COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
VIRGINIA TECH

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TO: Dr. Karen P. DePauw
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Graduate Life Center, Virginia Tech

PhD. in Geospatial and Environmental Analysis (GAEA) Inclusion and Diversity Plan

The College of Natural Resources and Environment recognizes and is dedicated to advancing issues surrounding diversity, equity, and inclusion (DEI). The college eschews all actions, policies, and informal and systemic injustices that infringe upon human rights and advancing the human condition. As such, the GAEA program is implementing the following plan—solidified in the Plan of Study—to create the space for a critical examination of DEI issues and to meet the Graduate School's Inclusion and Diversity requirement as stipulated by the Commission on Graduate Studies and Policies Resolution 2017-18A. This plan leverages resources provided by the University and Graduate School, expertise of the College of Natural Resources and Environment's Director of Inclusion and Diversity, and the disciplinary and professional experience of faculty members within Departments in the CNRE. Our plan is modeled closely on that of the MS degree in Geography as leadership of the CNRE's GAEA program has always been primarily from within the department of Geography.

1. **Virginia Tech Principles of Community – Valuing Human Diversity and Inclusion**: The Virginia Tech Principles of Community are required by the College of Natural Resources and the GAEA program to be included in all course syllabi. The most recent statement is provided to all faculty prior to each semester, along with additional campus resources, to be included in all course syllabi. The Principles of Community are also presented and discussed at the mandatory Orientation.

    a. *Learning Goals*:
        i. Recognize the inherent dignity and value of every person;
        ii. Appreciate the value of diversity in enriching our lives and the university community;
        iii. Understand our individual and collective commitments to Virginia Tech's Principles of Community.

2. **Redress and Shared Responsibilities – The Role of the Active Bystander**: Redress and shared responsibilities are addressed through a mandatory orientation session that occurs every fall prior to the first day of classes. This session includes a visit from a Graduate School

official at the Office of the Ombudsperson in which redress and shared responsibilities are discussed. Further information is provided on college and departmental policies and appropriate conduct among students, faculty, advisors, and Teaching and Research Assistant supervisors. Additionally, students are introduced to channels for redress and made aware of their responsibilities as active bystanders by attention to webpages and resources provided by (but not limited to): the "Title IX and Violence Against Women Act" at the Office for Equity and Accessibility, Dean of Students' "Student Code of Conduct," Graduate School's "Graduate Honor System" and "Disrupting Academic Bullying," Cook Counseling Center, Women's Center, InclusiveVT, and the American Association of Geographers' "Statement on Professional Ethics" and "Professional Conduct Policy anProcedures." This portion of the MS orientation session will be attended by new GAEA students at their first opportunity, typically in the days before the start of their first semester, to be followed by the orientation and information pertinent only to the GAEA program.

a. *Learning Goals*:
    i. Know where to seek resources to effectively navigate conflicts;
    ii. Recognize the right of fairness to all humans;
    iii. Realize the responsibility we have to advocate for fairness for all.

3. **Impact of Personal Actions and Words – The Effects on the Community in which we Live**: These impacts are addressed through two modules in GEOG 5004 every fall semester (newly required course added to the plan of study). One module is dedicated to content on and a discussion of critical components of the topic. A subsequent, discipline-specific module is a seminar series that demonstrates original geographic research and theories on the impacts of personal actions and words.
    a. *Learning Goals*:
        i. Understand how our actions and words manifest in societal consequences;
        ii. Explore the impacts of actions and words on communities;
        iii. Reflect and think critically on the impacts of actions and words and what has been learned for the future.

4. **Individual Introspection – Explore your Biases**: Individual introspection and biases are addressed through two modules in GEOG 5004 every fall semester (newly required course added to the plan of study). One module is dedicated to content on and a discussion of critical components of the topic. A subsequent, discipline-specific module is a seminar series that demonstrates original geographic research and theories on concepts related but not limited to introspection, biases, positionality, and social location.
    a. *Learning Goals*:
        i. Understand key terms and concepts related to individual and institutional biases;
        ii. Explore the impacts of individual and institutional biases;

iii. Reflect and think critically on the impacts of individual biases and how they can be dismantled.

