Department of Geographical Sciences

Internal Review Appendices

May 9 – 10, 2013

Appendices

1   Overview

1.1   Recommendations from 2004 External Review

2004 Review Committee Recommendations	Departmental Responses
Expand beyond its strengths in remote sensing and physical geography, solidifying GISc with remote sensing and building a human geography component	We are still in the process of developing and strengthening our HDGC component
Strategically focus the extant human-geography faculty interests and determine if these should be enlarged or a human-environment cadre added; in either case, several new positions are required	The focus is now on HDGC and this is in process – new positions have been created in this area.
Develop one visible and well-funded research core beyond global change and NASA-based activities	We are in the process of building the HDGC core component and a GI Science element.
Reduce the extreme emphasis on NASA-based funding, within and beyond global change interests	We have broadened our portfolio considerably to include DOE, USAID, NOAA funding – we still believe that Global Change is the right focus for our Department.
Retain the MA "niche" servicing federal agencies and NGOs	We developed the MPS GIS program in direct response to this recommendation
Rebalance the MA program relative to the Ph.D. program and MA-type placements relative to academic placement, especially regarding doctoral programs	See the response to the previous recommendation
Review the number and quality of graduate-level courses relative to peer leaders in the discipline and the strong research agenda of the department, and amend as necessary to continue to elevate the quality of graduate education	A considerable revamping of the graduate offerings has been made since the review. This is a work in progress and we continue to work to elevate the quality of the graduate teaching program. We developed the outcomes assessment (see Graduate Program section)
Increase the number of high quality applicants to the Ph.D. program	An ongoing process
Enlarge the range of fellowship-grants portfolio of the graduate students	Done
Improve the overall quality of undergraduate performance through a set of strategic planned efforts, including involving undergraduates in research experiences	We developed the outcome assessment and the internship program to help in this regard(see Undergraduate Program Section)
Work with the university to ensure the regular stocking of teaching laboratories	The teaching laboratories have been upgraded and we continue to enhance our teaching laboratory facilities

1.2 Vision and Mission Statement

Mission:

To make fundamental contributions to the advancement of geographic science by:

- Conducting disciplinary and integrative research in the physical and social sciences that spans local to global scales, with an emphasis on a geospatial perspective of our changing planet and its sustainability.

- Equipping undergraduate and graduate students to meet the challenges associated with the continuing evolution of geographic science while providing them with vibrant and fulfilling educational experiences.

- Applying geographic science to societal and environmental issues in our state, the nation and the global community.

Vision:

To lead the development of academic, educational, and research directions of human and natural systems, land cover/and land use change and geospatial information science, harnessing the integrative nature of geographic science to answer fundamental questions of global importance.

1.3 Departmental Staffing Counts by Title

Title	2004	2013*
Professor	5	11
Associate Professor	7.5	3
Assistant Professor	3	4
Total - Faculty	**15.5**	**18**
Adjunct Faculty	11	15
Lecturers - Part Time	4	2
Lecturer - Full Time	2	4
Total	**17**	**21**
Research Professor		1
Research Associate Professor	5	7
Research Assistant Professor	6	14
Research Associate	3	14
Visiting Researcher	1	7
Sub Total	**15**	**43**
Faculty Res Asst	29	22
Total	**44**	**65**
Res Grad Asst	16.75	39.5
Grad Asst	13.75	20.5
hourly undergrad student	0	15
Fellows	4	13
Total	**34.5**	**88**
Admin Staff	7	13
Tech Staff	2	2
Total	**9**	**15**
Grand Total	**120**	**207**

