

Guide to Geoenvironmental Studies Graduate Program

Department of Geography and Earth Science
Shippensburg University
www.ship.edu/Geo-ESS

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1. Department and Program Mission

The Geography-Earth Science Department at Shippensburg University is committed to student learning and personal development through innovative teaching, high quality field application, and use of geotechnology in all aspects of departmental programs. These commitments will deepen student appreciation of Geography-Earth Science, encourage life-long learning, and prepare graduates to be successful in their future endeavors. The geoenvironmental studies graduate program is designed to be flexible in order to meet the varied needs of a wide range of students. The specific mission of the graduate program can be summarized as follows:

- Develop mastery of theoretical knowledge and provide experience with practical applications from a wide range of environmental and geotechnical disciplines.
- Provide further training and experience to increase competitiveness in the environmental and geotechnical job markets.
- Provide continuing education to fulfill professional development requirements.
- Provide a solid foundation for continued graduate education.

2. Goals of Program

To accomplish this mission, the following goals have been established. The program is designed to be flexible so that individual students may accomplish these goals in a manner that is most appropriate for their development.

- Continue mastery of substantive environmental disciplinary knowledge.
- Develop proficiency in one or more geotechniques with a focus on field applications.
- Continue development of analytical and communication skills.
- Foster an attitude of life-long learning.

3. Admission to Program

Students apply for the graduate program in Geoenvironmental Studies directly through the graduate admissions office. When complete, application materials are sent to the department for evaluation. To be admitted, students must have an undergraduate GPA greater than 2.75. A graduate record exam (GRE) score is required if a student's GPA is less than 2.75. Application forms are available via the graduate school webpage. Further admissions information is available in the graduate school catalog.

4. Financial Support

Graduate Assistantships

The department is able to provide financial support to several graduate students each semester and a few graduate students during the summer in the form of graduate assistantships. The number of supported students fluctuates depending on administrative financial considerations as well as the availability of funds from faculty sponsored, externally funded research projects. Graduate assistantships are for full time students and provide a full tuition waiver as well as an hourly wage for up to 250 hours per semester (150 hours during the summer). Assistants will also be given communal office space and keys to select rooms around the department.

In return for financial aid, graduate assistants will assist faculty and staff in a variety of capacities. The specific duties will depend on specific faculty members. During all department associated responsibilities, assistants are expected to conduct themselves in a professional manner. For example, assistants should respect student privacy when grading material and should use sound judgment when unlocking doors for students they do not know. Assistants are also expected to take a leading role in the department by attending talks and events and setting an example for other students.

Assistantships are awarded on a competitive basis based on student prior performance, interviews, student interests, and current departmental needs. Assistantship awards are determined by the department chair and graduate coordinator in consultation with the department curriculum committee. Assistantships are typically awarded for four semesters. However, graduate assistants are subject to a performance review each semester to determine whether to renew the assistantship. This review is performed by the department chair, graduate coordinator, and the supervising faculty member. Due to the demands of being a full time student as well as a graduate assistant, assistants are not advised to hold additional employment while they are on the payroll as a graduate assistant. Outside employment is often associated with poor performance in graduate assistant duties and may potentially be grounds for non-renewal of assistantships. Required internships are not viewed as outside employment. If, however, an internship is interfering with assistantship responsibilities, an individualized solution may have to be arranged.

Other graduate assistantships exist outside the department and students are encouraged to apply for those positions as well.

Graduate Research Grants

The university maintains a small annual pool of money to be awarded to help support graduate research projects or to support travel to a professional conference for graduate students to present the results of their research. Students are encouraged to consult their advisor about applying for these funds.

5. Program Requirements

Students are required to take at least **36 credits** to complete the Masters degree in Geoenvironmental Studies. Listed below are the specific courses and requirements that must be completed to earn the degree.

- Students must take **GEO 503 Fundamentals of Geoenvironmental Research** during the first semester it is offered.
- Students must take a **minimum of 18 credits at the 500 level**, including GEO 503.
- Students may take a **maximum of 12 credits at the 400 level** for credit towards the MS degree.
- Students must take a **minimum of 3 credits of geotechniques courses** at either the 400 or 500 levels.
- Students may take a **maximum of 6 credits outside of the department**. **Selection of courses outside the Department should be done with approval of the student's advisor.**

- Students must complete a **thesis** (6 credits, GEO 612 and 613) **OR a one-semester research project** (3 credits, GEO 546 or 548) **and internship** (6 credits, GEO 609 and 610). These credits count towards the 36 total credits.
- Students must take and pass the departmental **practical exam**.

Students should consult the university graduate catalog for details on policies concerning: grades of C and F, grades of Q and I, grade and status appeals, withdrawing from or repeating classes, transfer credits and timelines for degree completion.