Formally submitted by:

Laurence Carstensen & Jim Campbell, Co-Directors
Geospatial and Environmental Analysis Doctoral Program
College of Natural Resources and Environment

Guidelines and Program Requirements for the Geospatial and Environmental Analysis Doctoral Program

Virginia Tech College of Natural Resources and Environment

Last revised May, 2021

Administrative Unit

The College of Natural Resources and Environment (CNRE) is the administrative unit for the doctoral program. It includes four departments: Fish and Wildlife Conservation (FWC); Forest Resources and Environmental Conservation (FREC); Geography (GEOG) and Sustainable Biomaterials (SBIO). Within the college, the department of Geography is the lead department with the program coordinator residing in that department. The doctoral program, consistent with its interdisciplinary focus, also involves collaborations with other academic units on campus that also teach geospatial courses, specifically the Department of Crop & Soil Environmental Sciences in the College of Agriculture and Life Sciences and the Departments of Civil and Environmental Engineering and Biological Systems Engineering in the College of Engineering.

Program Administration

The program is administered by either a chair (or co-chairs) of the program. The chair will come from the department of Geography with an optional co-chair from one of the other departments listed above if there is interest in the position. The chair(s) will make final determinations concerning admissions and awarding of assistantships in the program after seeking advice from those likely to be the applicants' advisors. The list of advisors includes all member of the departments listed above who work in the environmental or geospatial areas. The Chair of the Geospatial Program Committee will serve for a three-year term.

Admission Requirements

Complete application requirements are listed at:
https://geography.vt.edu/students/graduate/gea-admission.html

Students wishing to be admitted to the doctoral program must file official application materials with the Graduate School of Virginia Tech. The applicant is responsible for providing all supporting documents and payment of the required application fee. Applications for fall admission should be completed by February 15th of that year. It is highly recommended that applicants have an advisor in mind when they apply. It is often very helpful to have made previous contact with prospective advisors prior to applying as a good fit with an advisor will

allow that person to serve as a reference to the program's chair(s) during the admission process.

Students must have completed a master's degree from an accredited college or university by the time that they enter the program. It is highly preferred that applicants understand the fundamentals of both Geographic Information Systems and environmental systems as evidenced by either previous coursework or employment experience as determined by their Geospatial Program Advisor. Students without a background in either GIS or environmental systems may be accepted if they demonstrate exceptional promise, but such students will have to make up such deficiencies by taking additional courses their first semester as determined by their Geospatial Program advisors and such remedial coursework will not count toward the degree.

Applicants must submit official and current transcripts of all undergraduate and graduate coursework completed. Applicants must have a minimum 3.2 grade point average (on a 4.0 scale) for all courses taken as a graduate student. These GPA requirements may be waived given appropriate research experience after graduate school and letters of reference that document sufficient research skills and aptitude.

Applicants must supply the following: 1) three letters of reference, including at least two from former or current professors; 2) a sample of written research to enable the Geospatial Program Committee to evaluate an applicant's potential for research and writing ability; 3) a written explanation of the reason for applying to the doctoral program, including career objectives and likely main area of research for the dissertation; and 4) a personal vita or resume providing information on education, employment history, and professional activity.

Applicants must complete the General test of the Graduate Record Examination and score a minimum combined score that places them in the 75^{th} or higher percentile in both verbal reasoning and quantitative reasoning. We do not screen on these values, but they are considered necessary for success. Other aspect of an application can accommodate lower scores here in some cases. TOEFL (Test of English as a Foreign Language) scores are required of all international students whose first language is not English, except those applicants who have graduated from an accredited university where English is the language of instruction. Students must receive a minimum TOEFL score of 550 (paper version), 213 (computerized version), or 80 (Internet-based) to be admitted into the program. As an alternative to the TOEFL exam, students may take the IELTS (International English Language Testing System) exam and score a minimum of Band 6.0.

A maximum of 15 credit hours of graded course work, obtained at another accredited institution, may be considered for transfer toward the doctoral degree. All such credits must have earned grades of "B" or better, have been earned while a graduate student in good standing, and be acceptable for graduate degree credit at the student's "home" institution. The Geospatial Program chair(s) will determine whether the courses are suitable for transfer.

