GRADUATE STUDENT HANDBOOK

Department of Earth and Environmental Sciences Dalhousie University

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Cover Image: Aerial photo from the south of the Himalayan mountain chain in Nepal, including Chomolungma (aka Sagarmāthā or Mount Everest, the world's highest peak at 8844 m) and Makalu (8463 m) (4^{th} highest peak). The horizontal distance between the peaks of Mt. Everest and Makalu is 25 km. The relief is ca 5 km. i.e. the bottom of the valleys in the foreground is 4,000 m. The mean elevation o the Tibetan Plateau in the background is ca 5400 m. The photograph was taken at cruising altitude of ca. 8,500 m.

The top of the Chomolungma is covered by Paleozoic to Mesozoic marine sediments, all the other peaks are made of high-metamorphic grade rocks and Miocene leucogranites.

Several faculty members and students in the Dalhousie Departments of Earth Sciences and Oceanography have been carrying out geological research at high altitudes in Bhutan, India and Nepal, in order to understand the formation of the world's highest mountains during the collision of India with Eurasia. Computer modelling is providing successful simulations of the mountain chain's history. We are also studying changes in the Asian monsoon over the past few million years, as well as the seismicity and its causes.

QUICK LINKS

Faculty of Graduate Studies Main Website
Faculty of Graduate Studies Regulations
FGS Graduate Calendar
FGS Preparing for a defence
FGS News and Events

Department of Earth and Environmental Sciences Main Website
Department of Earth and Environmental Sciences Course Timetable
Department of Earth and Environmental Sciences Events Calendar
Dawson Geology Graduate Society (DGGS)

Funding, scholarships, travel grants (from FGS)
Dal-Online for Graduate Student Information System (GSIS)
Dalhousie University Killam Library
Dal International Centre
Registrars Office
Off-campus living

CONTACTS
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Administrative Secretary: Ms. Norma Keeping (norma.keeping@Dal.Ca)

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Important dates

August
- Deadline to submit your Annual Progress Report via GSIS (August 1)
- Deadline for those expecting to graduate in Fall to submit approved thesis to FGS

September
- Classes begin
- Poster presentations for all graduate students

October
- Tri-Agency Canada Graduate Scholarships - Doctoral Program (CGS D) (October 3)
- Deadline to submit nominations for Nedimović Family Scholarship

December
- Deadline to submit applications for the Lew King Scholarship (December 1)
- TriAgency Canada Graduate Scholarships - Masters Program (CGS M) (December 1)
- Killam Postdoctoral Fellowship (December 15)
- DEPARTMENT ANNUAL GRADUATE STUDENT REVIEW (All Dal and external members of all supervisory committees should attend) – (this is the day after classes end but before exams begin)
- Deadline for those expecting to graduate in May (without registering for the winter term) to submit approved thesis to FGS (Mid December)

January
- Harmonized Scholarship Process (HSP) for both Masters and Doctoral (early January)
- Application for EES Doctoral award (early January)

April
- Deadline for those expecting to graduate in May to submit approved thesis to FGS (early April)
- ERTH 6300 presentations
- Deadline for those expecting to graduate in October (without registering for the summer term) to submit approved thesis to FGS (late April)

Scholarships and grants

Dalhousie administrated scholarships:

Deadlines for 2022-2023

Scholarship	Deadline	Process
Vanier Canada Graduate Scholarship	Sept 30, 2021	Apply through ResearchNet
TriAgency Canada Graduate Scholarships - Doctoral Program (CGS D)	Oct 3, 2022 at 9:00pm	Apply through relevant Tri-Agency application portal and FGS Online Scholarship Platform
Michael Smith Foreign Study Supplement	Oct 1, 2022	Send application via email to fgs.slo@dal.ca
TriAgency Canada Graduate Scholarships - Masters Program (CGS M)	TBA, typically December 1	Apply through the TriAgency Research Portal
Opt-In Form for Masters HSP	December 1, 2022	Apply through the FGS Online Scholarship Platform
Killam Postdoctoral Fellowship	December 15, 2022 at 4:00pm	Apply through the FGS Online Scholarship Platform
Harmonized Scholarship Process (HSP) for both Masters and Doctoral	TBA, typically January 15	Apply through the FGS Online Scholarship Platform (OSP)

See more at:
https://www.dal.ca/faculty/gradstudies/funding.html

Many scientific societies also offer fellowships, research and travel grants to graduate students in Earth Sciences. Here are some examples:

The Geological Society of America (GSA)
https://www.geosociety.org/GSA/Education_Careers/Grants_Scholarships/GSA/grants/home.aspx?hkey=e4133995-e8fd-43a7-b169-7323b0d72ee9

Society of Economic Geologists (SEG)
https://www.segweb.org/SEG/Students-and-Early-Career/Student_Funding/SEG/_Students/Student_Funding.aspx?hkey=486e227b-d2c8-48af-adfa-6d660376ee30

The Mineralogical Association of Canada
https://www.mineralogicalassociation.ca/scholarships-and-grants/

The Mineralogical Society of America

http://www.minsocam.org/msa/Awards/Min_Pet_Award.html

Elements of graduate program at EES Department

Graduate programs and course work

MSc

The minimum time for completion of the MSc degree is 12 months of full-time study (see Faculty of Graduate Studies regulations, Section 2.3.1). Experience has shown that most students take at least 24 months to complete their work. Financial support is available for no more than 24 months.

Part-time study is also possible. Conditions for admission to this program are the same as those for full-time students. Financial support is not normally available for part-time study.

Research leading to the preparation and oral defence of a thesis is required.

Program requirements consist of:

- 3-credit hour compulsory course ERTH 6300: Research Design and Scientific Presentation,
- 9 additional credit hours of electives at the graduate level,
- completion of the thesis.

Graduate students are expected to attend the Earth Sciences seminars.

A grade of A or better is required in ERTH6300 to transfer to PhD.

PhD

The minimum time required to complete this program is two years from an MSc; normally four years are required (see Section 2.3.2, in the Faculty of Graduate Studies regulations).