6. Deficiencies and Prerequisites

If an incoming student has little or no experience with geography or environmental science, s/he may be required to take undergraduate courses (not for graduate credit) to overcome these deficiencies. The department chair, graduate coordinator, and curriculum committee will establish a list of deficiencies (if any) for all students before they begin the program. Courses from other higher education institutions or appropriate professional experience may fulfill deficiencies.

Graduate level courses are intended to examine content matter in a more robust manner and thus large amounts of time cannot be spent covering introductory material. Therefore, students are expected to have taken the necessary undergraduate introductory courses for applicable graduate classes. However, because most graduate classes do not have prerequisites, the department strictly adheres to the few required prerequisites. If a student is unsure if they meet the necessary requirements for a graduate course, they should consult with both the graduate coordinator and course instructor. This policy especially applies for graduate level GIS courses.

7. Description of Core Areas

The department has several core areas in which teaching and research activities are focused. While one goal of the program is to provide broad training in environmental science, students will align with one or more faculty members who will advise the student in course selection and research. As such, students must make contact with faculty members to determine where a student's specific interests lie. Below is a list of core areas and associated faculty members. Many faculty members have overlapping interests.

- **Climate and Meteorology:** Hawkins, Williams
- **Geology and Soils:** Applegarth, Blewett, Cornell, T. Feeney, Woltemade, Zume
- **Geotechniques:** Applegarth, Drzyzga, A. Feeney, Marr, Smith
- **Human Geography (economic, medical, transportation):** Fuellhart, Marr
- **Hydrology and Water Resources:** T. Feeney, Hawkins, Woltemade, Zume
- **Land Use and Planning:** Jantz, Pomeroy
- **Teacher Certification:** Smith

8. Academic Advisor

All students must select an advisor during their first semester in the program. This faculty member should have academic interests that are similar to the student. Students should make a point to

have discussions with potential advisors during the first month of their first semester. Selection of an advisor is not a binding decision as the advisor may change as a student's interests become more defined. The main duties of the advisor include: assistance in course selection, guidance of the thesis or research project, and crafting and evaluation of the practical exam. While one faculty member will be designated as the advisor, students are encouraged to seek the opinions and expertise of many faculty members. Students should meet with their advisor on a regular basis. Students bear the responsibility to select an advisor. Failure to select an advisor early in one's graduate program will seriously hamper completion of the degree in a timely manner.

9. Suggested Time Table for Degree Completion

The table below is provided as a guide for a typical student to progress successfully through the program and earn a degree. It is the department's intention that fulltime students take at least four semesters to complete the degree. Time less than four semesters often results in failure to achieve the goals of the program. If students take classes or conduct research during the summer, this time line may be modified.

Before arrival	<ul style="list-style-type: none"> • Make contact with individual faculty to assess interests. • Check about meeting deficiencies with the graduate coordinator/chair.
Semester 1	<ul style="list-style-type: none"> • Take GEO 503: Fundamentals of Geoenvironmental Research. • Fulfill deficiencies. • Take 400 and 500 level courses. • Discuss thesis/research ideas with individual faculty. • Choose an advisor. • Investigate internship options.
Semester 2	<ul style="list-style-type: none"> • Take 400 and 500 level courses. • Choose a thesis committee and project after extensive discussions and begin work. <p style="text-align: center;">OR</p> <p>Choose a one semester research project after extensive discussions. AND Work on details of setting up internship.</p>
Semester 3	<ul style="list-style-type: none"> • Take 400 and 500 level courses. • Work on thesis or finish research project (register for credits). • Internship (semester 3, 4, or summer) (register for credits). • Take practical exam (semester 3 or summer).
Semester 4	<ul style="list-style-type: none"> • Apply for graduation in first two weeks of semester. • Finish coursework. • Finish thesis or research project (register for credits). • Internship (semester 3, 4, or summer) (register for credits).
Before graduation	<ul style="list-style-type: none"> • Final graduation check from Department Graduate Program Coordinator and Dean of Graduate College.

10. Progress Checklist

Students are encouraged to use this checklist (or one similar) to insure that they have met all the necessary requirements for the degree.

<i>Check</i>	<i>Requirement</i>
	Fulfill deficiencies
	Choose an advisor
	Complete at least 36 graduate credits
	Complete GEO 503
	Complete at least one technique course
	Pass practical exam
	Complete 6 credits of thesis OR Complete 3 credits of research
	Complete 6 credits of internship

11. Academic Dishonesty

The department of Geography and Earth Science takes academic dishonesty very seriously. Instances of academic dishonesty will be submitted for appropriate judicial action. Students found guilty of academic dishonesty will be dismissed from the program. Students are strongly encouraged to read the university's policy on academic dishonesty closely available in the graduate catalogue so that there are no misunderstandings as to what is meant by the term.

