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# *Earth & Environmental Sciences, Vanderbilt University*

## *Graduate Student Handbook*

Graduate students in Earth & Environmental Sciences (EES) may pursue the following degrees:

- MSc in Earth & Environmental Sciences
- PhD in Earth & Environmental Sciences
- PhD in the Environmental Science (ES) option of Environmental Engineering (EnvE)

The EES MSc and PhD degrees are administered by EES, while the PhD program in Environmental Science is jointly administered by EES (part of the College of Arts & Science) and Civil and Environmental Engineering (CEE, part of the School of Engineering). Information relevant to all three degrees is covered in this document.

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## 1. Some expectations

The department seeks to support an environment of universal collaboration and cooperation among its members and shared academic community. Students are expected to conduct themselves accordingly, with respect for others and the goals of our department and profession. Students can similarly expect reciprocal respect from faculty, staff, and fellow students. To foster such an environment, students are encouraged to communicate regularly with department members and feel free to discuss any issues with their advisors, department faculty, the DGS, and the chair of the department, as appropriate. Current graduate students are also important resources for fellow students.

Commitment and dedication to research and teaching are a must. Specific arrangements vary from advisor to advisor, and from course to course, but graduate students are universally expected to be fully engaged in the academic mission of the program and to act responsibly in their research and interactions with others. Performance is based more on outcome than on the amount of time present in the department; yet, interactions with others are critical, so it is expected that students will spend the majority of work days in the department. Work hours are usually flexible – again with variations depending on advisor or course instructor.

Students receive a 12-month stipend, which includes full support for summer. The summer is an important time for most students given that it allows for immersion into research, leading to significant progress beyond what is typically possible during the academic year. Standard summer vacation time for graduate students is 3 weeks; the timing of vacation is to be arranged through discussion with advisors, advising committee, Director of Graduate Studies (DGS), or chair, as appropriate.

Safety in the laboratory is of paramount importance. The Safety Committee establishes protocols and organizes training to ensure a safe environment. Students are required to comply with such procedures. A minimum level of training is required, regardless of whether students use the laboratory or not; and more advanced training and orientation is required by specific labs. The goal of the regulations in place is to nurture a culture of safety in the department; comments and suggestions aimed at improving or streamlining the procedures are welcomed by the Safety Committee. Specific information on safety policies and procedures that all students should be familiar with can be found here: <https://my.vanderbilt.edu/eesequipment/requirements/>.

Graduate students in the department are expected to actively participate in the life of the department. While it is unreasonable to expect that everyone will participate in every activity, everyone should get involved in some way, and there are activities in which we expect regular attendance and participation.

The department runs a weekly seminar, currently on most Fridays at 3:10 pm (for the current schedule, visit: <http://www.vanderbilt.edu/ees/seminar.php>). Most seminars are given by external visitors, which are typically academics from peer institutions, many times having connections with faculty in the department. Seminars are a great way to learn about current research in various fields, serving as a way to broaden our perspectives. As such, everyone in the department is expected to attend seminars on a weekly basis. There are also many good reasons to meet with visitors, regardless of their expertise, for instance: visitors are experienced professionals who bring a different perspective to the department; each visit is an opportunity to showcase the qualities of the department. Whenever the seminar is given by an external visitor, a graduate student luncheon with the visitor is organized on Friday; students are strongly encouraged to attend the luncheon, regardless of whether their expertise matches that of the

visitor. Students should also feel free to request to meet with visitors as part of the schedule of their visit; every reasonable attempt will be made to accommodate such requests. Students are welcome to suggest potential speakers to the organizing committee.

## 2. Resources

A number of resources are available to students through the university. Some highlights include:

- Zerfoss Student Health Center: <https://medschool.vanderbilt.edu/student-health/>
- Psychological & Counseling Center: <https://medschool.vanderbilt.edu/pcc/student-services/>
- Center for Teaching: <https://cft.vanderbilt.edu/>
- Career Development: <https://my.vanderbilt.edu/gradcareer/>
- Grants, awards, and funding: <https://as.vanderbilt.edu/students/graduatestudents.php>

## 3. Financial support and fees

Most graduate students are full-time students who are supported through Graduate Assistantships, or by a combination of Graduate Assistantships and external fellowships. The financial package typically includes full tuition support, a twelve-month stipend of \$30,000 (all figures for 2017-2018), and health insurance (~\$3,000; if student elects to enroll in the Vanderbilt Health Insurance); but no dental or vision insurance. Some students are selected by the Graduate School to receive scholarships and fellowships in addition to the standard funding package.

In the rare instances in which students are admitted without full support, tuition is charged for courses on a per-credit hour basis (~\$1,600/hour). The same charges would apply if the full funding were to be discontinued. After completing the credits required for the degree, students who continue to work towards their degree without tuition support can continue to enroll for a fixed-fee of \$200 per term (semester or summer).

Students are responsible for the mandatory student activities and recreation fees, which cost approximately ~\$250 per semester. This fee includes use of the Recreation & Wellness Center during the academic year; an additional charge (<\$100) is assessed if the student is registered during the summer or if the student elects to use the facilities during the summer while not registered. Students are allowed to use the center for no more than half the days of the year per year. Each semester the department will pay these fees directly for the student, with a corresponding adjustment to their total annual stipend rate.

A transcript fee of approximately \$30 is charged to every student when they start in the program. This fee is required and it is the paid by the student.