Course Requirements

The doctoral program requires completion of 90 semester hours of graduate study, of which a minimum of 31 hours are devoted to required coursework as specified in Table 1, a minimum of 30 hours are devoted to Research and Dissertation (FOR/GEOG/FIW/NR 7994), and the remaining 29 hours are devoted to either additional coursework, additional hours of Research and Dissertation (FOR/GEOG/FIW/NR 7994), or any combination of coursework and Research and Dissertation (FOR/GEOG/FIW/NR 7994).[1]

The program has three areas of required coursework totaling 31 credits. The first is composed of required "Core Courses" consisting of 13 hours of classes that provide training in advanced research techniques, statistical and spatial analysis, and discussion of contemporary issues in GIS and remote sensing. The second area of coursework requires the selection of 12 hours of electives in geospatial classes involving both GIS and remote sensing. The third area involves 6 hours of classes from electives in environmental analysis. A review of the courses in the program reveals that a student will enroll in 17 hours of advanced geospatial classes (from both the Core and Geospatial Electives), ensuring thorough grounding in and understanding of the application of geospatial techniques to environmental issues.

Courses in the three required areas of the program are listed in Table 1.

Table 1: Minimum Requirements for Doctoral Program

Part I: *CORE COURSES*	Credits
Take all of the following:	
* STAT 5615: Statistics in Research I or STAT 5605 – Biometry I	3
* STAT 5616: Statistics in Research II or STAT 5606 – Biometry II	3
* GEOG/FOR 5104: Seminar in GIS and Remote Sensing (must enroll each Spring semester in residence, with a minimum of two times; 1 credit each time)	2
* GEOG 5034: Analysis of Spatial Data	3
* FOR 5494: Natural Resource Research Procedures	2
* GEOG 5004: Colloquium	1
Total CORE hours	**14**
Part II: *GEOSPATIAL COURSES*	Credits
Select four courses (total) from the following. A minimum of one course must be completed in each category. NR 6314 is required for all candidates.	

[1] The requirement for completion of 90 hours for a doctoral degree is a Virginia Tech Graduate School requirement.

These are suggested courses to fulfill this requirement. Your committee may allow others appropriate for your program.	
• NR 6314: Advanced Topics in Geographic Information Technology	3
Category 1: Geographic Information Systems	3
• BSE 5244 (CEE 5244): Advanced GIS Applications in Hydrologic Analysis	3
• CEE 5224: Advanced GIS Applications in Civil and Environmental Engineering	3
• FOR 5264 (GEOG 5364): GIS Applications in Natural Resource Management	3
• GEOG 5084: Elements of Geographic Information Systems	3
• GEOG 5314: Advanced Spatial Analysis in Geographic Information Systems	3
• GEOG 5384: Programming for GIS	4
• GEOG 5394: Web Mapping	3
Category 2: Remote Sensing	3
• FOR 5254: Remote Sensing of Natural Resources	3
• FOR 6214 (/GEOG 6214): Forestry Lidar Applications	3
• GEOG 5124: Aerial Photointerpretation and Analysis	3
• GEOG 5354 (GEOS 5354): Advanced Remote Sensing	3
• GEOG 5374: Remote Sensing and Phenology	
Note: A student can substitute one 3-credit 5984 Special Study course focusing on a topic in geospatial analysis for one of the above geospatial courses if approved by the student's Advisory Committee.	
Total GEOSPATIAL hours	**12**
Part III: *ENVIRONMENTAL ANALYSIS COURSES*	Credits
Select 2 courses from the list below. These are suggested courses to fulfill this requirement. Your committee may allow others appropriate for your program.	
Select two of the following courses:	
• BIOL 5024: Population and Community Ecology	3
• BIOL 5034: Ecosystem Dynamics	3
• CEE 5124: Fundamental of Environmental Toxicology	3
• CEE 5184: Techniques for Environmental Analysis	3
• FIW 5114: Fisheries & Wildlife Conservation Genetics	3
• FIW 5214: Vertebrate Population & Habitat Analysis	3
• FIW 5514: Fish Population Dynamics and Modeling	3
• FIW 5814: Stream Habitat Management	3
• FIW 6214: Advanced Habitat Analysis	3
• FOR 5214: Advanced Forest Inventory	3
• FOR 5224: Forest Biometry	3