12. Research Expectations

Students are required to complete either a thesis or one-semester research project under the supervision of their advisor. Students are responsible for making adequate progress on their projects. The definition of adequate will vary between students, projects, and advisors but there are some general guidelines:

- Students should start investigating research ideas their first semester.
- Students should maintain regular contact with their advisor. When difficulties arise, students should seek their advisor not avoid him/her.
- Students can expect that advisors will be regularly available for guidance and discussions within reason. Individual advisor-student relationships and time commitments will vary.
- Research and theses are the STUDENT's projects. The advisor exists for guidance. Students should initiate action, not wait to be told what to do.

13. Thesis Description

Thesis research allows a student to pursue a research project of their choice over the course of multiple semesters. A thesis differs significantly from a one semester research project in terms of the scope and expected contributions of the project. While students perform the vast majority of analyses on their own, they are expected to work in close collaboration with an advising faculty committee. The student should have regular meetings with their committee and especially with their lead advising faculty member. While each faculty member may have his or her own specific requirements, the following guidelines apply to all students completing a thesis.

- **Three semester time line.** Due to the involved nature of a thesis, students are expected to spend at least three semesters working on their project. A summer devoted to thesis work can be considered the equivalent of a semester. Summer work may often be required especially if extensive field work is involved in the project. Below is a time line for completing the final stages of a thesis which works backwards from the date the final draft

of the thesis is submitted to the Registrar for binding. The purpose of this table is to allow students to budget the amount of time necessary for the final stages of a thesis. Specific dates vary each semester and the advisor may alter this timeline.

- **Completed thesis** is due to the Registrar 4 weeks before graduation (i.e. *mid November or early April*).
- Two weeks or more may be needed for corrections after the oral defense. The **oral defense** should be scheduled no later than *early November or late March*.
- Two weeks are needed for committee members to review the thesis before the defense. The **final draft** is due no later than *late October or early March*.
- Two weeks or more may be needed for the student to make revisions based on the chair's comments on the initial draft(s). The **chair will provide feedback by early October or late February**.
- Two weeks are needed for the chair to review the initial draft. The **initial draft needs to be submitted no later than late September or early February**. Note that the student/chair review process can be altered if substantial revision occurred after the proposal defense, drafts are submitted in sections (e.g. literature review, methods) as they are completed, and ongoing communication is occurring between the student and chair.
- **Choose an advisor and thesis committee.** Students considering a thesis should begin discussions regarding their research intentions with appropriate faculty members during their first graduate semester. Students should select a thesis advisor by their first semester and a committee by their second semester. Formal paperwork regarding the selection of an advisor and committee must be filed with the registrar's office. Students must enroll in thesis for 6 credits (GEO 612 and 613) during semesters that make the most financial and logistical sense.
- **Conduct preliminary research** based on discussions with one or more faculty members, to more specifically define the project and to be certain that it is manageable. This will entail review of literature and may require some preliminary data collection and/or testing of your research methods. This step will be carried out as part of the student's research proposal development. Your research design should ensure that the project can be completed in three semesters.
- **Develop a thesis proposal.** While some sections of the proposal may be preliminary, all proposals should include:
 - Title page
 - Signature page
 - Table of contents
 - List of tables
 - List of figures
 - Abstract
 - Introduction
 - Previous studies (general literature review and significant local studies)
 - Description of study area (geological, soils, biological, topography, land use, etc.)
 - Purpose and scope (clear statement of hypotheses/ research goals/ thesis questions to be addressed and the limits of this research)
 - Methods (description of data sources, analytical, statistical, or other techniques)
 - Expected results
 - Expected difficulties
 - Expected contributions
 - Summary

- Research calendar
- Acknowledgements
- References
- Appendices

Keep in mind that much of what is written for the proposal can be used in the final thesis. Thus, while the proposal requires a great deal of effort, it is both essential and an important contribution to your final product. As a general guideline, thorough research proposals typically range from 10 to 30 pages and must include at least 15 refereed sources (e.g. research journals). Upon completion of the proposal, students should submit a draft to the advisor. Upon completion of draft revisions, a final proposal should be distributed to all committee members. A well-organized student can complete much of the work for a proposal as part of the required GEO 503 course.

- Students must **orally defend** their thesis proposal. This defense will be in front of the thesis committee members and will be open to the public. The defense must be announced two weeks prior. The committee will provide feedback and barring the requirement of major revisions to the proposal will sign off on the project. The oral defense will include:
 - 20 minute student presentation
 - Question and answer period from the public
 - Question and answer period from the committee
- **Regular meetings** to discuss progress with your advisor are expected throughout the thesis project.
- **Theses** typically range from 50 to 100 pages in length. Specific details of length and subsections will be determined in consultation with the thesis advisor. Typically, theses include the following sections:
 - Title page
 - Signature page
 - Table of contents
 - List of tables
 - List of figures Abstract
 - Introduction
 - Review of the literature
 - Study area
 - Data and methods
 - Results and discussion
 - Conclusion
 - Proper citation and references
 - Appendices
 - Professional quality presentation of tables, figures, maps, and other graphics
- Students must **orally defend** their thesis. This defense will be in front of the thesis committee members and will be open to the public. The defense must be announced two weeks prior. The oral defense will include:
 - 20 minute student presentation
 - Question and answer period from the public
 - Question and answer period from the committee

Based on the written document and the oral defense the committee will either sign off on the thesis or recommend changes. Assuming changes are made satisfactorily, the committee will then sign off on the thesis.