## 4. Registration

Students are required to register every semester and summer to maintain full-time status, including health-care benefits. Full-time status is achieved by registering for at least 9 credit hours of courses or research hours; or by registering for zero credits of research, in addition to any courses a student may be taking. Students who register for the Fall semester prior to the start of the Summer term do not need to register for the Summer to maintain full-time status.

Up to 12 credit hours of tuition per semester are included as part of Graduate Assistantships; registering for more than 12 credit hours is highly discouraged, and it would generate charges that would have to be covered by the student or using some other funding source.

While registration is done relatively early, sometimes when not all graduate course offerings have been decided, students are able to add and drop courses during the first week of classes to adjust their schedules. To the extent possible, students should try to register for courses they intend to take so as to facilitate planning for the semester.

## 5. Teaching assignments

Teaching provides the opportunity for students to teach and interact with other students. It is also an important tool in developing a student's communication and organizational skills. Teaching is thus a critical part of our graduate students' professional development, and an important connection across the academic community of students and faculty. All graduate students are expected to teach through formal teaching assignments as part of the graduate program.

Beginning in 2017-2018, all students are expected to have one formal teaching assignment per year during their tenure in the graduate program – typically, this corresponds to serving as a teaching assistant for a semester-long course in either the Fall or Spring semester. In some cases, students can teach beyond this minimum expectation to seek further professional development in the area of science education. It is also possible to adjust the teaching load across multiple years, so that students can have a full year without teaching to facilitate their research endeavors. Finally, waivers from teaching assignments in specific years can also be considered, particularly for students who secure external fellowships. All requests for deviations from the typical expectation of one semester-long teaching assignment per year should be discussed with the DGS, advisor, and advisory committee well in advance.

It is useful to emphasize that students are not hired to be teaching assistants; rather, serving as a teaching assistant is an expectation of the program (similar to others, such as coursework) and an important component of professional development. Thus no conflict exists between teaching and simultaneously receiving either an external student fellowship or being paid from an external grant. As part of the training process, students will enroll in the zero-credit EES Teaching Practicum for each semester that they serve as teaching assistants. This course formalizes the one-hour meeting that is that is typically held each week among the teaching assistants and course instructors.

Teaching assignments in the department are intended to provide students with a meaningful experience. Intellectual engagement and professional growth should be expected. It is our goal that student responsibilities are reasonably commensurate with their experience and specific knowledge, although in some instances students may be asked to take on a more challenging assignment. Typically, such assignments are aimed at more senior students (specially PhD candidates), who we encourage to accept challenging and rewarding tasks, such as giving lectures or designing and implementing new lab activities.

At the end of each semester, the chair, director of graduate studies (DGS), and director of undergraduate studies (DUS) will decide, in consultation with faculty and students, the distribution of teaching assignments for the following semester. While the opinion of students is sought and taken into

account when making decisions, multiple factors play into the final arrangements, so it may not be possible to accommodate everyone's wishes and desires. Students interested in particular arrangements (e.g. choice of which semester to have a teaching assignment; desire to be a teaching assistant for a particular course) are encouraged to discuss with advisor and specific instructors ahead of time. Also, contingencies may lead to changes in assignments, so any arrangement made in advance should be considered tentative until official assignments are announced prior to the beginning of the semester.

## 6. Research assignments

Engagement in research activities is a cornerstone of the graduate experience. It is thus expected that graduate students will be engaged in research throughout their tenure in the graduate program. The focus of a student's research effort should remain primarily on tasks that advance them toward completion of their degree. Yet, with careful planning it is also reasonable and appropriate for students to engage in research being conducted by the advisor, the immediate research group, or collaborators at Vanderbilt or elsewhere. In all cases, the research experience should involve significant intellectual involvement, and proper credit should be given to the contributions made by students (e.g., by co-authorship in conference abstracts and published articles). Such involvement should also help the student broaden their perspective, interests, or expertise beyond what is possible in the context of their own specific research.

For most graduate students, a portion of funding that supports their stipend and health insurance will come from external grants secured by faculty. In this case it can be valuable for students and faculty to jointly develop projects in which the student can be a significant contributor to these projects while also being intellectually engaged. This high level of research involvement and training is consistent with the expectation of most funding agencies and it helps to justify the use of those grant funds in supporting graduate student education. It also encourages students to be part of larger research endeavors and to learn about conducting grant-funded research. However, when engaging in projects that are outside the immediate scope of the student's thesis research, then student involvement should remain in line with the mission of the graduate program, meaning that its value is commensurate with the degree being sought and the student's experience level. Thus, students should not otherwise be assigned or regularly engage in research activities that lack opportunity for intellectual engagement and growth.

It is also important to emphasize that the outcomes of research efforts are best assessed on timescales longer than a single semester. Student progress should be measured with this in mind, focusing on the advancement of research towards desired outcomes such as conference abstracts and published papers, rather than on short-term metrics such as hours spent in the lab, numbers of samples processed, etc. Students should understand, nonetheless, that sustained effort in all aspects of their research project is critical for long-term success.

## 7. Summer assignments

Following each academic year, the summer term provides students with critically important time for intellectual growth and to advance their research, given that it is possible to devote much more time to the research endeavor without other commitments (e.g. coursework, teaching) in parallel. For this reason, students are typically expected to work full-time during the summer. Regardless of the source of funding used for support, students should be given flexibility to pursue their research full time, with a

set of goals to be agreed upon with advisor and committee, and maintaining the collaborative spirit we cultivate in the program.