● FOR 5334 (PPWS 5334): Plant Water Relations ● FOR 5354: Advanced Forest Soils ● FOR 5374: Advanced Forest Ecology ● FOR 5484: Wilderness Management ● GEOG 5214 Health and the Global Environment ● GEOG 5344: Globalization of Nature ● GEOG 5234: Human Impacts on the Environment ● NR 5114: Global Issues in Natural Resources ● NR 5324: Biological Implications of Natural Resource Policy &Management ● NR 5714: Ecosystem Management ● NR 5724: Conservation Ecology ● PHS 5014: Environmental Health	3 3 3 3 3 3 3 3 3 3 3 3
Total ENVIRONMENTAL ANALYSIS hours	**6**
TOTAL MINIMUM COURSEWORK = 32 CREDITS	
Part IV: *RESEARCH AND DISSERTATION*	Credits
● FOR/GEOG/FIW/NR 7994: Research and Dissertation - minimum (based on enrolling in up to12-15 hours of Research and Dissertation per semester)	**30**
Part V: *ADDITIONAL HOURS*	Credits
● Other coursework and/or additional hours of FOR/GEOG/FIW/NR 7994 – minimum (which can include up to 15 hours of coursework transferred from another university and/or graduate coursework taken at Virginia Tech prior to enrolling in this program)	**29**
TOTAL MINIMUM DEGREE REQUIREMENT = 90 CREDITS	

Program Requirements

All requirements of the doctoral program in Geospatial and Environmental Analysis are consistent with those of the Virginia Tech Graduate School.

Progress and Completion Requirements

A student must make satisfactory progress toward the degree to remain in the program. Satisfactory progress is defined as meeting the following requirements during the time periods specified. In addition to completing the credit hours specified in Table 1, a student must complete the following requirements to receive the doctoral degree.

Residency Requirement: To satisfy the residency requirement, students must spend at least one full, normally continuous, academic year (24 credit hours) in residence on the Blacksburg campus.

Student Advisory Committee: All entering students must have an advisor who has agreed to work with him or her as a requirement for program acceptance. As plans can change and it is difficult to assume before arrival that a good working relationship will develop, this arrangement can be viewed as temporary. At least three weeks before the completion of the second semester of study toward the doctoral degree, students will select an Advisory Committee. In composing the Advisory Committee, a student will first select the major advisor, who can either be the original advisor or another faculty member. Any full-time faculty member in the College of Natural Resources and Environment with a doctoral degree and in a tenured or tenure-track position may serve as a major advisor. Also, faculty who have a doctoral degree and are in a tenured or tenure-track position in departments in other colleges and who are teaching geospatial electives in the doctoral program can serve as the major advisor.

A student's Advisory Committee will consist of the major advisor and **at least three** additional members. The composition of the Advisory Committee must follow university guidelines for committee membership. **As the GEA is an interdisciplinary degree program housed in the CNRE, at least two members of the Advisory Committee must be from the College of Natural Resources, and at least two departments from those within the GEA program must be represented on an Advisory Committee**.

Program of Study: By the end of the first year, a student must submit a Program of Study to the student's Advisory Committee. The Program of Study will list which classes will be taken to satisfy the course requirements for the doctoral program and the semester in which the courses will be taken. After the Advisory Committee approves the Program of Study, the student must submit it to the Graduate School for final approval. Any courses listed on the Program of Study will become a part of the requirements for the doctoral degree.

Students must complete each course on the Program of Study with a minimum grade of B-; otherwise, the student will not receive credit for the course. A student must maintain a minimum GPA of 3.0 to maintain good standing.

Evaluation of Student Progress: A student will arrange to have a meeting of the Advisory Committee by early May of each year to evaluate the student's progress during the academic year. The student will submit a self-evaluation form, which is available on the GEA website, to the student's Advisory Committee before the meeting. The Advisory Committee will provide a written evaluation to the student concerning the student's progress. In addition, the Advisory Committee may require an evaluation provided by the Chair of the student's Advisory Committee at the end of each Fall semester.

Teaching Experience: All doctoral students must gain experience in classroom or laboratory teaching for at least one semester during their programs. Such activity will increase the communication skills of students as well as prepare those interested in pursuing a career in higher education or extension work.

Dissertation Proposal: A student's Advisory Committee can require the submission of the dissertation proposal as early as the student's second semester after enrolling in the doctoral program. The Advisory Committee will set the deadline and format for approval of the dissertation proposal. The dissertation proposal must be approved by the Advisory Committee before the student takes the preliminary exam. The proposal will outline the specifics of the proposed research, including objectives, review of relevant literature, methodologies of data collection and analysis, significance of the proposed research to the fields of geospatial and environmental research, and timeline for completion.