The doctoral program is developed under the regulations and procedures of the Faculty of Graduate Studies (see Faculty of Graduate Studies regulations).

Doctoral students are required to complete:
3 credit hours of graduate electives
3-credit hour ERTH 6300: Research Design and Scientific Presentation
ERTH6300 may be replaced by another 3-credit hours of graduate electives if a student has already taken the course as a part of the MSc program.

The students are required to pass ERTH6310: PhD Proposal Defence, which normally takes place within the first year of the program. Students who receive “fail” will be asked to withdraw.

Doctoral students are required to present pre-defence Lecture to the Department within the third year of the program, and to attend the Earth Sciences seminars.

Research leading to the preparation and oral defence of a thesis is required.

Syllabi for ERTH 6300, ERTH 6353, and ERTH 6310 can be found on departmental website at:
https://www.dal.ca/faculty/science/earth-environmental-sciences/graduate.html

Research methods and proposal development (ERTH 6300)

Course Description

The focus is on preparing and presenting a short research (thesis) proposal, using a format based on NSERC Discovery Grant proposals. Most "in class" time is spent on research design, related topics such as critical reading and error analysis, and on student presentations of the various components of their proposals. Limited instruction in effective writing and presentation will be given in an online class, with extensive written feedback from the course instructors and classmates on oral and written assignments. Attendance at departmental seminars is compulsory.

Course Pre-requisites, Co-requisites and/or other Restrictions

This course is restricted to current graduate students in the Department of Earth and Environmental Sciences

PhD Thesis proposal defence (ERTH 6310)

Course Description

This course includes the defence of the PhD thesis proposal, as developed in ERTH 6300, and is mandatory for all PhD students. The main purpose is to ensure that the student has a thorough understanding of the fundamentals in the student's chosen area of study and has attained an adequate level of knowledge in the discipline (of general and supporting science) to achieve the thesis goals. The PhD proposal defence consists of questions from the Examining Committee on all components of the student's PhD proposal to meet the above objective.

Co-requisite ERTH 6300

Quantitative methods in Earth Sciences (ERTH 6353)

Course Description

The course focuses on the understanding and application of key quantitative methods in Earth and Environmental Sciences. This course introduces quantitative methods and their application including data processing and analysis, numerical modelling methods, inversion methods, etc. Labs provide practical exercises for strengthening understanding of the quantitative methods. Necessary software or computer codes will be provided.

Course Pre-requisites, Co-requisites and/or other Restrictions

This course is restricted to current graduate students majoring in Earth and Environmental Sciences. Calculus (MATH 1000 or similar) and linear algebra (MATH 1030 or similar) are required prerequisites. Students need to get permission from the instructor and their supervisor before they register for the course.

Similar prerequisite courses for self-learning:

• Calculus: https://ocw.mit.edu/courses/mathematics/18-01sc-single-variable-calculus-fall- 2010/index.htm

• Linear Algebra: https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring- 2010/

Course Rationale and/or Other Restrictions and Requirements

It is recommended that students have a working knowledge of one or more programming languages (e.g., MATLAB). Students should have their computer and MATLAB at the lab classes.

- MATLAB downloading from Dalhousie: https://software.library.dal.ca/
- MATLAB programming for self-learning: https://www.coursera.org/learn/matlab

Participation in the Annual Poster presentation session (September)

All graduate students in 2nd and following years of their degree share their research with the Department every year in a format of a poster presentation. This poster session is taking place on Friday afternoon at the end of September. The posters need to describe the student's research accomplished during the past year since the previous presentation. The students may use posters presented at scientific conferences within that year. The best poster receives **Marcos Zentilli Travel Award** in the amount of $1000 to support the student travel for presenting at national or international conference.

Attendance and participation in Department of Earth Sciences colloquia

All graduate students and faculty are expected to attend the colloquium lectures. Some weeks will have two speakers. The designated time for the colloquium lectures is Thursday (sometimes Tuesday) at 11:30 am to 1:00 pm, although some special lectures may be provided outside these times. There are many reasons we want you to attend and participate in discussions. The lectures often provide an opportunity for our department members to get updated on major developments in fields of science that are in or outside our fields of expertise. The speakers usually put a lot of effort to prepare for their talk. We want to show our interest in learning and respect of these lecturers, many of whom are distinguished lecturers.
Students enrolled in ERTH-6300 are requested to attend at least one lecture per week, as part of the participation grade for the course. This is an excellent opportunity to learn how to do a research presentation at a conference or your thesis defence.

The "PhD Seminar" for Ph.D.s (3rd year of PhD program)

Every Ph.D. student in our department is expected to give a lecture to the department at least one year prior to defence. **This should happen at 2.5 years into your program, i.e. usually in the third winter of your program.**

The purpose of the PhD seminar is for the department as a whole to give our Ph.D. students some feedback, share in their excitement about research progress to date, but also discuss with the supervisor and any committee members present about the progress and timeline for the graduation. This lecture is up to 40 minutes, i.e. double the time you will have to present during your thesis defence. Thus, the department will likely learn much more about the details and choices of your thesis in the PhD seminar. The lecture and ensuing question period are also important components in the evaluation of your candidacy for the Ph.D. program.

The lecture has a great deal of flexibility regarding format and content. This is followed by another ca. 40 minutes of questions and discussion from the audience. Then all faculty members and thesis supervisory committee members who are present will meet in camera to discuss (i) the lecture and Q&A session, (ii) the progress made in the first few years of the degree program, and (iii) any concerns about the thesis plan, and future work.