While the focus of the summer effort should be on research, students can selectively engage in teaching and professional development activities during the summer, as appropriate. Students interested in such activities should discuss them with the advisor, advisory committee, and DGS. It should be emphasized that the benefits of such activities should outweigh the possible losses deriving from students being displaced from their research endeavors during the summer.

Beginning in Summer 2017, all students are guaranteed full-time support through the summer, allowing students to focus on progress toward their research and degree requirements. Advisory committee and DGS can be consulted as necessary. Also, it is EES policy that if a student is compensated for time spent performing teaching or professional development activities beyond a total of one or two weeks during the summer, then the funds derived from that activity will be deducted from the normal support for that period. This is not intended to be restrictive but rather to encourage students to engage with outside activities that contribute substantively to their professional development. Specific circumstances should always be discussed with the advisor and DGS prior to making commitments.

Summer support includes 3 weeks of vacation. Details on how to organize the vacation time should be discussed with each advisor.

## 8. Selection of advisor and advising committee

Incoming students have usually identified one or more faculty with whom they have common interests, and who may serve as advisors, prior to starting in the program. Nonetheless, upon arrival students are encouraged to talk with as many faculty members in the department as reasonably feasible, as well as to others in allied departments, as appropriate. Students should be aware that they have been admitted to a program, not to work with a specific advisor. As such, they should feel free to explore possibilities and directions of interest before deciding on an advisor. This should be done as expeditiously as possible so as not to delay progress towards completion of the program; but it should be done thoughtfully, so that the right research direction and advisor are identified.

Successful completion of the program usually requires that student and advisor develop good rapport and working relationship. Students and faculty alike should strive to nurture a cordial and productive working relationship that is based in mutual respect, particularly given our shifting demands and varied roles within the academic environment. In cases in which problems do arise, the DGS and chair should be considered 'safe' resources both for counseling and for consideration of potential solutions or corrective actions. It is generally much easier to address problems when they are starting to develop, so students are strongly encouraged to seek counsel from DGS or chair (or other faculty members) as soon as issues of concern or doubt become apparent, whether with an advisor, or another faculty member, staff or student. Regular and open communication among our department community is encouraged, and no student should ever feel isolated from support or help.

In the case of the PhD program, students select, in consultation with primary advisor, the advising committee. Committee members will often play important roles in advising and mentoring students, so decisions should be made thoughtfully as well. Students should consider the styles and expertise that would be helpful over the course of their progress in the program. Students and advisor should strive for

breadth of expertise and approaches in composing advising committees. In the case of the MSc program, committees (except for advisor) are selected by the DGS, who tries to assure that some breadth in expertise and approaches is represented in all committees; suggestions from the students are sought, and reasonable effort is made to accommodate student requests. In all cases students are strongly encouraged to interact with committee members as extensively as possible and reasonable, beyond the mandated meetings once a semester.

## 9. Committee meetings

All graduate students are expected to meet with their advising committee every semester. These meetings provide an opportunity for student, advisors, and advising committee to review progress by the students, and to assist the student in making plans moving forward. Not all committee meetings need to be long and formal — rather, it is of greater importance that students meet regularly with their committee than to wait for an ideal time or some major development. More formal, in-depth committee meetings are nevertheless important and should be emphasized ahead of major junctures in the graduate program.

The primary advisor is responsible for completing an online form (available at: <http://j.mp/2bTmmQD>) after each meeting, summarizing the main findings of the meeting. If necessary, the primary advisor should also contact the DGS to inform if there are significant concerns that warrant discussion or intervention.

## 10. Annual student evaluations

At the end of every Spring semester, EES faculty perform an annual evaluation of all graduate students in the program. This is in addition to more detailed evaluation performed by advisory committees. The goal of this evaluation is to provide an assessment of the state of the program, with a focus on the progress of all students. Faculty try to identify strengths and weaknesses of the program, and they also strive to identify situations that require attention and possibly action.

In preparation for the annual evaluation, students submit a short form and their CV. The form includes general information (e.g. start date in the program), program requirements (e.g. coursework, preliminary and qualifying exam dates), and expected milestones (e.g. anticipated date of defense). The CV provides specific information on measurable outcomes. While the general format of the CV is open to the students, there are specific headings that are required, so that the information provided by all students is comparable. If no product is available for a specific heading, the CV should still include the heading. Frequent updates to the CV help students develop their professional portfolio over time, and also help identify potential gaps and weaknesses early on, encouraging action to overcome them.

Results of the annual evaluation are typically communicated to each student by their primary advisor. In specific cases, the DGS may communicate directly to a student the outcome of the evaluation. Regardless, students are encouraged to contact the DGS if they have questions regarding the annual evaluation, both leading to and after the evaluation has taken place.

## 11. Courses offered

Traditionally, most faculty in EES offer at least one graduate-level course per year, which has resulted in some 4-6 graduate courses per semester (see below). However, many faculty rotate their graduate teaching such that individual courses may only be taught every second or third year. There is also a fair number of special-topic courses that may or may not be taught regularly, and in any given year at least one faculty member is likely to be on leave. As a result, it can be difficult to clearly state which and when courses will be offered beyond the semester in question. While this can make advance planning difficult, it does better allow for faculty to react to the needs and interests expressed by students, which is a positive aspect. A list of graduate courses offered in the last 4 years is included below. For questions pertaining to specific courses, students are encouraged to discuss with the relevant instructors to inquire about their plans for the near future.