* including hires in process

4

2 Academic Program

2.1 Undergraduate Course Offerings

Fall 2012	Title	Instructor	Description
130	Developing Countries	Luna	An introduction to the geographic characteristics of the development problems and prospects of developing countries. Spatial distribution of poverty, employment, migration and urban growth, agricultural productivity, rural development, policies and international trade. Portraits of selected developing countries
140	Natural Disasters: Earthquakes, Floods, and Fires	Yearwood	Catastrophic Environmental Events (CCE) that are becoming more common i this time of global environmental change and it is essential that today's students be equipped with the knowledge and skills to be leaders as we, as a society, understand the upheaval that these CCEs are causing. Students will examine how CEEs shape human society and ecosystem from the interdisciplinary perspective afforded by the field of Geography. Students will use the latest geographic science concepts and techniques in exploring these events. Using satellite imagery they will gain a multi-scale perspective of the ecological and societal aspects of the events.
170	Intro to Methods of Geospatial Intelligence and Analysis	Torrens	Introduction to technical methods used in gathering, analyzing, and presenting geospatial information, addressing the needs of geospatial analysis, such as environmental monitoring, situational awareness, disaster management, and human systems. Topics include basics of locational reference systems, map projections, satellite and airborne remote sensing, global positioning systems, geographic information systems, cartography, and introductory statistics and probability. The course is a gateway to more advanced technical classes in geoinformatics
201	Geography of Environmental Systems	Yearwood	A systematic introduction to the processes and associated forms of the atmosphere and earth's surfaces emphasizing the interaction between climatology, hydrology and geomorphology.
202	Intro to Human Geography	Torrens	Introduction to what geographers do and how they do it. Systematic stud of issues regarding social and cultural systems from a global to a local scale. Looks at the distribution of these variables and answers the question "Why here, and not there"?
211	Geography of Environmental Systems Lab	Enrici and Khan	A laboratory course to accompany GEOG 201. Analysis of the components of the earth's energy balance using basic instrumentation; weather map interpretation; soil analysis; the application of map and air photo interpretation techniques to landform analysis.
212	Intro to Human Geography Lab	Kirn	Introduction to the basic methods and techniques employed in human geography.
310	Maryland and Adjacent Areas	Eney	The physical environment, natural resources, and population in relation to agriculture, industry, transport, and trade in the State of Maryland and adjacent areas.
312	The United States and Canada	Eney	The two countries as functioning geographic systems with important differences and key linkages. An examination of the cultural, environmental, and economic components and their spatial variation. Attention to the role of regions in national economies.

5

313	Latin America	Luna	A geography of Latin America and the Caribbean in the contemporary world: political and cultural regions, population and resource distribution, historical development, current levels of economic and social well-being, urbanization, development policies, migration trends, physical features and climates.
328C	Topics in Regional Geography: Sub-saharan Africa	Hansen	Selected topics in regional geography.
332	Economic Geography	Silva	Principles of managing scarce resources in a world where everyone faces tradeoffs across both time and space. Focuses on the relationship between globalization processes and changing patterns of locational advantages, production, trade, population, socioeconomic and environmental grace and sustainability.
345	Intro to Climatology	Yearwood	The geographic aspects of climate with emphasis on energy-moisture budgets, steady-state and non steady-state climatology, and climatic variations at both macro-and micro-scales.
372	Remote Sensing	Prince	Principles of remote sensing in relation to photographic, thermal infrared and radar imaging. Methods of obtaining quantitative information from remotely-sensed images. Interpretation of remotely-sensed images emphasizing the study of spatial and environmental relationships.
373	Geographic Information Systems	Zhou	Characteristics and organization of geographic data; creation and use of digital geospatial databases; metadata; spatial data models for thematic mapping and map analysis; use of geographic information system in society, government, and business. Practical training with use of advanced software and geographic databases.
384	Internship in Geography 1	Eney	Supervised field training to provide career experience. Introduction to professional level activities, demands, opportunities. Placement at a public agency, non-profit organization, or private firm. Participation requires application to the internship advisor in preceding semester.
385	Internship in Geography 2	Eney	Supervised field training to provide career experience. Introduction to professional level activities, demands, opportunities. Placement at a public agency, non-profit organization, or private firm. Participation requires application to the internship advisor in preceding semester.
396	Honors Research	Geores	First course in the departmental honors sequence. Student development of a potential research topic under the guidance of a faculty advisor, culminating in a written and oral presentation of a research proposal.
397	Honors Thesis	Geores	Second course in the departmental honors sequence. Student research under the auspices of a faculty advisor, culminating in a research paper to be defended orally before the geography honors committee.
418	Field and Laboratory Techniques in Environmental Science	Dubayah	Lecture and laboratory learning each week. A variable credit course that introduces field and laboratory analyses in environmental science. Individual learning contract are developed with instructor.
437	Political Geography	Zlatic	Geographical factors in the national power and international relations; an analysis of the role of geopolitics and geostrategy, with special reference to the current world scene.
442	Biography and Environmental Change	Prince	Biogeographical topics of global significance, including a consideration of measurement techniques, and both descriptive and mechanistic modeling. Topics may include: scale in biogeography, climate and vegetation, global carbon cycle, biodiversity, interannual variability in the biosphere, land cover, global biospheric responses to climate change, NASA's Mission to Planet Earth and Earth Observation System.