Format of Ph.D. Seminar at 2.5 years
The format is often something along this outline, but it is ultimately up to you and your supervisor(s):
1. *General objectives/goal of the thesis and why it is important (ca. 4 minutes)*
2. *A brief overview of the chapters/papers completed or to be completed (ca. 5 min)*
3. *Detailed presentation of one of the papers or chapters completed, with conclusion (ca. 20 min,…for this component, many students give a version of a previous lecture they presented at GAC, AGS, AGU, AAPG, etc)*
4. *A summary of work to be completed, with timeline (ca. 5 min)*
5. *Concluding remarks*

Ph.D. students should make the arrangements for this lecture:

(i). **Ensure that it happens in the semester corresponding to ca. 2.5 after your arrival**, but not during summer months or during any study or holiday breaks or other university closures.
Examples:

Your start date	Schedule your 2.5-yr Lecture
September 2016	Jan-Mar 2019
January 2017	Sep-Oct 2020
May 2017	Nov-Dec 2020

(ii). **How to determine the date, time, and location.** First, contact Darlene (or another department administrator) who will coordinate with the colloquium series coordinator to determine which dates are available. The typical times are Tuesday and Thursday at 11:30-1:00 pm, when most faculty should be present. You and your supervisory committee will then choose the date and time when most of the committee members can be present at the lecture. Note that while all committee members do not need to be present, the co-supervisors and at least half of the supervisory committee should be. Only in special circumstances should a supervisor participate remotely. Once a date and time has been selected, contact Darlene and the graduate coordinator.

(iii). **At least two weeks** before the scheduled PhD Seminar, provide Darlene with your name (as you wish it to appear on the notice for your lecture), a **title for your lecture, an abstract** (less than 200 words), and an optional figure or photograph regarding your lecture, which should all fit on a single page (see appendix for the template).

The Graduate Coordinator or other representative of the department will chair the PhD Seminar, Q&A session, and subsequent *in camera* session. This person will ensure that the **Department of Earth and Environmental Sciences PhD Seminar Form** (see appendix) is completed, and the outcomes are conveyed to the student, and that the form is handed to Norma Keeping for archiving in the student's file.

Deadlines

You are responsible for meeting the deadlines of your graduate program. There are various deadlines, and while your supervisor, department, and external units will try to remind you, they are your responsibility. See the **Important Dates** section of this handbook, the FGS website, and websites for funding agencies and conferences for some deadlines. Examples include: ensuring you register and pay tuition for your graduate program and required courses, and complete forms and your Annual Progress Report to receive your pay cheques (missing a deadline can delay your salary by weeks).

Dal's Graduate Student Information System - GSIS

It is your responsibility to keep the information on your online GSIS updated. It has important information such as your contact information, program requirements, thesis supervisory committee membership, and progress reports. You should communicate the thesis supervisory committee membership and the courses that you and your committee have agreed for you to complete to Department Secretary Norma Keeping before the end of the first semester. Occasionally updates to your GSIS will require your approval.

NOTE: You have to submit an Annual Progress Report before **August 1** each year (for program starts in January it is December 1). Failure to do this will likely mean that you will not receive salary, and some scholarships and fellowships require updated annual reports to be renewed.

See more on how to complete GSIS on FGS website:
https://www.dal.ca/faculty/gradstudies/currentstudents/gsis.html

Your Supervision

Supervisor

All graduate students must have a supervisor before being admitted to their graduate program.

By '*supervision'* we mean

1. developing innovative and important research projects
2. attempting to secure funding for the research project
3. assisting in the facilitation of equipment or lab space, or access to the field or datasets
4. mentoring during (and often long after) your experience at Dalhousie
5. helping to administer your graduate program
6. intellectually challenging you in many ways
7. helping you gain experience in authoring and reviewing manuscripts and proposals
8. introducing you to other researchers and ideas
9. ensuring a high standard of scientific ethics, safety, lab practices, and thesis quality
10. maintaining an active and high-quality supervisory committee

A sole supervisor must be a member of the regular faculty of the Department of Earth Sciences, Dalhousie University.

Positive student-supervisory relationships are extremely important for student success. FGS has prepared a guide on how to navigate student-supervisory relationships:
https://www.dal.ca/faculty/gradstudies/currentstudents/supervision.html

Co-supervisors

Sometimes graduate students have shared supervision by faculty members of our department. It is also common that a faculty member or research scientist at another Department or an Institution wishes to co-supervise a student through our program, at which time the supervision must be shared by a faculty member from our Department. The external co-supervisor quite often provides the funding for the student and the research, facilitates most of the research, provides most of the thesis direction and editing, has high standards for the thesis, provides a more direct pathway for applied and socially relevant applications of the research, and leads to opening more doors for future employment.
In instances where one co-supervisor is not a faculty member of our Department, the Dalhousie co-supervisor should have relevant expertise to engage with the student about the thesis research, and help provide guidance regarding research methodologies, course selection, and thesis format.
The EES Department co-supervisor is responsible for maintaining information on the student's GSIS. Both co-supervisors are jointly responsible for the administration of the graduate student's program, including forms submitted to the chair for a thesis defence, setting committee meetings, and routine contact with the student. Although the University and FGS consider the co-supervisors to equally share the responsibility of supervision, our department recognizes that co-supervisors often do not have equal levels of involvement in the supervision, funding, and administration of a graduate student's research program, and therefore we informally refer to the more involved co-supervisor as the "principal co-supervisor". Also, for grant applications that require an indication of the number of supervised and co-supervised HQP, we recognize the right for the "principal co-supervisor" to indicate that they are the student's supervisor.

Qualifications of the Supervisor according to FGS Regulations Section IX.

Appointment	Program	Supervisor	Co-Supervisor	Comments
Regular FGS Member (Are employed by Dalhousie. All of our professors and some instructors)	Ph.D.	Yes	Yes	Must have a Ph.D.
	M.Sc.	Yes	Yes	Must have Ph.D. or M.Sc.
Adjunct (FGS) (Most of our instructors and some non-Dalhousie scholars with appropriate academic qualifications who have regular involvement with Dalhousie graduate programs; nominated by our department)	Ph.D.	No	Yes	Must have Ph.D.
	M.Sc.	No	Yes	Must have Ph.D. or M.Sc.
Adjunct (Scholar) (Have the necessary academic credentials and are actively engaged in research; nominated by our department)	Ph.D.	No	No	Can serve on one supervisory committee concurrently
	M.Sc.	No	Yes	Can serve on one supervisory committee concurrently

Thesis supervisory committee

In our department, all graduate students require a thesis supervisory committee. The thesis supervisory committee has several responsibilities:

1. it is composed of scientists who have expertise in Earth or Environmental Sciences and, when possible, in your field of interest. The committee will seek to help you reach your graduate goals by providing access to facilities, funding, and guidance.
2. the committee will help establish your graduate program, including course work and research topic and methodologies.
3. the committee will help resolve rare instances of disagreement between you and your supervisor.