The Vanderbilt course numbering system is designed to allow for courses to be cross-listed for both undergraduate and graduate credit. Courses that may be taken for graduate credit are numbered at the 5000-level or higher. When such courses are cross-listed at the undergraduate level (<5000-level), instructors must design alternative assignments to provide adequate challenges and assessment suitable for graduate students. As such, while there are substantial shared activities (e.g. most lectures) between cross-listed undergraduate and graduate courses, there should be unique elements (e.g. additional lectures, project) that cater to each constituency. This is a new development (starting Fall 2015) that will be evaluated in the coming semesters; input from students is sought on the matter. Graduate students can register in select undergraduate-only courses not formally listed for graduate credit, with permission from DGS and course instructor; students interested in taking such courses should discuss the issue with advisor, advising committee, and DGS, as appropriate.

## 12. External funding and grant applications

Graduate students are eligible to apply for a number of funding opportunities, both internal and external to Vanderbilt. Students are encouraged to seek appropriate opportunities and to apply to at least some of those. Students should discuss the costs and benefits associated with various opportunities to decide to which ones they should apply. Vanderbilt students can also set up an account to use [PIVOT](#), a powerful search engine that provides access to many opportunities for research, travel, internships, and scholarships ([https://as.vanderbilt.edu/externalgrants/COMM\\_Pivot.php](https://as.vanderbilt.edu/externalgrants/COMM_Pivot.php)). Some key opportunities are given in Table 1.



Table 1: Graduate Fellowship and Funding Opportunities

| Opportunity                               | Source | Link  |
|---|--------|---|
| NSF Graduate Research Fellowship          | NSF    | <a href="https://www.nsfgrfp.org/">https://www.nsfgrfp.org/</a>                         |
| NASA Earth and Space Science Fellowship   | NASA   | <a href="http://nspires.nasaprs.com/external/">http://nspires.nasaprs.com/external/</a> |
| DOE Office of Science Graduate Fellowship | DOE    | <a href="http://science.energy.gov/wdts/scgf/">http://science.energy.gov/wdts/scgf/</a> |

Research and travel grants:

| Opportunity  | Source             | Link  |
|--|--------------------|---|
| Student Travel Grants                                    | VU Graduate School | <a href="http://gradschool.vanderbilt.edu/funding/university_scholarships.php">http://gradschool.vanderbilt.edu/funding/university_scholarships.php</a>                     |
| Dissertation Enhancement Grants                          | VU Graduate School | <a href="http://gradschool.vanderbilt.edu/funding/dissertation_grant.php">http://gradschool.vanderbilt.edu/funding/dissertation_grant.php</a>                               |
| SEPM Student Assistance Grants                           | SEPM               | <a href="https://www.sepm.org/Apply-for-a-Student-Assistance-Grant">https://www.sepm.org/Apply-for-a-Student-Assistance-Grant</a>   |
| AAPG Grant-in-Aid Program                                | AAPG               | <a href="http://foundation.aapg.org/students/graduate/grantlist.cfm">http://foundation.aapg.org/students/graduate/grantlist.cfm</a>   |
| Evolving Earth Student Grant                             | Evolving Earth     | <a href="http://www.evolvingearth.org/evolvingearthgrants/grantsmain.htm">http://www.evolvingearth.org/evolvingearthgrants/grantsmain.htm</a>                               |
| Lewis and Clark Fund for Exploration and Field Research  | APS                | <a href="https://www.amphilsoc.org/grants/lewisandclark">https://www.amphilsoc.org/grants/lewisandclark</a>   |
| Graduate Research Grant                                  | GSA                | <a href="http://www.geosociety.org/grants/gradgrants.htm">http://www.geosociety.org/grants/gradgrants.htm</a>   |
| Mathematical Geosciences Student Scholarships and Awards | IAMG               | <a href="https://iamg.org/student-affairs/student-and-postdoctoral-research-grants.html">https://iamg.org/student-affairs/student-and-postdoctoral-research-grants.html</a> |
| Grant-in-aid for Research                                | Sigma Xi           | <a href="https://www.sigmaxi.org/programs/grants-in-aid">https://www.sigmaxi.org/programs/grants-in-aid</a>   |
| East Asia and Pacific Summer Institutes (EAPSI)          | NSF                | <a href="https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5284">https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5284</a>   |

### 13. Overview of timeline and requirements

Below we outline the key requirements and overall timeline for the graduate programs offered by EES. Essentially all students start on the program in the Fall semester, so the description below assumes the Fall as the starting term.

Students entering the EES PhD without an MSc degree (direct-PhD students) are required to first complete the EES MSc degree before transitioning to the PhD program. The guidelines for the MSc program are the same for all students. Students in the EES MSc program interested in transitioning to the EES PhD program have two options if they decide to apply for admission into the EES PhD program (early-admission in the Fall, or regular admission in the early Spring); please see section 13.1.1 for more details.

### 13.1. MSc in Earth & Environmental Sciences

Students are strongly encouraged to complete their degree requirements, including thesis, in 2 years, i.e. by the end of the second summer in the program. A small fraction of students are able to complete all requirements by the end of the second Spring semester in the program. Occasionally, circumstances may lead to a student completing all requirements except the thesis by the end of the second summer, and they must then complete the thesis during the third year in the program. Students and advisors should work together to avoid this latter scenario, which is primarily considered in cases of extenuating circumstances. Financial support is typically only available for 2 years for MSc students; students working on a thesis during the third year do not receive compensation from the program, and they are responsible for the \$200 tuition required to maintain their status as students (see Section 4).