456	The Social Geography of Metropolitan Areas in Global Perspective	Zlatic	A socio-spatial approach to human interaction within the urban environments: ways people perceive, define, behave in, and structure world cities and metropolitan areas. Cultural and social differences define spatial patterns of social activities which further define distinctions in distribution and interaction of people and their social institutions.
472	Remote Sensing: Digital Processing and Analysis	Liang	Digital image processing and analysis applied to satellite and aircraft land remote sensing data. Consideration is given to preprocessing steps including calibration and geo registration. Analysis methods include digital image exploration, feature extraction thematic classification, change detection, and biophysical characterization. One or more application examples may be reviewed.
475	Computer Cartography	Zhou	Advanced skills of computer mapping using more sophisticated software packages. Map projection evaluation and selection, coordinate system conversion, techniques of quantitative thematic mapping, map design and generalization, hypermedia and animated cartography. Emphasis on designing and making cartographically sound sophisticated thematic maps.
Spring 2013	**Title**	**Instructor**	**Description**
130	Developing Countries	Luna	An introduction to the geographic characteristics of the development problems and prospects of developing countries. Spatial distribution of poverty, employment, migration and urban growth, agricultural productivity, rural development, policies and international trade. Portraits of selected developing countries
170	Intro to Methods of Geospatial Intelligence and Analysis	Torrens	Introduction to technical methods used in gathering, analyzing, and presenting geospatial information, addressing the needs of geospatial analysis, such as environmental monitoring, situational awareness, disaster management, and human systems. Topics include basics of locational reference systems, map projections, satellite and airborne remote sensing, global positioning systems, geographic information systems, cartography, and introductory statistics and probability. The course is a gateway to more advanced technical classes in geoinformatics
201	Geography of Environmental Systems	Yearwood	A systematic introduction to the processes and associated forms of the atmosphere and earth's surfaces emphasizing the interaction between climatology, hydrology and geomorphology.
212	Intro to Human Geography Lab	Kirn	Introduction to the basic methods and techniques employed in human geography.
306	Intro to Quantitative Methods for the Geographic Environmental Sciences	Dubayah	Essentials in the quantitative analysis of spatial and other data, with a particular emphasis on statistics and programming. Topics include data display, data description and summary, statistical inference and significance tests, analysis of variance, correlation, regression, and some advanced concepts, such as matrix methods, principal component analysis, and spatial statistics. Students will develop expertise in data analysis using advanced statistical software.
310	Maryland and Adjacent Areas	Eney	The physical environment, natural resources, and population in relation to agriculture, industry, transport, and trade in the State of Maryland and adjacent areas.
328A	Topics in Regional Geography; Western Europe: From an Integrated Geographic Perspective	Eney	Selected topics in regional geography.