- Students are required to **submit a copy** of their thesis to the Department Office (in electronic pdf format) so that it can be archived and catalogued in national/international

research databases.

- Appendix A provides detailed information on formatting your thesis.

14. One Semester Research Description

Geoenvironmental Research allows a student to pursue a research project of their choice over the course of one semester. While this is primarily an independent research project, the student is expected to work in close collaboration with the advising faculty member. The student should have regular meetings with that faculty member, especially in developing the research design. There is a possibility for students to complete more than one research project but no more than 3 credits may be earned for any single project. If a single project is 6 credits worth of work, students should opt to complete a thesis. While each faculty member may have his or her own specific requirements, the following guidelines apply to all students enrolled in Geoenvironmental Research.

- **One semester time line.** All students are expected to complete the research project in one semester. Extensions are rarely granted only if extenuating circumstances prevent the research from being completed in a single semester.
- **Formulate your project prior to the semester you intend to work on the project.** Discuss your research intentions with appropriate faculty members during your first graduate semester. You must have approval from the professor with whom you are working prior to enrolling for the semester research project.
- **Conduct preliminary research** based on discussions with one or more faculty members to more specifically define the project and to be certain that it is manageable. This will entail review of the literature and may require some preliminary data collection and/or testing of your research methods. This step will also be carried out prior to the beginning of the semester in which you intend to enroll for the project. Your research design should ensure that the project can be completed in one semester.
- **Develop a research proposal.** While some sections of the proposal may be preliminary, all proposals should include:
 - Introduction
 - Previous studies (general literature review and significant local studies)
 - Description of study area (geological, soils, biological, topography, land use, etc.)
 - Purpose and scope (clear statement of hypotheses/ research goals/ thesis questions to be addressed and the limits of this research)
 - Methods (clear description of data sources, analytical, statistical, or other techniques)
 - Expected results
 - Expected contributions
 - Research calendar
 - Outline of final report

Keep in mind that much of what you write for the proposal can be used in the final research report. Thus, while the proposal requires a great deal of effort, it is both essential and an important contribution to your final product. As a general guideline, thorough research proposals typically range from 10 to 30 pages and must include at least 15 refereed sources (e.g. research journals).

- **Regular meetings** to discuss progress with your professor are expected throughout the semester.

- The **final project report** is due on the date set by the advising professor. While specific guidelines may be set by individual faculty, typical research reports range from 20 to 50 pages in length. All geoenvironmental research projects must include:
 - Abstract
 - Review of the literature (including at least 15 refereed sources)
 - Proper citation and references
 - Professional quality presentation of tables, figures, maps, and other graphics
 - Well-organized paper structure, based on a hierarchy of chapters (or sections) sub-divided into sub-sections
- Students are required to provide an **oral presentation** of their research results. This can be done through:
 - “Student Research Brown Bag Series”
 - University Day presentations
 - Conference presentations, such as PGS or AAG
 - Class presentations

15. Internship

Students who do not choose the thesis option must complete a 6-credit internship (GEO 609 and 610; 240 hours of work) as part of their program requirements. Internships provide practical experience in a geoenvironmental subfield as a student works in close collaboration with a non-academic advisor. The experience often serves to focus a student’s future career ambitions. Internships may be paid or unpaid. Internships may also lead to future employment or allow a student to make valuable contacts in the discipline. Internships are set up based on consultation with the department internship coordinator. A student’s academic advisor may also provide advice on setting up an internship as well. Setting up an internship can often require a fair amount of planning. Therefore, students are encouraged to begin to explore their options during their first semester.

16. Practical Exam

The practical exam is designed to assess whether a student has accomplished the program goals as outlined previously in this guide. In condensed form, the program goals are:

- Mastery of substantive knowledge
- Proficiency in geotechniques
- Development of analytical and communication skills

The exam will be written and evaluated by the student’s advisor along with one other faculty member from the Department of Geography and Earth Science jointly chosen by the student and advisor. Scheduling of the exam is up to the student and advisor. Students must however, give at least **one month advance notice** of when they intend to take the exam. Because the exam is based on a culmination of experiences from the graduate program, students ideally should take the exam at least after the 2nd semester (or 18 credits if the student is not taking a full load). From the faculty perspective, the exam does not assess whether the student can answer the question “perfectly” but rather assesses how well the student met the above-stated goals. The faculty recognizes the limited time and resources associated with the exam and are therefore evaluating students on their thought process and clarity in expressing that thought process.