The MSc program requires 30 credit hours of graduate credit, with a minimum of 24 credit hours deriving from courses; the remaining 6 credit hours can be fulfilled with courses or research hours. Most students will take 3 courses in each of the first 2 semesters and 1 course in each of the final 2 semesters, but this is flexible and there is considerable variability.

During the first semester in the program, students should meet with several faculty members and discuss their interests and research possibilities. Students should then identify a principal advisor, who will help guide the student through the program.

For MSc students, the DGS, in consultation with the chair, faculty, and students, will assign each student to a committee of 3 faculty members. Typically, the committee will be composed of 2 faculty members with interests closely aligned with those of the student (including the advisor and, possibly, a co-advisor) and 1 faculty member with interests less aligned with that of the student. The goal is to have broad representation and to make sure MSc students are broadly trained and exposed to a wider range of expertise, styles, and approaches. Students should meet with their advisory committee every semester, typically towards the end of the semester.

During the second semester in the program, students should identify a research topic and prepare their proposal. The MSc proposal is supposed to be short (absolute max of 5 pages single-spaced total, including figures and tables; reference list can appear on additional pages), and should show that the student is able to identify a suitable problem, come up with adequate methods to tackle the problem, and is capable of articulating ideas in writing. The proposal is initially reviewed by the advisor, and then by the other committee members. After all 3 members have approved the proposal, students should send it to all faculty (by email to [eesfaculty@list.vanderbilt.edu](mailto:eesfaculty@list.vanderbilt.edu)); faculty members may send comments on the proposal to the student, at their discretion. The deadline for the completion of the proposal is 2 weeks before the end of the Spring semester. The goal is for students to use the summer to advance their research.

Much of the focus of the second year in the program is in performing the research that will culminate with the thesis. Students should work closely with their advisor and other members of the committee to make sure satisfactory progress is being made towards completion of the thesis. Writing is almost always harder and takes longer than one anticipates (even for faculty), so students are encouraged to begin the writing process as early as possible, at least 3 months in advance, in consultation with their advisor.

There is no formal defense for the MSc program, but students are required to give an oral presentation (~30 min) to the whole department. Students are encouraged to make the presentation at least a few weeks before the final deadline for depositing the thesis with the Graduate School, so that there is time to incorporate suggestions or make modifications based on feedback received following the presentation. Typically MSc students make their presentation before the end of the Spring semester, regardless of whether they intend to graduate in the Spring or Summer terms.

A written thesis is required to obtain the MSc degree. The organization of the thesis has to follow the guidelines provided by the Graduate School (<http://gradschool.vanderbilt.edu/academics/theses/>), but the specifics of the organization and content should be discussed with the advisor. Students should be aware that deadlines for submission of the thesis occur relatively early in each term (mid-March for Spring graduation; mid-July for Summer graduation). The thesis needs to be approved by the advisor and by one additional faculty member, referred to as the reader. Signatures by both are required for formal submission of the thesis.

*Table 2: Ideal timeline for completion of the MSc program*

| <b>Ideal time for completion</b>  | <b>Task</b>                                |
|---|--|
| End of 1 <sup>st</sup> semester   | Identify advisor                           |
| Late in 1 <sup>st</sup> or early in 2 <sup>nd</sup> semester                      | Meet with advising committee               |
| Spring Break (but no later than two weeks before end of 2 <sup>nd</sup> semester) | Submit proposal to advising committee      |
| End of 4 <sup>th</sup> semester   | Complete all coursework                    |
| End of 4 <sup>th</sup> semester   | Make thesis presentation to the department |
| By 2 <sup>nd</sup> Summer deadline  | Deposit thesis with Graduate School        |

### 13.1.1. Transition to the PhD programs

Students admitted exclusively to the EES MSc program who are interested in the PhD program are strongly encouraged to discuss their interest with advisor, advising committee, and DGS. Prior to applying for the PhD, students are expected to have discussed in some detail with their prospective advisor a plan for the PhD; support of the prospective advisor is critical for admission into the PhD program.

Students interested in applying for the PhD programs will have two options:

- 1) During the Fall semester of the second year in the EES MSc program, students can elect to be considered for early admission into the PhD programs. If accepted, students will be expected to commit to starting the PhD program in the following Fall semester prior to the end of the Fall semester (i.e., they will not be able to consider other programs for the PhD). This option should be pursued by students whose primary interest is to continue their PhD studies at Vanderbilt.
- 2) Students can apply for the EES PhD programs (deadline of Jan 15) via the Graduate School and be considered with the general pool of applicants. Students who are interested in exploring options with other PhD programs in addition to Vanderbilt should pursue this path. Also, students who were not accepted for early admission can apply at this time to seek admission into the PhD programs.

Students who were admitted into the EES PhD program without a prior MSc degree will need to complete the EES MSc degree by the end of the second summer in the program. Enrollment in the EES PhD program will be contingent upon satisfactory progress in the program.

In all cases, students who start the PhD program after obtaining an EES MSc degree will be expected to progress more quickly through the program (see below); diligence during the transition from the MSc to the PhD is important for successful admission into and completion of the PhD program.

