quality of the M.Sc. thesis because the time allowed to pursue a research project full time would be smaller.

We request that the committee reconsider the restriction on "double-dipping", so that students only need to complete a total of 120 credit hours for both their B.Sc. and M.Sc., provided a sufficient number of credits are at the 6000 level.

Likely Demand for 4+1 Programs
As it stands, it is most common for chemists who want a career as a research scientist to earn a Ph.D. We already allow direct admission to a Ph.D. program from an B.Sc. (Hons) for these exceptional students, so a 4+1 M.Sc. is not likely to be desirable to these students.

The primary employment market for our M.Sc. students are service or junior management positions with employers such as analytical research laboratories, government agencies, or natural resource industries. These employers typically want students who have extensive experience working in a research lab (i.e. multiple years), so shortening length of the program could make it more difficult for our graduates to be hired for these positions.

Some students who wish to go into a professional program after graduation may be interested in a 1 year M.Sc. program if they are not admitted after the end of their B.Sc. A 4+1 program could be attractive to these students, provided they can enter the program at the end of their 4th year. Nevertheless, this would work against the needs for ASM who require skilled students who are available for full time research over a significant period of time (i.e. 2 years minimum).
4+1 programs would be most advantageous if they attracted exceptional students from across Canada for specialized programs. This would require extensive national-level advertising to be worthwhile. These programs would have different requirements and expectations than our established M.Sc. program. Note that existing SGS regulations state that students cannot submit their theses for examination until all their courses are complete, so unless the thesis requirement is eliminated, they would need to complete all their graduate courses and seminars one semester before their intended completion, leaving a very small time frame for them to do research. In any 4+1 program, we would probably need to create a new graduate research project course, like those in the environmental science M.Sc. program, instead than requiring a research thesis.

Possible 4+1 Programs

- Materials Science B.Sc. / M.Sc. which would include chemistry, physics, and engineering courses at the undergraduate and graduate levels. Students would be required to complete 4 semesters of a research project course in a materials science research lab.
- Computational Chemistry B.Sc. / M.Sc. would extend our existing computational chemistry B.Sc. degrees to allow students to complete a 1 year M.Sc. after their B.Sc. Students would be required to complete 4 semesters of a research project course in a computational research lab.
- Environmental Chemistry B.Sc. / M.Sc. would establish a new program where students would take courses in analytical chemistry, biochemistry, and earth science. Students would be required to complete 4 semesters of a research project course in an environmental / analytical chemistry lab.
- Medicinal Chemistry B.Sc. / M.Sc. would establish a new program where students would take courses in organic chemistry and biochemistry. Students would be required to complete 4 semesters of a research project course in medicinal chemistry research lab. The establishment of this program would require the hiring of at least one medicinal chemistry ASM.
- B.Sc. / M.Sc. in Chemical Education would establish a new program where students would complete the requirements of a B.Sc. (chemistry) major and the requirements for a B.Ed. to earn an M.Sc. in chemical education. Students would be required to complete 2 semesters of a research project course in a chemistry lab and a 2 semester practicum with a teacher or professor. This would require cooperation with the Faculty of Education and professional recognition of the M. Sc. Chem. Ed. degree.