Typically, your thesis supervisory committee members will serve on your thesis examining committee as well.

The principal roles of this committee are:

1. providing administrative and research guidance
2. providing breadth of research expertise and insights
3. helping the supervisors facilitate the proposed research through either direct involvement in the student's thesis or providing access or links to funding and apparatus, software, or databases
4. assisting in course recommendations and recognition of knowledge deficiencies
5. minimizing the probability of overspecialization of a student's research, particularly if access to adequate facilities or supervision in that field is limited
6. providing timely feedback on parts of the thesis or on questions posed by the student or (co-) supervisor
7. reading and editing the entire submitted thesis in a timely manner
8. deciding when a thesis has met the required high standards and is ready to be defended
9. making decisions where there may be differences of opinions between a student and (co-)supervisor
10. seeking and participating (even if remotely) in committee meetings (at least one per year)
11. routinely checking the feasibility of the research and evaluating the student's progress
12. contacting the graduate coordinator if there are deficiencies or problems that may negatively affect the student's graduate experience or the department or university.
13. attending the annual graduate student review whenever possible (December Stop Day of each year, i.e. the day immediately before December exam week)
14. typically in our department, some of the members of the thesis supervisory committee will be

members of the thesis examination committee
15. to participate in a Ph.D. student's pre-defence lecture

Composition

1. All members of supervisory committees are either Regular, Adjunct (FGS) or Adjunct (Scholar) members of the Faculty of Graduate Studies.
2. One supervisor or two co-supervisors and at least two additional members, at least one of whom is from the student's graduate department.
3. Committees larger than 5 are discouraged owing to scheduling difficulties and the potential of delays in feedback.
4. **Regular members of the faculty at Dalhousie should constitute no less than 50% of the membership of a supervisory committee.**
5. Refer to tables entitled *Serving on a Supervisory Committee*, given in Section 9.1 of the FGS Regulations, which define explicitly the permission to serve on Supervisory Committees.

The greatest challenge for the thesis supervisory committee is deciding when a thesis is complete and ready for defence. There are many reasons to want to include more research in the thesis, and sometimes it is difficult to know when to stop. There are also pressures to speed up the defence: (i) the student has landed an ideal job; (iii) the student is close to exceeding the time limit on the program. There are no acceptable reasons to accept a substandard thesis. Doing so lessens the quality of our previous student's degrees and the quality of our entire department or university. Furthermore, it is at odds with the desire for our students and faculty to strive for excellence, innovation, and international impact. To prevent the pressure to accept a substandard thesis (usually this means incomplete, but also scientifically unsound or not rigorous), the student and supervisory committee should discuss the objectives and scope of the thesis that must be met, and revisit and if necessary, revise these objectives during each committee meeting.

Thesis supervisory committee meetings

A thesis committee meeting should be held:

1. Near the end of the first semester. This means that at least two members of the committee other than the supervisor have already been selected by this time.
2. In the second semester, prior to the submission of the thesis proposal
3. At least once a year after that
4. Within six months prior to a submission of a final thesis that the student believes is ready for defence

- This is the opportunity for you and your committee to exchange ideas regarding your thesis progress and your next objectives.
- Committee meetings serve to help the student ensure that objectives and requirements for the thesis are clear and understood by the student and committee members.
- There is no set format or duration for a committee meeting, except that it is chaired by the supervisor or principal co-supervisor, and usually involve some or all of the following:
  1. progress (including new data or interpretations, research activities, presentations at workshops or meetings, manuscripts),
  2. enrolment or completion of course work
  3. research challenges or difficulties
  4. indications of any changes to the thesis direction or previous goals
  5. recommendations for future objectives
  6. recommendations for authorship of co-authored publications
  7. discussions to ensure clarity of expectations

8. scientific and academic advice from the committee
9. review of previous items that were to be addressed
10. establish a list of action items with clear deadlines
11. discussion regarding whether more expertise is needed on the supervisory committee as new developments occur in the student's thesis research
12. leaves, internships, holidays

- The student should ensure that notes are taken during the committee meeting, and that the major developments during the meeting are expressed in their annual report on GSIS.
- The supervisor or principal co-supervisor will need to print, complete, and submit to Norma Keeping the Department of Earth Sciences **Thesis Supervisory Committee Meeting Form** (see appendix). The form should be reviewed and signed by the committee members and the student. The student is encouraged to ask for confirmation or clarification of points raised.

Annual Graduate Review

The Annual Graduate Review is held by EES Department on Stop Day (the day after classes end; no exams are permitted on this day), which is in the first or second week of December. It provides a means for the Department as a whole, but especially the Graduate Coordinator and Graduate Secretary, to get feedback from supervisors and supervisory committees about the progress of each graduate student. It also provides a time when the graduate faculty can meet to discuss (i) changes in the administration of graduate programs, and (ii) anticipated deficiencies or problems. An action list is generated, which may include prompts for communications with students about deadlines, or subsequent additional discussions with supervisory committee members. A week before the Review, the graduate coordinator circulates to supervisors and committee members a database of information regarding student progress. Supervisors and co-supervisors should update the database information for their students and return email it to the graduate coordinator prior to Stop Day.

Your Thesis Defence

A thesis defence is one of the most important academic events for the Department of Earth Sciences and Dalhousie University. It serves to ensure the high academic standard for thesis quality established by our department. It provides an open forum for a student to demonstrate that the thesis data, interpretations, approach, and significance can be defended. It allows a student to demonstrate depth of knowledge of the field of research in front of a committee of experts, and an audience of peers and other geoscientists. It provides the supervisor(s) and the department an opportunity to demonstrate the quality of their graduate programs.