### 13.2. PhD Programs

Completion of the PhD program usually takes place in 3-4 years beyond the MSc, depending on prior experience by students. Most PhD students starting in the program have completed an MSc degree beforehand, either at Vanderbilt or elsewhere, so this timeline reflects the expectation that entering students have substantial research experience and prior coursework beyond the undergraduate level. Students entering the PhD program without an MSc degree are expected to complete the program in ~5 years total; such students will be expected to complete all the requirements of the MSc program in EES (following the guidelines above) prior to pursuing the requirements of the PhD program, as detailed below.

Differently from the MSc degree, a strict deadline is not desirable for the PhD program given that students need to reach a level of maturity that would allow them to be independent researchers after completion of the PhD. However, given limitations in funding, financial support is typically only secured for 4 years (5 years for students entering without an MSc degree); support for additional years in the program has to be negotiated on a case-by-case basis. Students who have completed all degree requirements except for the dissertation (i.e., coursework, research credits, comprehensive and qualifying exams), and who need to continue to work on the dissertation after financial support has been discontinued, can maintain student status by paying the fixed fee of \$200 per semester.

Both PhD programs require 72 hours of graduate credit, with a minimum of 36 credit hours deriving from courses; the remaining 36 credit hours can be fulfilled with courses or research hours. Students who completed an MSc degree in EES can request the use of their prior Vanderbilt coursework towards the 36 credit-hour requirement. Students who completed graduate coursework in other universities can also request to use their coursework towards the credit-hour requirements, but a minimum of 24 course credit hours need to be completed at Vanderbilt.

Most PhD students have identified an area of interest and potential advisors when they start in the program. During the first semester, students should discuss with potential advisors research possibilities and potential projects. Student should identify an advisor, and together they would then select a few faculty members to comprise the advising committee. At the early stages, the student can opt to have a smaller committee (3-4 people) and wait to finalize the composition of the committee once the research direction is clear. Official committees require at least 4 faculty members. It is common for committees to have a 5<sup>th</sup> member; but larger committees are generally discouraged as they become more difficult to manage logistically. In the EnvE program, committees include at least 2 faculty members from EES and 2 from CEE, in keeping with the interdisciplinary nature of the program. In the EES program, committees need to have at least one member NOT from EES, either from another department at Vanderbilt, or from a different institution. Non-Vanderbilt members are typically faculty members in other PhD-granting universities, and they have experience mentoring graduate students; in any case, such cases

should be discussed with the advisor, advising committee, and DGS, and a request to include them in the committee needs to be approved by the Graduate School upon the request of the DGS.

Students are expected to have a formal meeting with their committee at least once a semester. The student should present to the committee a filled-out progress report – following one of the templates provided here: <http://www.vanderbilt.edu/ees/resources.php> – to help the committee evaluate the progress made by the student. Meetings with committees usually take place towards the end of the semester, but they can happen at any time it is deemed necessary.

The expectation is that coursework will be primarily fulfilled in the early stages of the program, particularly in the first 3 semesters. Students are encouraged to discuss with advisor, advising committee, and DGS course selection so as to select a coherent collection of courses that helps them grow academically and professionally. Requirements differ in the two programs:

1) There are no required courses in the EES program, and students have complete freedom to select courses. Consultation with the advisor, committee, and course instructors is nevertheless encouraged to ensure an appropriate breadth and depth of coursework.

2) In the EnvE program, there are some requirements that need to be met by the collection of courses chosen by the student. First, at least 2 of the courses need to be taken in EES and at least 2 in CEE. Second, courses should fulfill requirements in terms of distribution into 4 areas: (a) Materials [minimum 2 courses]; (b) Processes [minimum 2 courses]; (c) Systems [minimum 1 course]; (d) Quantitative foundations [minimum 1 course]. A list of current courses that satisfy each distribution area is available, but advising committees have the authority to decide if the coursework performed by a student satisfies the distribution requirements. Finally, a capstone course is required; offerings of the capstone have been irregular, so students should discuss with the DGS to devise a plan of action when no capstone courses are being offered in any given year.

A preliminary exam is required in the EES program, and a comprehensive exam is required as part of the EnvE program. Approval in the appropriate exam is required before advancing to the qualifying exam (see below).

The EES preliminary exam is taken no later than the end of the second semester in the PhD program; students who completed an MSc program at EES will typically take the preliminary exam earlier, during the first semester in the PhD program, while students starting with an MSc from other programs will typically take the exam during their second semester in the program. The preliminary exam consists of the defense of a preliminary version of the research proposal. Students should submit, 2 weeks prior to the exam (and thus no later than 2 weeks prior to the end of the semester), a proposal to the advising committee (at least 3 faculty members, at least 2 of which from EES). The proposal should be no more than 10-pages long, no less than single-spaced, with font no smaller than 12-point Times New Roman, and with margins no less than 1 inch on every direction; figures and tables are included in the page limit, but references can be listed on additional pages; organization and other details are flexible and should be discussed with advisor or advising committee. The proposal should be complete enough to allow faculty members to evaluate progress and provide advice for preparation of the final proposal to be presented as part of the qualifying exam. The primary goal of the exam is advisory in nature; however, as at any time, it provides an opportunity for the committee to assess whether students are making

satisfactory progress towards the degree, a requirement for continued enrollment in and funding by the program.