Students will be given a broad statement or question for their exam. They may also be provided with a dataset or other ancillary data depending on the specific nature of the exam. The exam will last exactly one week during which time students are expected to better define their exam question, collect appropriate data to answer their question, analyze the data, and write up the results. Due to the limited amount of time to accomplish these tasks, final reports should be no longer than 20 pages, double spaced. Also due to time constraints, students should schedule to take the exam at a time when they can devote a large amount of time to this single project. If a student feels unable to devote extensive time to the exam, they should delay taking the exam until they are able to devote the time. Based on prior approval from the advisor, students may take the exam during the summer, winter, or spring breaks.

Below is a sampling of potential exam questions. These sample questions are meant to give a general idea of what questions from different content areas may cover. It is likely that actual questions would provide more detail and clarification. Conversations with the student advisor are critical in preparing for the exam.

- Assess and map the nighttime temperature pattern associated with Shippensburg and the surrounding area.
- Analyze the geology of the Shippensburg area with the goal of establishing the ideal location for a new city water supply well.
- Create a geodatabase to analyze migration trends for Franklin County, Pennsylvania.
- Determine and map the potential spread of West Nile Virus in Pennsylvania.
- Assess the infiltration capacity of soils in the Shippensburg area for the purpose of recommending locations that are best suited for residential and commercial development.
- Create a zoning plan for Shippensburg that effectively allows for the residential and commercial growth projected for the area.

While the structure of each final report will be different, each exam should contain the following components in some form.

- Abstract
- Introduction containing a clearly defined question to be answered
- Brief review of relevant literature (5-10 sources)
- Description of data collected and methodologies of data collection and analysis
- Analysis of data
- Discussion of results
- Conclusion

Students will pick up their exam from the main office. The date and time will be noted. Students must return their final report to the main office exactly one week later. Failure to hand in the exam on time will result in failure of the exam. Exams will be evaluated as pass, revise and resubmit, or fail. Below is a general rubric for evaluating the exam.

If the exam is evaluated as revise and resubmit, students will have one week to make any necessary corrections after consulting with their advisor. The resubmission is expected to be of a quality that is higher than the original submission, meet the criteria in the evaluation rubric, and address all of the concerns outlined by the exam readers. If a student does not redress specific concerns outlined by the exam readers within the resubmission document, the student **MUST** explain why those

concerns were not addressed in a separate document. The exam readers will use the separate explanatory document in their decision as to the outcome of the practical exam. Resubmissions will be evaluated as pass or fail. If a student fails the exam, s/he must wait at least three months before taking the exam again. Failure of the exam for a second time will result in dismissal from the program.

General Rubric for Evaluating Practical Exam

	Pass	Revise and Resubmit	Fail
Question	Student has defined a researchable question.	Student has defined a researchable question.	Student has failed to define a researchable question.
Literature	Student has 5-10 sources of appropriate background literature and has synthesized this literature in such a way as to reveal the importance of their particular question.	Student has 5-10 sources of appropriate background literature but the synthesis does not adequately elucidate the relevance of the particular question.	Student has too few or inappropriate sources or no relevant synthesis of the literature has occurred.
Data	Student has collected the appropriate data to answer their question and have done so in a manner to insure the data are valid and the answer to the question is defensible.	Student missed a piece of data collection and/or the methodology was flawed. Either issue may or may not invalidate the general theme of the results.	Student failed to collect the appropriate data and/or collected the data in an inappropriate manner.
Methods and Analysis	Data are analyzed and presented in a way that clearly illustrates how the data answer the original question	Mistakes exist in the analysis and/or there is a lack of clarity in the data presentation.	Insufficient analysis and/or complete lack of clarity in data presentation make results inappropriate, incorrect, unreasonable, or not understandable.
Discussion	Discussion of the results places the results in the context of previous work and suggests avenues for future research.	Discussion of the results does not place the results in the context of previous work and/or does not suggest avenues for future research.	Discussion is completely lacking in placing results in the context of previous work and does not suggest avenues for future research.
Structure and Grammar	Clear structure to the final report. No major grammatical errors. Few minor grammatical errors.	Unclear structure to the final report and/or grammatical errors exist.	Structural and grammatical errors render the report not understandable or is simply poorly written.
Outside Assistance	No outside assistance except for physical labor associated with data collection.	No outside assistance except for physical labor associated with data collection.	Outside assistance for duties other than physical labor associated with data collection.

The practical exam is intended to test the student's mastery of the previously stated goals. As such, issues of academic integrity are taken very seriously. Students may enlist other people to help with any physical labor required during data collection. However, all other components of the exam must be the student's sole work. This includes but is not limited to, ideas on which data to collect, methodologies for collecting data, analysis of data, and writing of the final report. When picking up the exam, students will sign a statement acknowledging that they understand that all components of the exam except for physical labor associated with collecting data must be their own work. Students will also affirm that there are no impediments of any kind (e.g. medical, emotional, physical, employment) that would hinder their performance on the exam. Upon

completion of the exam, students will sign a second statement that assures that these guidelines were indeed followed during the exam and list any unforeseen impediments that arose during the exam. Violation of these principles will result in failure of the exam and dismissal from the program.