Start planning your thesis defence?

Students and supervisors should consult the FGS Regulations for more information:
http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=2&chapterid=399&topicgroupid=1435&loaduseredits=False

Students should contact our graduate secretary Norma Keeping, who will start paperwork and explain the steps.

M.Sc. thesis defence

Administered by the Department.

Each Master's thesis shall be defended orally. The student shall be present and examined by an Examining Committee during a public defence.

The defence should only proceed if the thesis supervisory committee agrees that the thesis is ready for defence.

The supervisor provides written notice by email to the Department Chair, copying the Graduate Coordinator and Graduate Secretary, that the thesis is defendable and that a defence should be scheduled. Considering that the external examiner may require 1 month to review the thesis, the department requires **at least 1.5 months notice**. The Graduate Coordinator notifies the FGS for informational purposes.
Note that there are several considerations regarding the timing of a thesis defence.

(i) They cannot occur on a weekend, holiday, or scheduled study break. They should not occur in the months of June or July when many of our faculty and graduate students are in the field.
(ii) The defence should be scheduled before dates set by FGS and the Registrars Office regarding deadlines for convocation or tuition fee requirements for the following semester.

External Examiner

The supervisor or principal co-supervisor, in consultation with the student and thesis supervisory committee will propose an external examination committee in writing by email to the Department Chair. At this time, only one **external examiner needs to be suggested**. A CV and complete address and contact information for the proposed external examiner should be provided.

The Department requires that the external examiner has no relationship with the student and (co-) supervisors i.e. a 'beyond arm's length' involvement with them. For example, external examiners shall not have:

(i) published with the supervisor or co-supervisors even on review articles or presentations in the past 10 years;
(ii) have not interacted with the student, or the supervisor's or co-supervisor's lab or research group even for fee-for-service activities in the past 10 years;

(iii) worked in our department in the past 10 years; or
(iv) graduated from our department in the past 5 years.

An external examiner shall have successfully supervised or co-supervised two or more students who have graduated from thesis-based graduate programs, or shall have 10-years of research or industry experience and served on at least two thesis committees of students who have graduated from thesis-based graduate programs.

The external examiner does not have to be an active university faculty member.

The external examiner should be present at the defence.

The Department Chair will decide if the proposed external examiner is suitable for the defence. The supervisor should NOT contact the external examiner (it is the role of the department chair (or designate) to communicate with the external examiner regarding the defence date and time, potential conflicts of interest, the willingness of the examiner to provide careful evaluation of the thesis, and the ability of the examiner to participate in person at the defence).

Master's Thesis Examining Committee

Each Master's Thesis shall be examined by an examining committee, following the criteria given below:
There shall be a Chair, usually Graduate Coordinator or Department Chair, who is not a participating member of the Supervisory Committee, and whose duty is to ensure that the exam is appropriate and fair and to submit a report as noted below. The Chair is not an examiner, but may ask questions for clarification during the defence.

The table below summarizes the minimum composition of an examining committee and the examiners status with the Faculty of Graduate Studies. Additional examiners, who may or may not be FGS members are permitted beyond these minima.

	Single Supervisor	**Co-supervised**
Chair (independent)	1 (Grad. Coordinator or designate with Regular FGS membership)	1 (Grad. Coordinator or designate with Regular FGS membership)
External Examiner	1 (Appointed by the Department Chair based on recommendations from the supervisor or principal co-supervisor)	1 (Appointed by the Department Chair based on recommendations from the supervisor or principal co-supervisor)
Minimum Examiners	1 Supervisor with Regular FGS* Membership 1 Reader with Regular FGS Membership* 1 Reader with FGS Membership**	1 Co-supervisor with FGS Membership** 1 Co-supervisor with Regular FGS* Membership 1 Reader with Regular FGS Membership* 1 Reader with FGS Membership**
Minimum Total	5	6

*Current or emeritus faculty members at Dalhousie may be **Regular FGS members**
**FGS membership includes Regular, Adjunct(FGS), or Scholar(FGS)
For information on FGS membership, please consult the FGS Regulations Section 1 on Membership, at http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=2&chapterid=399&topicgroupid=1426&loaduseredits=False

In addition to the Chair, one of the Readers must be an independent (i.e. not on the student's supervisory committee) member of EES Department, who will read the thesis to ensure the department's standard of quality is

met. The other Reader can be a member of the student's thesis supervisory committee. In the past, most Department Chairs have also read the thesis and may elect to participate in the thesis defence as a voting member of the examining committee.

Voting
Only examiners with FGS membership may vote on the outcome of an examination and sign the Master's Thesis Approval Form.

Planning the defence
In consultation with the (i) student, (ii) Graduate Secretary, (iii) Graduate Coordinator, on behalf of the Department of Earth Sciences the supervisor or principal co-supervisor contacts the examining committee to ***arrange a date, time, and location*** for the thesis defence one month prior to the event.

All costs related to the defence are paid by the supervisor, principal co-supervisor, or co-supervisors. This includes any flights, accommodation, ground transportation, meals, or communication costs for any members of the examining committee including the external examiner. These costs also include the cost of printed versions of the thesis requested by examining committee members, bound versions of the thesis, and any celebratory functions if the defence is successful. Three weeks prior to the defence, the Department of Earth Sciences Graduate Secretary should be notified of any flight or travel information including accommodation, and examiner's mobile phone number. Arrangements should be made in consultation with the Department Office and the Earth Sciences Colloquium Series organizer.

The student is responsible for ensuring that all fees are paid, including tuition and library fees so they are permitted to graduate. Students must be registered for the term in which they present their approved electronic theses to the Faculty of Graduate Studies Office, as well as for the term in which they have their defence.
The student provides digital copies of the thesis to the examining committee and the Department Chair one month prior to the defence. The student gives the option and will provide hard copies to any examiner desiring it.