The EnvE comprehensive exam is typically taken at the start of the fourth semester in the program; at that time, most, if not all, of the required coursework should have been fulfilled. The student must have taken at least 2 EES and 2 CEE courses before taking the exam. The written portion of the exam includes 2 subparts, the Fundamentals and the Integrative Problems. Both subparts consist of questions designed by faculty members with whom the student took courses – 2 from EES and 2 from CEE, who do not need to be part of the advising committee. The exam also includes an oral part, which consists of a critical appraisal of a scientific article chosen by a group of faculty members – which can be, but does not need to be, the same as those participating in the written part; the main advisor usually participates actively in the choice of the selected article. Results of the exam can reach the following outcomes: (i) a clear pass; (ii) a conditional pass – pending meeting additional requirements; (iii) fail but be allowed to take the exam a second time; or (iv) fail and be terminated from the program. The expectation and experience is that most students who properly prepare for the exam pass it on their first attempt.

A qualifying exam is required by both programs; the format is the same in both programs. The qualifying exam is a requirement imposed by the Graduate School to all programs. Students are required to take the qualifying exam no later than the end of their 4<sup>th</sup> semester in the program; students who completed an MSc at Vanderbilt are expected to take their qualifying exam sooner, ideally by the end of the 2<sup>nd</sup> semester in the PhD program (i.e., 6<sup>th</sup> semester including MSc and PhD programs). The qualifying exam consists of presentation of a final version of their written proposal and oral defense of such proposal. The written proposal should demonstrate the ability to propose a novel project that is worthy of a PhD. The student should demonstrate command of the topic to be studied and of the methods to tackle the problem, as well as present an adequate appraisal of possible results and implications. The proposal should be no longer than 12 pages (no less than single-spaced, margins no smaller than 1 inch in every direction, font no smaller than 12-point Times New Roman), including figures and tables; references may appear in additional pages. The oral presentation of the proposed research is open to the public. In the oral presentation, the student should clearly and briefly present the project, as well as answer questions from the faculty members participating in the exam. At the time of the qualifying exam, the advising committee is officially appointed by the Graduate School upon request and recommendation of the DGS or chair. The committee must consist of at least 4 faculty members from the Graduate Faculty, one of whom should be from a different department than EES. The exam needs to be officially scheduled with the Graduate School at least two weeks in advance. The advising committee should receive the proposal no later than a week before the exam. Students approved in the qualifying exam are recommended for promotion to candidacy, at which time they officially become PhD candidates.

After passing the qualifying exam, the student focuses on research and preparation of a dissertation, while continuing to perform tasks associated with teaching and research assistantships. The expectation is that students will gradually become more intellectually independent, but they will continue to closely consult and work with advisors as the research progresses.

A written dissertation is required to obtain the PhD degree. The Graduate School stipulates that the dissertation has to be completed within 4 years of admission to candidacy, with a potential extension for one additional year; but students should bear in mind that full financial support will most likely not be granted for such an extended period of time. The organization of the thesis has to follow the guidelines

provided by the Graduate School (<http://gradschool.vanderbilt.edu/academics/theses/>), but the specifics of the organization and content should be discussed with the advisor and advising committee. The dissertation needs to be approved by the advising committee and submitted to the Graduate School. Students should be aware that deadlines for submission of the dissertation occur relatively early in each term (mid-March for Spring graduation; mid-July for Summer graduation).

A dissertation defense – officially known as the final examination – is also required to receive the PhD degree. Like in the case of the qualifying exam, the dissertation defense has to be officially scheduled with the Graduate School at least 2 weeks in advance, and the advising committee has to be appointed upon the request and recommendation of the DGS or chair. The candidate should send a complete draft of the dissertation no later than 2 weeks before the defense, and committee members are expected to read the document in detail for the defense. The defense consists of a public presentation of the key aspects of the research conducted and presented in the dissertation, followed by a closed-doors meeting with the advising committee. In the oral presentation, the candidate should be able to explain to a broad audience the main findings as well as important implications of the work. The oral presentation is immediately followed by questions from the audience (members of the advising committee excepted). The advising committee will then meet with the student and ask questions about and related to the presentation and/or dissertation; the student should be able to satisfactorily answer the questions posed by the committee members. At the end of the closed-door meeting, the committee will meet and make a determination of whether the student has passed the examination or not. Most typically, the committee will request that the student make changes to the written dissertation to reflect suggestions made during the examination; in general, it is the responsibility of the advisor to ascertain that such changes have been satisfactorily made prior to submission of the dissertation, but committee members can request to see the final draft to make sure satisfactory additions or modifications have been made.

*Table 3: Ideal timeline for students entering the EES PhD program with an EES MSc degree.*

| <b>Ideal time for completion</b>        | <b>Task</b>  |
|---|--|
| End of 1 <sup>st</sup> semester         | Identify advisor and at least 2 additional members for advising committee; take Preliminary Exam |
| End of 2 <sup>nd</sup> semester         | Complete all coursework (research hours excluded); take Qualifying Exam                          |
| End of 4 <sup>th</sup> semester         | Complete all credit requirements (including research hours)                                      |
| End of 6 <sup>th</sup> semester         | Take Final Exam (defense)  |
| By 3 <sup>rd</sup> year Summer deadline | Deposit thesis with Graduate School  |