17. Facilities

The department has two 20-computer student labs that are equipped with the latest versions of GIS, image processing, word processing, and data analysis software as well as color and black and white laser printers. In addition, there is a small research computer lab that is equipped with specialized software along with a 42 inch plotter for poster printing. Attached to the computer labs is a communal graduate assistant office that also contains computers. Graduate students also have access to the student lounge located between the GIS labs.

The department owns numerous pieces of field equipment that can be used for classroom applications as well as student research. The software associated with much of this equipment is available in the student or research computer labs. There is dedicated lab space for processing any samples that are collected for classroom or research field projects. Arrangements also exist for more sophisticated offsite sample processing. The university is also part of the Marine Science Consortium at Wallops Island. Students may take advantage of this facility during their graduate program for classroom, research, and internship opportunities.

18. Marine Science Consortium

The university is a Full-Member University of the Marine Science Consortium (MSC) located at Wallops Island, Virginia. The MSC is a dedicated education/research facility on the eastern Shore of Virginia adjacent to Chincoteague National Wildlife Refuge and Assateague National Seashore, as well as NASA's Goddard Space Flight Center. In addition to providing access to a number of terrestrial coastal environments and ecosystems, facilities and resources of the MSC are designed to provide access to aquatic environments in estuarine, bay, and marine environments through a number of research vessels and small water craft. The facility also provides housing, cafeteria, classroom, equipment, and laboratory space for students and faculty.

Through our membership in the MSC, and in consultation with the graduate coordinator at Shippensburg, students are encouraged to take full advantage of this facility and its resources during their graduate program. Students may choose from a number of 3 to 4 week summer courses taught at the MSC for which they will register at Shippensburg for credit hours. Please note some courses are not available for graduate credit. For these courses, a course fee is required (paid to the MSC) to cover the cost of room/board and other expenses, and is not covered by graduate assistantships. Students also have the option of developing their required independent research projects (3 credit, or 6 credit Thesis options) using the MSC facilities at low cost to conduct their research. Students may also opt to register in the summer for Problems in Marine Science through the University (course fee applies) and receive graduate research credit under the supervision of a faculty advisor.

Other opportunities afforded through the MSC membership, include access to Consortium partnered internships through NASA's Goddard Space Flight Center. These internships, available by application only to consortium members, range across a number of different disciplines and provide access to cutting edge research in a number of NASA supported fields. For more information please consult with the GEO/ESS MSC Program Director at the University.

19. Gamma Theta Upsilon (GTU) International Geography Honor Society

The GTU chapter at Shippensburg University was created in 1937. The goal of GTU is to further interest in Geography through a common organization. Activities include community service, academic conferences and speakers, and social and recreational outings. As an undergraduate and graduate honor society, GTU serves to foster a strong sense of student involvement in the department. To become a member of GTU students must have taken three or more geography or earth science classes and have at least a B average in those classes.

Appendix A. Thesis Document Format

This document is offered as a suggested format for theses in the Geography and Earth Science Department. The individual requirements of each thesis committee may require deviation from the suggested format.

THE DOCUMENT

Please remember that the document that you are producing is *your* thesis. While your committee may advise you concerning the approach you take to completing your research, *you* are responsible for the content of the thesis. You should make every effort to produce a thesis of which both you and the department will be proud. Also remember that *more* is not necessarily *better*.

BINDING AND COPIES

We ask that you provide 2 bound copies of your thesis to the university: one copy for the library and one for the department. Additional copies of your thesis for yourself or others may also be bound. Final thesis copies should be printed on high quality paper and each of the 2 university copies must have original signature pages.

COMPONENTS

Below are the major components of the thesis in the order that they should occur. All components must be present in the final thesis.

1. **Title Page** – the title page should list the title of the thesis, your name, the department, the university, and the date of completion. See example at the end of this document. No page number.
2. **Signature page** – required by the university and available in the departmental or registrar’s offices. See example at the end of this document. No page number.
3. **Table of Contents** – consists of a list of all major components except the signature page and title page. Major components are left justified; subheadings are indented based on their level. Page numbers listed in the Table of Contents should be right justified. Numbered using small case Roman numerals starting with lower case i. Page numbers centered at the bottom of the page.
4. **List of Tables** – all tables within the thesis text are listed and are left justified. Page numbers listed in the List of Tables should be right justified. Numbered using lower case Roman numerals. Page numbers centered at the bottom of the page.
5. **List of Figures** - all figures within the thesis text are listed and are left justified. Page numbers listed in the List of Figures should be right justified. Numbered using lower case Roman numerals. Page numbers centered at the bottom of the page.