7

328B	Topics in Regional Geography; China	Liang	Selected topics in regional geography.
330	As the World Turns: Society and Sustainability in a Time of Great Change	Geores	Cultural geography course on society and sustainability. Culture is the basic building block that is key to sustainability of societies. Course will cover sustainability of societies on different scales, examining local, regional, and worldwide issues. Sustainability will be examined as a key element of environmental sustainability. How societies adjust to rapid world change will be examined as a positive and/or negative factor in sustainability.
342	Intro to Biogeography	Kellner	The principles of biogeography, including the patterns, processes and distributions of living organisms from local to global scales, aspects of ecophysiology, population and community ecology and evolutionary biology. Spatial processes in the biosphere will be covered.
372	Remote Sensing	Prince	Principles of remote sensing in relation to photographic, thermal infrared and radar imaging. Methods of obtaining quantitative information from remotely-sensed images. Interpretation of remotely-sensed images emphasizing the study of spatial and environmental relationships.
373	Geographic Information Systems	Zhou	Characteristics and organization of geographic data; creation and use of digital geospatial databases; metadata; spatial data models for thematic mapping and map analysis; use of geographic information system in society, government, and business. Practical training with use of advanced software and geographic databases.
384	Internship in Geography 1	Eney	Supervised field training to provide career experience. Introduction to professional level activities, demands, opportunities. Placement at a public agency, non-profit organization, or private firm. Participation requires application to the internship advisor in preceding semester.
384H	Internship in Geography 1	Geores	Supervised field training to provide career experience. Introduction to professional level activities, demands, opportunities. Placement at a public agency, non-profit organization, or private firm. Participation requires application to the internship advisor in preceding semester.
385	Internship in Geography 2	Eney	Supervised field training to provide career experience. Introduction to professional level activities, demands, opportunities. Placement at a public agency, non-profit organization, or private firm. Participation requires application to the internship advisor in preceding semester.
385H	Internship in Geography 1	Geores	Supervised field training to provide career experience. Introduction to professional level activities, demands, opportunities. Placement at a public agency, non-profit organization, or private firm. Participation requires application to the internship advisor in preceding semester.
396	Honors Research	Geores	First course in the departmental honors sequence. Student development of a potential research topic under the guidance of a faculty advisor, culminating in a written and oral presentation of a research proposal.
397	Honors Thesis	Geores	Second course in the departmental honors sequence. Student research under the auspices of a faculty advisor, culminating in a research paper to be defended orally before the geography honors committee.
398F	Special Topics in Geography; Desertification: Science and Myth	Prince	An introductory course dealing with special topics in geography.
410	Washington, DC: Past and Present	Zlatic	This course is designed as a field study of Washington, D.C. from its origin as the Federal Capital to its role in the development of the metropolitan area. Through lectures and extensive field trips, the course will focus on the symbiosis and interrelation of Washington, D.C. and its region: historical, socio-economic, spatial and environmental.

413	Migration: Latin America and the United States	Luna	Develops an understanding of the push and pull factors that have contributed to human mobility (migration) that has transformed the Americas. The class is divided in two parts: immigration and emigration from Latin American and Latin America migration to the United States. We will be interested in studying the migration shifts that have occurred in Latin America and the theories that help explain them. The themes that will be addressed are the history of migration with Latin America and to North America, the impact of this migration on both sending and receiving countries, and the various policy strategies and issues concerning migration.
415	Land Use, Climate Change, and Sustainability	Feng	The issues of climate change and land use change as two interlinked global and regional environmental issues and their implications for society and resource use are explored.
416	Conceptualizing and Modeling Human-Environmental Interactions	Yu	Develops skills to carry out research that integrates environmental and economic aspects of sustainability by introducing extensively used quantitative tools for analyzing human-environmental interactions in the field of ecological economics. These include, e.g., index number calculations and decomposition analysis, Environmental Kuznets Curve (EKC), environmental input-output analysis and life-cycle analysis, and multi-criteria decisions aid (MCDA). Students will need laptops to run models during class.
435	Population Geography	Zlatic	The spatial characteristics of population distribution and growth, migration, fertility and mortality from a global perspective. Basic population-environmental relationships; carrying capacity, density, relationships to national development.
441	The Coastal Ocean	Yearwood	Introduction to coastal oceanography, focusing on the physical, biological, and geological aspects of ocean areas on the inner continental shelves. Wave, currents, and tidal dynamics of bays, open coast, estuaries, and deltas. Sedimentary environments of major coastal types. Ecology and biogeochemical relationships, including benthic and planktonic characteristics. Coastal evolution with sea level rise. Human impacts: eutrophication, modification of sedimentation. The coastal future: rising sea level, hypoxia, and increased storminess.
473	Geographic Information Systems and Spatial Analysis	Zhou	Analytical uses of geographic information systems; data models for building geographic data bases; types of geographic data and spatial problems; practical experience using advanced software for thematic domains such as terrain analysis, land suitability modeling, demographic analysis, and transportation studies.
498B	Topical Investigations: Social Ecological Systems	Prell and Hubacek	Independent study under individual guidance.
498P	Topical Investigations: Global Criminal Economy	Silva	Independent study under individual guidance.
498R	Topical Investigations; Land Cover Characterization Using Multi-Spectral, Multi-Temporal Remotely Sensed Data Sets	Hansen	Independent study under individual guidance.