*Table 4: Ideal timeline for students entering the EES PhD program with an MSc from another university.*

| <b>Ideal time for completion</b>        | <b>Task</b>  |
|---|--|
| End of 1 <sup>st</sup> semester         | Identify advisor   |
| End of 2 <sup>nd</sup> semester         | Identify at least 2 additional members for advising committee; take Preliminary Exam |
| End of 3 <sup>rd</sup> semester         | Take Qualifying Exam   |
| End of 4 <sup>th</sup> semester         | Complete all coursework (research hours excluded)                                    |
| End of 6 <sup>th</sup> semester         | Complete all credit requirements (including research hours)                          |
| End of 8 <sup>th</sup> semester         | Take Final Exam (defense)  |
| By 4 <sup>th</sup> year Summer deadline | Deposit thesis with Graduate School  |

*Table 5: Ideal timeline for the ES option of the EnvE program.*

| <b>Ideal time for completion</b>        | <b>Task</b>   |
|---|---|
| End of 1 <sup>st</sup> semester         | Identify advisor  |
| End of 2 <sup>nd</sup> semester         | Identify at least 2 additional members for advising committee           |
| Beginning of 4 <sup>th</sup> semester   | Take Comprehensive Exam   |
| End of 4 <sup>th</sup> semester         | Complete all coursework (research hours excluded); take Qualifying Exam |
| End of 6 <sup>th</sup> semester         | Complete all credit requirements (including research hours)             |
| End of 8 <sup>th</sup> semester         | Take Final Exam (defense)   |
| By 4 <sup>th</sup> year Summer deadline | Deposit thesis with Graduate School                                     |



## 14. EES graduate courses offered since Fall 2014

| <b>Instructor</b> | <b>Course</b>  | <b>Term</b> |
|-------------------|--|-------------|
| DeSantis          | EES 5220: Life Through Time  | Spring 2017 |
| Claiborne         | EES 5260: Petrology  | Spring 2017 |
| Furbish           | EES 5420: Geomorphology  | Spring 2017 |
| Bennartz          | EES 5650: Physics of the Climate System                            | Spring 2017 |
| Ayers             | EES 5750: Sustainable Systems Science                              | Spring 2017 |
| Gilligan          | EES 5760: Agent- and Individual-Based Computational Modeling       | Spring 2017 |
| Tate              | EES 5891: Applied Structural Geology                               | Spring 2017 |
| Darroch           | EES 5891: Mass Extinctions   | Spring 2017 |
| Jorge             | EES 5891: Ecology of the Anthropocene                              | Spring 2017 |
| Oster             | EES 7300: Isotopes and the Environment                             | Spring 2017 |
| Miller            | EES 7350: Magmatic Processes and the Construction of the Crust     | Spring 2017 |
| Gilligan          | EES 5110: Global Climate Change                                    | Fall 2016   |
| Gualda            | EES 5250: Earth Materials  | Fall 2016   |
| Morgan            | EES 5340: Structural Geology and Rock Mechanics                    | Fall 2016   |
| Darroch & Miller  | EES 5510: Earth Systems through Time                               | Fall 2016   |
| Furbish           | EES 5550: Transport Processes in Earth and Environmental Systems   | Fall 2016   |
| Ayers             | EES 5600: Geochemistry   | Fall 2016   |
| Oster             | EES 5680: Paleoclimates  | Fall 2016   |
| Gualda            | EES 7110: Advanced Topics in Earth Materials: Thermodynamics       | Fall 2016   |
| Bennartz          | EES 4650: Physics of the Climate System                            | Spring 2016 |
| Gilligan          | EES 5760: Agent- and Individual-Based Computational Modeling       | Spring 2016 |
| Ayers             | EES 6891: Special Topics: Reviews in Mineralogy & Geochemistry     | Spring 2016 |
| Gualda & Darroch  | EES 7110: Advanced Topics in Earth Materials: Imaging              | Spring 2016 |
| DeSantis          | EES 7620: Macroecology and Biogeography                            | Spring 2016 |
| Gilligan          | EES 5110: Global Climate Change                                    | Fall 2016   |
| Gualda            | EES 5250: Earth Materials  | Fall 2016   |
| Darroch & Miller  | EES 5510: Earth Systems through Time                               | Fall 2016   |
| Ayers             | EES 5600: Geochemistry   | Fall 2016   |
| Ayers             | EES 5750: Sustainable Systems Science                              | Fall 2015   |
| DeSantis          | EES 5820: Paleoecological Methods                                  | Fall 2015   |
| Miller            | EES 5830: Volcanic Processes                                       | Fall 2015   |
| Bennartz          | EES 6891: Geospatial Statistics                                    | Fall 2015   |
| Gualda            | EES 311: Advanced Topics in Earth Materials: Phase Transformations | Spring 2015 |
| Oster             | EES 330: Isotopes and the Environment                              | Spring 2015 |
| Goodbred          | EES 338: Sedimentary Systems: Source-to-Sink                       | Spring 2015 |
| Bennartz          | EES 390: Intro Atmospheric Physics                                 | Spring 2015 |
| Furbish           | EES 255: Transport Processes in Earth and Environmental Systems    | Fall 2014   |
| Oster             | EES 268: Paleoclimates   | Fall 2014   |
| Gualda            | EES 311: Advanced Topics in Earth Materials: Thermodynamics        | Fall 2014   |
| Furbish           | EES 390: Applications of Probability and Statistics                | Fall 2014   |
| Bennartz          | EES 390: Remote Sensing  | Fall 2014   |