Examples of potential themes for dissertation research in Geospatial and Environmental Analysis include:

- Deforestation
- Treeline Ecotone Change
- Precision Forestry
- Urban Forestry
- Endangered Species
- Invasive Species
- Human Impacts on the Environment
- Biodiversity Conservation
- Fish Habitats and Species Migration Corridors
- Spatial Modeling of Spawning Habitat Suitability
- Visualization in Fisheries Management
- Vulnerability Analysis in Relation to Bioterrorism
- Natural Hazards Mitigation
- Environmental Health
- Epidemiology
- Climate and Disease
- Environmental Change at the Rural-Urban Fringe
- Wildlife-Human Interactions
- Phenology
- Climate Change
- Land Use & Land Cover
- Paleotempestology

Research and Dissertation Credits: Following approval of the dissertation research proposal, the student is expected to register for FOR/GEOG/FIW/NR 7994 Research and Dissertation for consecutive semesters until the dissertation has been defended. A student must complete a minimum of 30 hours of research and dissertation credits.

Dissertation Research: Given the focus of the program on the application of geospatial analysis of environmental issues, research for the dissertation must have a fieldwork component approved by the student's Advisory Committee.

Progress Reports: After approval of the dissertation research proposal, each doctoral student will submit an annual progress report on the dissertation research to the student's Advisory Committee each May. The purpose of the progress report is to enable the Advisory Committee to evaluate research progress and to provide the opportunity to offer suggestions for modifications or additions to the research. This report is a part of the reporting mentioned above under the evaluation of student progress.

Qualifying Examination: An Advisory Committee, at its discretion, may require a student to pass a qualifying examination. The timing of the qualifying exam is also at the discretion of the Advisory Committee, but it must be held before the preliminary exam. The optional qualifying exam may be used to evaluate subject mastery, to determine deficiencies, and to determine whether the student should continue into dissertation research. If more than one member of the Advisory Committee provides an unsatisfactory grade on the qualifying examination, the student must wait a minimum of 15 weeks before retaking the exam. A student is only permitted to take a qualifying exam twice; if a student fails to pass the qualifying exam a second time, the student will be dropped from the program.

Preliminary Examination: All students must take the preliminary exam. An Advisory Committee can require full-time students to take the preliminary exam as early as the fourth semester after enrolling in the doctoral program. This examination must be taken no later than at least six (6) months before the Final Examination, which is the defense of the dissertation. The preliminary exam must be scheduled with the Graduate School. The preliminary exam will consist of either an oral exam or a written exam or a combination of both as determined by the Advisory Committee. The student's Advisory Committee will determine the content of the exam. The results of the preliminary examination will indicate whether the student has mastered the materials in the courses taken. If more than one member of the Advisory Committee provides an unsatisfactory grade on the preliminary examination, the student must wait a minimum of 15 weeks before retaking the exam. A student is only permitted to take a preliminary exam twice; if a student fails to pass the preliminary exam a second time, the student will be dropped from the program.

Upon passing the preliminary exam, a student officially becomes a candidate for the doctoral degree.

Dissertation: A doctoral student must complete a dissertation that involves original research. The dissertation should describe the nature and significance of the research problem, the relevant literature, methodology employed, analysis of data, and conclusions. After completing the final draft of the dissertation, a student will submit it to all members of the Advisory Committee for review. The Committee should be allowed a minimum of one month to review the dissertation. A student must complete all changes to the written dissertation requested by members of the Advisory Committee.

Final Examination: After the Committee has reviewed the dissertation, a student must make a

public presentation of the results of the dissertation research and then make an oral defense of the dissertation before the Advisory Committee. The oral defense constitutes the final examination. If more than one member of the Advisory Committee provides an unsatisfactory grade on the final examination, the student must wait a minimum of 15 weeks before retaking the exam. A student is only permitted to take the final exam twice; if a student fails to pass the final exam a second time, the student will be dropped from the program.

Awarding of Degree: Once a student passes the final examination and all members of the Advisory Committee give a passing grade to the written dissertation, the student will receive the doctoral degree.