After verifying the following information with the student's supervisor or principal co-supervisor, the student provides in writing by email to the Graduate Secretary the thesis title, thesis abstract, the student's name, previous degrees (date, degree, university), and a list of the examining committee. The department office will advertise the defence broadly (all faculty, adjuncts, students, Faculty of Science, Faculty of Graduate Studies, plus selected scientists and contacts at the various geoscience institutions in Nova Scotia.

The supervisor or a co-supervisor will ensure that any audio-visual equipment necessary is available for the defence.It is desirable for all members of the examining committee to be present at the defence. However, in an effort to reduce global carbon emissions and in the recognition that all examining committee members may not be in Halifax for the defence, the EES Department will permit virtual or blended defences. In rare and special circumstances if a member cannot attend owing to urgent conditions out of their control (e.g., flight delay owing to weather; serious medical issue), questions should be submitted by email to the Chair of the examining committee if possible, but not to the student or supervisor(s).

Recommended proceedings for a M.Sc. thesis defence in EES Department

1. Defence Chair welcomes the student, examining committee, and audience, explains the proceedings, and introduces the student.
2. The student gives a 20-minute formal presentation in English that summarizes the research and its significance. The intended audience shall be geoscientists with a wide range of backgrounds at the M.Sc. and higher level. Jargon, acronyms, and unnecessary technical terms shall be minimized. Owing to its brevity, the presentation

usually cannot include all aspects of the thesis research. The format of the presentation is up to the student and supervisors, but should include the following: (i) thesis objectives, (ii) hypotheses tested, (iii) importance of the problems, questions, or hypotheses being addressed, (iv) a brief summary of methodology and justification for the approach and any difficulties in data collection, reduction, or interpretations, (v) one or a few key results and interpretations, (vi) assessment of uncertainty and validation of assumptions, (vii) conclusions of the thesis, (viii) statement of importance of the conclusions, (ix) future work recommended, and (x) references and acknowledgements.

3. The Chair will thank the student, and introduce the examining committee.
4. The first round of questions will continue in the following order, with durations estimated as follows:

   (i) External examiner (15-20 min.)

   (ii) Independent Reader (15-20 min.)

   (iii) Other Reader (10-15 min.)

   (iv) Supervisor, or Principal Co-supervisor (10 min.)

   (v) Other co-supervisor (10 min)

   (vi) Department Chair (optional) (10 min)
5. At the end of the first round of questions from the examining committee for a M.Sc. Thesis Defence, there is a 10-minute (maximum) duration permitted for questions from the audience.
6. The Chair may ask if the student or member of the examining committee require a brief bathroom break of 5 minutes.
7. The second round of questions continues, with the external examiner allocated 15 minutes, and all other examiners 10 minutes, in the same order as the first round.
8. The Chair may ask a question for clarification, and then will ask the external examiner if he or she has any remaining questions.
9. The Chair will then ask the audience and student to leave, so the examining committee can discuss the defence in camera.
10. The Chair will ask each member (in the order of questioning) to vote on the thesis according to the following categories: a) approved as submitted; b) approved upon specific corrections with a clear timetable for completion, normally within one month; c) rejected but with permission to re-submit a revised thesis for re-examination with a clear timetable for completion, within one year; and d) rejected outright. At this time, each examining committee member should briefly state their rationale. Only examiners with FGS membership may vote on the outcome of an examination. The Department Chair and Defence Chair cannot vote. The outcome will be based on the majority vote. In the case of a tie, the Department Chair may vote, or in his or her absence, the Defence Chair may vote.
11. With assistance from the examining committee, the Chair will review the changes that are required and ask for any clarification if necessary.
12. The examining committee will indicate a feasible time for the required edits to be completed. In establishing the due date, the committee should consider (i) the extent of the edits required, (ii) deadlines for convocation, fees, or other FGS deadlines; (iii) if members of the examining committee will need to review the corrections or if the supervisor or principal co-supervisor will evaluate the edits.
13. All members of the examining committee but one (usually the supervisor or principal co-supervisor) should sign the Masters Thesis Approval Form (http://www.dal.ca/content/dam/dalhousie/pdf/fgs/thesesanddefences/master_thesis_approval_ext ended.pdf). The signed form should reside in the department office with the Graduate Secretary.
14. The Chair will invite the student back, and report the result of the deliberations and thesis defence. The Chair

will communicate the nature of the recommended edits if any, and indicate the date that the edits are required. The Chair will ask the student if he or she understands the nature of the most important edits and agrees to the due date.

15. The Defence Chair will communicate the results of the defence to FGS.
16. When the thesis is considered complete, the supervisor will sign the Masters Thesis Approval Form, and return it to the Graduate Secretary.
17. The student will submit the final thesis to the FGS according to the detailed instructions provided by FGS.

Ph.D. thesis defence

Administered by the Faculty of Graduate Studies.

Because the FGS regulates all Ph.D. thesis defences, the student and supervisors are directed to the FGS regulations for the latest version of instructions and proceedings:
http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=2&chapterid=399&topicgroupid=1435&loaduseredits=False

The student and supervisors are also directed to the following website which provides a very useful checklist with deadlines for items required before, during, and after the defence:
http://www.dal.ca/faculty/gradstudies/currentstudents/thesesanddefences.html

Each Ph.D. thesis shall be defended orally. The student shall be present and examined by an Examining Committee during a public defence, following the criteria given in the FGS regulations.

1. **Six months prior to the anticipated Ph.D. defence,** the student should discuss the potential date and deadlines for forms to be submitted to FGS. The student and supervisor(s) should discuss the composition of the external examining committee, and the supervisor or principal co-supervisor should communicate to the Department Chair that a defence in 6 months is likely.