2.2 Geographical Sciences Concentrations

Geographical Sciences has two concentrations; Geographical Sciences and Geographic Information Sciences. Within the Geographical Sciences concentration, there are two tracks to guide students through their course work:

a Development and Sustainability Track

The Development and Sustainability track addresses both fundamental and applied issues in coupled human and natural systems, such as population, socio-economic development, consumption and production, poverty, climate impacts and adaptation, vulnerability and mitigation, as well as the examination of policy options and trade-offs associated with sustainability. This track aims to attract students who are concerned with the relations between people and the natural world, the effects of human beings on ecosystems and the global inequalities in the distribution of wealth and access to resources. It examines sustainability of societies based on past environmental decisions, and the effects of today's choices on future generations. This program highlights the current and cross-disciplinary research in Geography, Environmental Studies and related fields that focus on the increasingly important issues of development and sustainability. Students are also exposed to the latest software, tools, and applications of Geographic Information Systems (GIS) as well as spatial statistics. This track integrates the study of human and environmental processes, giving the students the opportunity to study the spatial aspects of critical issues such as food availability, energy use, and migration, and the causes and impacts of natural disasters.

b Environmental Systems and Natural Resources Track

The Environmental Systems and Natural Resources Track emphasizes the Earth's physical environmental systems. Within this Track students are introduced to some of the latest concepts and techniques being used to understand environmental systems. Coursework centers on developing an understanding of physical and biological systems, and on how we monitor and model these systems. The latter provides a direct linkage to the broad array of research in the Department centered on monitoring and modeling vegetation dynamics. There is a further stress placed on quantifying human and natural disturbances and their landscape-scale impacts, especially through remote sensing. This includes examining changes to the earth's surface and the implications of these changes to climate and the global carbon cycle.

Geographic Information Science Concentration

Students opting for a Geographic Information Science concentration gain the technical skills needed to acquire, manage, and analyze geographic data and information. Students receive computer training in digital processing of remote sensing observations and cartographic vector data, spatial analysis, visualization and the display of information and products.

Students are taught technical GIS skills that are broadly applicable to both human and physical systems. From local events to multi-scale processes, the department is developing and applying advanced Geographical Information Systems (GIS) and developing GIS technologies that help to collect, manage,

10

analyze and visualize spatial data and information. Students in this concentration gain insights into advanced computer modeling, geographic visualization, geo-computing, and spatial statistics. Geospatial intelligence involves the analysis of imagery and geospatial information to describe, assess, and visually depict physical features, human activities, and geographically reference activities on the Earth. Students in this track receive training in digital processing of remote sensing observations and cartographic vector data, spatial analysis, display of information products in image processing and GIS software. The curriculum provides students with the necessary background to use remote sensing in various science and applications fields including environmental monitoring, disaster assessments and law enforcement.