6. **Abstract** – the abstract should be titled as ABSTRACT in all capitals, bold, and centered, followed by two blank lines. The body of the abstract should be no more than 1 page and should clearly and concisely state the research question, methods used, major findings, and the importance of the findings to the discipline. Numbered using lower case Roman numerals, centered at the bottom of the page.
7. **Thesis Text** – the thesis text should include the following the following major chapters or sections:
 - a. Introduction
 - b. Statement of the Problem or Research Question
 - c. Review of Literature
 - d. Description of the Study Area
 - e. Data and Methods
 - f. Results or Major Findings
 - g. Discussion of the Results
 - h. Conclusion or Summary

The naming of these sections can be tailored to the specifics of the thesis if needed. Sub-sections should be added as necessary. Major sections start on a new page and are to be capitalized, bold, centered, and followed by two lines. Sub-sections should be hierarchical. Page numbering begins here using Arabic numerals starting with 1, centered at the bottom of the page.

8. **Endnotes** – endnotes are used to convey information which is of use to the reader, but if included in the text would disrupt the flow. Asides or trivial information should not be included as endnotes. The endnotes section must be placed before the references and appears as NOTES in all capitals, left justified, and followed by two lines. The individual endnotes are denoted by superscript sequential Arabic numbers and should be 10pt font. Page numbering should be Arabic numerals, centered at the bottom of the page. In general, most theses do not need endnotes and this component is optional.
9. **References** – the references component should be titled as REFERENCES in all capitals, bold, and centered, followed by two blank lines. References must be formatted using the Chicago Manual of Style. All references must be cited in the text. References should be left justified, hanging. Please see the citation format section below for examples. Page numbering should be Arabic numerals, centered at the bottom of the page.
10. **Appendices** – appendices are composed of information that may be relevant to the thesis but is too detailed or extensive to be included in the body of the text. Appendices typically consist of data, supplementary maps or figures, questionnaires, or detailed statistical output. Page numbering should be Arabic numerals, centered at the bottom of

the page. In general, most thesis will have appendices consisting of data and detailed statistical output, however this component is optional.

FORMATTING

Below are specific thesis formatting guidelines. While there is some leeway in formatting, depending on the specific nature of the thesis or committee wishes, please use these guidelines unless there is a compelling reason to deviate from them.

Margins: Left – 1.25” (to accommodate binding)
Right – 1”
Top – 1”
Bottom – 1”

Spacing:

All thesis text should be double spaced. Figure captions, references, appendices, table of contents, lists of figures and tables should be single spaced.

Font:

Most fonts are acceptable. However, the most commonly used are Times New Roman, Book Antigua, Arial, Calibri, and Corbel. Regardless of the font used, it must be consistent throughout the thesis. Font size should be either 11pt or 12pt.

Figures:

Maps, graphs, and digital images should both be labeled sequentially as Figure *x*. Do not restart the numbering with each new section or component. Color figures may be used, but recognize that grayscale figures reproduce more clearly. Each figure must have an accompanying caption that explains its importance, and if necessary, points out characteristics that are of particular interest. All figures must be completely legible as they appear in the thesis and should be embedded in the thesis text as close to their first reference as possible.

Citation Format:

All sources listed in the REFERENCE section of the paper must be cited in the text of the paper or as the source information for maps, figures, etc... Please use the Chicago Style Manual format for citations. Examples of citations can be found in any article in the *Annals of the Association of American Geographers*. Copies of the *Annals* are located in the Allan conference room or in the Lehman Library periodicals section. Below are some examples of the required citation format:

1.a) Standard citation in the paper...

The effects of a succession of epidemics must be measured not only in mortality, but also in their secondary effects, which may be even more far-reaching (Zinsser, 1934).

1.b) Standard citation in the references...

Zinsser, Hans. 1934. *Rats, Lice, and History*. New York: Little, Brown and Company.

2.a) Article in an edited book in the paper...

... evidence for infection has been found in many other mammals (Burgdorfer, 1980).

2.b) Article in an edited book in the references...

Burgdorfer, A. S. (1980). Spotted fever-group diseases. In J. H. Steele (Ed.), *Section A: Bacterial, rickettsial, and mycotic disease* (pp. 279-302, Vol. II). C.R.C. Handbook Series in Zoonosis. Boca Raton, FL: CRC Press.

3.a) Government document in the paper...

According to the U.S. Census Bureau (1990) Shippensburg, Pennsylvania has approximately 5200 permanent residents.

3.b) Government document in the references...

U.S. Census Bureau. (1990). *1990 Census of Population and Housing*. Washington, D.C.: U.S. Government Printing Office.

4.a) WWW citation in the paper...

The World Health Organization and the Joint United Nations Programme on HIV/AIDS (UNAIDS) estimate that, worldwide, as many as 42 million people have been infected with HIV since the pandemic's onset (CDC Internet Site, 1998).

4.b) WWW citation in the references...