2. **Three months prior to the Ph.D. defence**, the supervisor completes and submits a Request to Arrange an Oral Defence of a Doctoral Thesis Form to the department chair https://cdn.dal.ca/content/dam/dalhousie/pdf/fgs/thesesanddefences/Request_to_Arrange_Oral_Defence_of_a_Doctoral_Thesis_extended.pdf . This should include a CV and complete address and contact information for the proposed **external examiner**. The FGS rules regarding the eligibility of the external examiner are stated on the form. In addition to these FGS rules, the Department requires that external examiners shall not have:
   (i) published with the supervisor or co-supervisors even on review articles or presentations in the past 10 years;
   (ii) have not interacted with the student or the supervisor's or co-supervisor's lab or research group even for fee-for-service activities in the past 10 years;
   (iii) worked in our department in the past 10 years; or
   (iv) graduated from our department in the past 10 years.
   An external examiner shall have successfully supervised or co-supervised two or more students who have graduated from thesis-based graduate programs, or shall have 10-years of research or industry experience and served on thesis committees of at least two Ph.D. students who have graduated from thesis-based graduate programs. The external examiner does not have to be an active university faculty member. The external examiner should be present at the defence. The Department Chair will decide if the proposed external examiner is suitable for the defence, and will submit the signed form to FGS.
   The supervisor CANNOT contact the external examiner (it is the role of the FGS to communicate with the external examiner regarding the defence date and time, potential conflicts of interest, the willingness of the examiner to provide careful evaluation of the thesis, and the ability of the examiner to participate in person at the defence).

3. **One and a half months before the defence**: The defence should only proceed if the thesis supervisory committee agrees that the thesis is ready for defence. The supervisor provides written notice by email to the Department Chair, copying the Graduate Coordinator and Graduate Secretary, that the thesis is defendable and that a defence should be scheduled. Considering that the external examiner may require 1 month to review the thesis, the department and FGS requires at least 1.5 months notice. The student submits to FGS a Ph.D. Thesis Submission Form along with the completed thesis. The student and supervisor or principal co-supervisor will submit to the Department Chair a completed Ph.D. Examination Information Form.

https://cdn.dal.ca/content/dam/dalhousie/pdf/fgs/thesesanddefences/PhD_Examination_Information_Form_extended.pdf, and if acceptable, the Department Chair will sign and submit this to the FGS.

4. Note that there are several considerations regarding the timing of a thesis defence. (i) They cannot occur on a weekend, holiday, or scheduled study break. They should not occur in the months of June or July when many of our faculty and graduate students are in the field. (ii) The defence should be scheduled before dates set by FGS and the Registrars Office regarding deadlines for convocation, registration, or fee requirements.

5. The table below summarizes the minimum composition of an examining committee for a Ph.D. thesis defence for the EES Department.

	Single Supervisor	**Co-supervised**
Chair (independent)	**1 (appointed by FGS)**	**1 (appointed by FGS)**
External Examiner	**1 (External to Dalhousie, appointed by FGS)**	**1 (External to Dalhousie, appointed by FGS)**
Minimum Examiners	**1 Supervisor with Regular FGS* Membership** **1 Reader with Regular FGS Membership*** **1 Reader with FGS Membership***	**1 Co-supervisor with Regular FGS* Membership** **1 Co-supervisor with FGS Membership*** **1 Reader with Regular FGS Membership*** **1 Reader with FGS Membership***
Departmental Representative	**1 Graduate Coordinator or Chair of Department (non-voting member of the examining committee)**	**1 Graduate Coordinator or Chair of Department (non-voting member of the examining committee)**
Minimum Total	**6**	**7**

*Current or emeritus faculty members at Dalhousie may be Regular FGS members
**FGS membership includes Regular, Adjunct(FGS), or Scholar(FGS)
For information on FGS membership, please consult the Guidelines for Categories of Adjunct Appointments through FGS, at https://www.dal.ca/faculty/gradstudies/faculty/membership/adjuncts.html

6. The FGS contributes up to $1000 toward the cost of travel, accommodation, and meals for the External Examiner. All additional costs beyond this are to be paid by the supervisor, principal co-supervisor, or co-supervisors. This includes any flights, accommodation, ground transportation, meals, or communication costs for any members of the examining committee including the external examiner. These costs also include the cost of printed versions of the thesis requested by examining committee members, bound versions of the thesis, and any celebratory functions if the defence is successful. Three weeks prior to the defence, the Department of Earth Sciences Graduate Secretary should be notified of any flight or travel information including accommodation, and examiner's mobile phone number. To help reduce the cost burden, the EES Department will agree to provide one night accommodation and one meal (up to $100, excluding alcohol) if the external examiner presents a lecture to the department during his or her visit. Arrangements should be made in consultation with the Department Office and the Earth Sciences Colloquium Series organizer.

7. The student is responsible for ensuring that all fees are paid, including tuition and library so they are permitted to graduate. The student must be registered for the term in which they present their approved electronic theses to the Faculty of Graduate Studies Office, as well as for the term in which they have their defence.

Appendices

The following are Graduate Student forms used by the Department of Earth Sciences

- REPORT OF GRADUATE THESIS SUPERVISORY COMMITTEE MEETING
- PH.D. PROPOSAL DEFENCE FORM
- PRE-PH.D. DEFENCE LECTURE
- PH.D. PRE-DEFENCE LECTURE FORM

Dalhousie University Department of Earth and Environmental Sciences
REPORT OF GRADUATE THESIS SUPERVISORY COMMITTEE MEETING

Student Name:_____**Date of Meeting**: _____
Program: MSc PhD
Research Topic: _____

COMMITTEE MEMBERSHIP:

Supervisory role	Name	Present/Remote/Unavail.
Supervisor *or* Principal Co-Supervisor		
Co-Supervisor		
Member		
Member		
Member		

Please consider the following six items during the committee meeting, and provide a report where indicated (use a separate page if needed).

1) SUMMARY OF STUDENT RECORD:

Program start date: YYYY/MM/DD_____
Date of last committee meeting: YYYY/MM/DD___
Date of thesis proposal defence: YYYY/MM/DD___
Date of Ph.D. Pre-Defence Lecture: YYYY/MM/DD_____
Proposed defense date (approx.): YYYY/MM/DD _____

2) SUMMARY OF COURSE WORK AND GRADES:

Course name and number	Grade
ERTH 6300	
ERTH 6353	
ERTH 6310	

Course work completed? YES NO

3) REVIEW WITH STUDENT AND COMMITTEE ANY RECOMMENDATIONS MADE AT THE PREVIOUS COMMITTEE MEETING.