2.3   Environmental Science and Policy Concentrations

Environmental Science and Policy (ENSP) Geographical Sciences Majors

The University of Maryland offers a multi-departmental program in Environmental Science and Policy (ENSP). The program has several concentrations. Students enrolled in the Land Use, Global Environmental Change, or Marine and Coastal Management Concentrations of the Environmental Science and Policy Program (ENSP) are considered majors in our Department and these concentrations form an integral part of our undergraduate program.

a   ENSP Land Use Concentration

Students in this concentration gain an understanding of the cultural aspects of resource use and the connections between land use, climate change and sustainability. This concentration provides students with a background in the ecological, cultural, regional, and international dimensions of land use, while developing broad technical skills in geographic information science and remote sensing.

b   ENSP Marine and Coastal Management Concentration

Students in this concentration learn the basic principles of coastal oceanography and littoral processes, and their relationship to meteorological conditions and forcing and the factors influencing biological productivity in the coastal zone. Students are taught how to utilize geospatial analysis and data assimilation to become familiar with computer modeling; and gain a background in environmental policy as it relates to marine and coastal management and land use.

c   Global Environmental Change Concentration

This concentration covers both the biophysical and human dimension of global change and provides students with an understanding of the scientific underpinnings, societal impacts, and policy responses to global environmental issues.

11

2.4 Undergraduate Outcomes Assessments Rubrics

Scoring Rubrics: Physical Geography Content, Methods, and Data (GEOG 211)

This is a lab-based course in basic Physical geography with a class goal to give hands-on experience incorporating geographic concepts with basic methodology to students doing research using various computer programs and researching techniques to explore a number of Physical geography topics by dividing them into several assignments:

Table 10	Assessment Criteria				
Objective	**Not Acceptable**	**Novice**	**Acceptable**	**Proficient**	**Accomplished**
1A) Content: demonstrate an understanding of the nature of the physical systems and processes of the Earth's environment and their interactions. The following exercises will be utilized to test the students' knowledge: Labs 2 & 9 from GEOG 211.	• Does not understand of the fundamental principles, concepts and knowledge of Physical geography systems and Earth's processes.	• Shows some understanding of the fundamental principles, concepts and knowledge of Physical geography systems and Earth's processes.	• Shows appropriate understanding of the fundamental principles, concepts and knowledge of Physical geography systems and Earth's processes.	•Has good understanding of the fundamental principles, concepts and knowledge of Physical geography systems and Earth's processes.	•Shows exceptional understanding of the fundamental principles, concepts and knowledge of Physical geography systems and Earth's processes.
1B) Methods: demonstrate knowledge of understanding the nature of geographical processes and their value in understanding human-environment relationships. The following exercises will be utilized to test the students' knowledge: Labs 3, 4, 5, 6 & 7 from GEOG 211.	• Does not understand geographical processes and their value in understanding human-environment relationships.	• Shows some understanding of geographical processes and their value in understanding human-environment relationships.	• Shows understanding of geographical processes and their value in understanding human-environment relationships.	•Has good understanding of geographical processes and their value in understanding human-environment relationships.	•Shows exceptional understanding of geographical processes and their value in understanding human-environment relationships.

1C) Technique and Data: demonstrate an understanding of the methods and techniques of data collection, display and analysis used in the study of environmental systems. The following exercises will be utilized to test the students' knowledge: Lab 1from GEOG 211.	• Does not understand how to use geographic data collection techniques or their application to environmental systems.	• Shows some understanding of how to use geographic data collection techniques or their application to environmental systems.	• Shows understanding of how to use geographic data collection techniques or their application to environmental systems.	•Has good understanding of how to use geographic data collection techniques or their application to environmental systems.	•Shows exceptional understanding of how to use geographic data collection techniques or their application to environmental systems.