CDC. (1998). Addressing the Global Epidemic: CDC's International Activities. (http://www.cdc.gov/nchstp/hiv_aids/pubs/facts/internat.htm). Accessed: [Give date the site was last accessed].

**SCHOOL OF GRADUATE STUDIES
SHIPPENSBURG UNIVERSITY
1871 Old Main Drive
Shippensburg, PA 17257-2299**

THESIS INSTRUCTIONS

The following information is provided to assist the graduate student in working with his department in planning for his master's degree thesis:

1. The graduate student will confer with his respective department chairperson to arrange for the appointment of a major thesis adviser and a Thesis Committee. The committee should be composed of the major research adviser and at least two other members of the faculty who teach graduate classes.
2. When the committee is established, the student must complete the form, Arrangements for Completing the Thesis Requirements for the Master's Degree. This form is available in the Registrar's Office.
3. With approval of the thesis adviser, the graduate student may schedule and register for thesis credit. The student must contact the Registrar's Office to schedule, as thesis is not listed as a regularly scheduled class. Each student must complete six thesis credits but may register for three credits at a time. The student should indicate the course and department number. (Example: English 612 – Thesis I or English 613 - Thesis II)
4. Q grades must be submitted for a thesis when the work is not completed. Only when the thesis is completed can a regular letter grade be recorded. Under no conditions can a regular letter grade be submitted unless the thesis is completed and signed by all members of the Thesis Committee.
5. The completed and approved thesis must be submitted to the Registrar's Office in final form within one calendar year of the date of registering for Thesis II. Students who do not complete the thesis within one calendar year from the date on which they registered for Thesis II must register for thesis credit again and pay the appropriate course fees.
6. Upon completion, a copy of your thesis will be housed in the Lehman Library and made available to the public. Students interested in having their thesis copyrighted may obtain information from the Ezra Lehman Memorial Library, Shippensburg University, or by writing to the Copyright Office, Library of Congress, Washington, DC 20559.

***Your defended Thesis should be submitted to the
Registrar's Office approximately 30 days before
your intended graduation date!***

**SCHOOL OF GRADUATE STUDIES
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Shippensburg, PA 17257-2299**

ARRANGEMENTS FOR COMPLETING THE THESIS REQUIREMENTS FOR THE MASTER'S DEGREE

To be completed by the student: (Each student must complete 6 thesis credits but may register for 3 credits at a time.)

NAME: _____ S.U. ID NUMBER: _____

DEGREE: _____ FIELD OF SPECIALIZATION: _____

NOTE: "Q" grades must be submitted for a Thesis when the work is not completed. Only when the Thesis is completed can a regular letter grade be recorded. Under no conditions can a regular letter grade be submitted unless the Thesis is completed and signed by all members of the Thesis committee. The student must submit the Thesis to the Graduate Office in final approved form within one calendar year from the date that he/she registers for Thesis II. Otherwise, he/she must complete registration again and pay the appropriate course fees.

Tentative date you expect to receive the Master's degree _____

Date of registration for the Thesis _____

Major faculty thesis adviser _____

Second faculty member of thesis committee _____

Third faculty member of thesis committee _____

Have faculty thesis advisers agreed to serve? _____

Have you made arrangements for an initial meeting with thesis advisers? _____

DATE: _____ SIGNATURE: _____

To be completed by Department Chairperson

I recommend the approval of the above Thesis Committee. All committee members have been contacted by me and have agreed to serve on the Committee.

DATE: _____ SIGNATURE: _____

Department Chairperson

Please schedule the student named above for the thesis credit indicated in the semester or term stated below:

Thesis I (Code #) _____ Year _____ Fall Spring Summer: Term III Term IV Term V

Thesis II (Code #) _____ Year _____ Fall Spring Summer: Term III Term IV Term V

To be completed by Graduate Office: (A copy of this form will be returned to the Department Chairperson and to the major faculty thesis adviser.)

The Thesis Committee is approved as recommended.

DATE: _____ SIGNATURE: _____

Dean of Graduate Studies

Date Scheduled: _____ Scheduling Officer: _____

QUANTIFYING THE ASSOCIATION BETWEEN WATER QUALITY AND LAND
COVER IN GREEN TOWNSHIP, FRANKLIN COUNTY, PENNSYLVANIA

By
Ima Smartee

A Thesis
Submitted to the Department of
Geography and Earth Science and the Graduate Council
in partial fulfillment of the requirements for the degree of
Master of Science

SHIPPENSBURG UNIVERSITY
Shippensburg, Pennsylvania
May, 2008

DEPARTMENT OF GEOGRAPHY AND EARTH SCIENCE

SHIPPENSBURG UNIVERSITY

Upon the recommendation of the chairperson of the department of Geography and Earth Science this thesis is hereby accepted in partial fulfillment of the requirements for the degree
of

Master of Science

Thesis Committee

Committee Chairperson

Date

Committee Member

Date

Committee Member

Date