4) BASED ON THE MATERIAL PRESENTED AT THIS COMMITTEE MEETING, HAS THE STUDENT DEMONSTRATED ADEQUATE PROGRESS IN THEIR RESEARCH?

5) PROVIDE A BRIEF ASSESSMENT OF THE STUDENT PROGRESS IN RESEARCH (INCLUDING ANY SIGNIFICANT MILESTONES, SUCH AS PAPERS SUBMITTED, MEETING PRESENTATIONS, ETC), WHICH SHOULD BE DISCUSSED WITH THE STUDENT.

6) RECOMMENDATIONS OF THE ADVISORY COMMITTEE FOR THE STUDENT WITH SPECIFIC DEADLINES, IF APPLICABLE.

Signature of the committee members present:

_____ _____

_____ _____

_____ _____

Student signature: _____ Date: _____

Date of Next Thesis Supervisory Committee Meeting YYYY/MM/DD _____

Original: to graduate administrator; Copies to all committee members

Dalhousie University Department of Earth and Environmental Sciences
PH.D. Proposal Defence FORM

Student Name _____ Date of Defence _____

Examining Committee Members Present (including remote participation)

Name	***Role***

Outcome (pass/fail): _____

Check all that apply (provide comments below)

Y N

☐☐ The quality and defence of the written thesis proposal meet standard

☐☐Scientific questions, objectives, project rationale clearly demonstrated

☐☐ Depth and breadth of knowledge in the chosen area of study, including relevant basic science is demonstrated

☐☐ The scientific merit of the research problem and level of innovation in approach to solving it are demonstrated

☐☐Feasible and best methods or approaches

☐☐ Originality, creativity, and ability to make critical judgments on scientific matters are demonstrated

☐☐Thesis breath likely to meet Dal/Dept standards

☐☐ The likelihood of achieving success in the research in a four-year period

☐☐Readings recommended

☐☐Changes to methods recommended

☐☐Course work or training recommended

Confidential Comments (Unique situations involving student or supervisory committee that should be noted)

Comments/requirements for supervisor to convey to student

(Use back of sheet, or attach sheets, if necessary)

Dalhousie University Department of Earth and Environmental Sciences

PRE-PH.D. DEFENCE LECTURE

January X, 201X, 11:30 am

Milligan Room, 8th floor Biology/Earth Sciences Wing of LSC

This is the title of my talk: it may be the title of my thesis

Ms. Candy Date

The rest of this page is an abstract for your talk. It should be with Cambria (this or similar) font, 14 pt., with left justification, and single spacing, as is written here. The date and time are set after you consult with (i) your supervisory committee to ensure your supervisor(s) and as many of the thesis supervisory committee members can participate, (ii) Darlene (to ensure there are no conflicting department events), and (iii) the Graduate Coordinator so he or she can prepare to chair the lecture. The abstract should be about 300 words. It is an abstract for your lecture, not for your entire thesis. It should fit in the space provided here. If you have an interesting image that would be useful then please also include it on this page (e.g. Fig. 1). Your supervisor should edit your abstract. Please email this page to Darlene or Norma.

It is not necessary for your abstract to describe everything that your thesis is about. You will want to start off with the overall goals of your entire thesis, and why they are important. Then you may want to provide details on only one or two of your thesis chapters, your hypotheses or questions being addressed, why they are interesting, your methodological approaches, validity of assumptions, choices of field or lab site, results, interpretations, and the significance of your results so far.

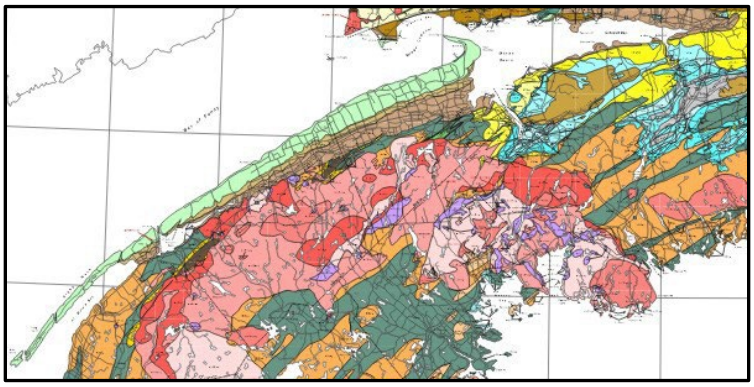

Figure 1 Map of the geology of the Nova Scotia study area

Note that this abstract is 300 words. There is space for a small image, which for instance may be some graph of your data, or a model output, seismic imagery, or a field photo. Colour images are great, because this form will be emailed to the general geoscience public. However, note that posted hard copies of this form may not be in colour. Please include a caption for the image and a legend if necessary.

Dalhousie University Department of Earth and Environmental Sciences
PH.D. Seminar FORM

Student Name _____ Date of Lecture _____

Thesis Supervisory Committee Members Present (including remote participation)

Name	***Role***

Other faculty members present for the *in camera* discussion

Name	***Name***	***Name***

Proposed defence month (mm/yy): _____

Check all that apply (provide comments below)

Y N

☐☐Lecture quality and content meets standard
☐☐Scientific question, objectives, rationale clearly stated
☐☐Notion of importance and impact clearly communicated
☐☐Feasible and best methods or approaches
☐☐Original intellectual contributions defined
☐☐Thesis likely to meet Dal/Dept standards

☐☐Readings recommended
☐☐Changes to methods recommended
☐☐Course work or training recommended
☐☐Requires additional supervision
☐☐Time-line requires revision
☐☐Adequate funding and access to finish

Confidential Comments (Unique situations involving student or supervisory committee that should be noted)

Comments/requirements for supervisor to convey to student

(Use back of sheet, or attach sheets, if necessary)