2.5 PhD Portfolio Guidelines

Comprehensive Portfolio Guidelines
Department of Geographical Sciences
University of Maryland

1. Objectives

The Comprehensive Portfolio in Geographical Sciences is designed to help students <u>develop</u> the required background for doctoral research and <u>demonstrate</u> their readiness to undertake such research. The Comprehensive Portfolio is developed by the student during the pre-candidacy phase of the PhD program. Successful assessment of the Comprehensive Portfolio is required before a student may defend a dissertation proposal. The Comprehensive Portfolio should demonstrate both the breadth and depth of a student's relevant background, and provide a clear indication of their aptitude and readiness for Ph.D. level work. *The portfolio thus provides both a vehicle for self-reflection and a comprehensive record of a doctoral student's experiences and ongoing progress toward his or her academic and professional goals.*

Students will use the process of developing a Comprehensive Portfolio to:
1. Define and clarify academic and professional goals;
2. Formulate specific plans to achieve these goals through coursework, research, and field-based activities;
3. Reflect upon the process and results of their learning activities;
4. Modify goals and plans as needed based on reflective self-evaluation and feedback from faculty advisors; and
5. Demonstrate a readiness to proceed to the next step of the doctoral program: creating and defending a dissertation proposal.

Based on advice from the Graduate Committee, the Graduate Director will appoint the three members of the Portfolio Advising Committee (PAC). The members of the PAC will consist of the student's tenure/tenured track or research faculty advisor (who will lead the PAC, convene the meetings and provide written assessment reports), plus two other members of the tenured/tenure track faculty. As students' progress through the PhD program prior to candidacy, they will meet with their PAC each semester to review goals, plans, and accomplishments, and to discuss possible modifications and additional work needed to facilitate continued progress in the doctoral program.

The end of this process will be a formal Comprehensive Portfolio Assessment, where the PAC evaluates the student's readiness to proceed to the Proposal Development Stage based upon a review of the student's portfolio, analogous to the traditional doctoral

13

comprehensive exam. Usually the portfolio process precedes the proposal development stage but in exceptional cases and based on the approval of their advisor, the student can form the Doctoral Student Advisory Committee (DSAC) prior to completion of the review of the Comprehensive Portfolio.

2. Comprehensive Portfolio Timelines

Upon entry into the graduate program, students are assigned into one of two tracks: those with a master's degree and a solid background in Geographical Sciences or relevant disciplines, and those with only a bachelor's degree or an incomplete background in Geographical Sciences. Master's students may schedule their Comprehensive Portfolio Assessment (see Section 4 below) **anytime**. Bachelor's students may do so **after the end of their third term of full-time study**. For bachelor's students, the PAC may suggest the student discontinue graduate study if the 1st year review has raised considerable doubts about the ability of the student to complete the program.

Each semester, the student will meet with their PAC and make an oral presentation on the progress that has been made towards development of their Comprehensive Portfolio. The first PAC meeting will take place during the orientation week in late August prior to the start of the fall semester; the other meetings will normally be scheduled based towards the end of the semester. At these meetings, the students will discuss progress with the members of the PAC, who in turn, will discuss areas where additional progress is needed. After each semi-annual meeting, the PAC will provide the student with a written assessment on the progress the student is making towards development of their Comprehensive Portfolio, and identify areas where improvement is needed in order to pass the Comprehensive Portfolio Assessment. A copy of this semi-annual assessment, signed by all members of the PAC, will be also be submitted to the graduate director.

3. Comprehensive Portfolio Contents

The Comprehensive Portfolio should be compiled using a well-designed electronic format that facilitates appropriate organization of materials, provides for easy access to materials, and allows for frequent updating. Each item listed below should be completed by the time of Portfolio Review #1, unless otherwise specified:

I. **Current Vita/Resume**
    (see e.g. http://www.careercenter.umd.edu/page.cfm?page_ID=43&section_ID=1)

II. **Goal Description**

    A. Copy of original Goal Statement from admissions file.
    B. Current Goal Statements
        1. **Written description** (3-5 pages) **detailing academic goals** (specialization and supporting areas of study), **research goals** (problems, topics, theories, concepts, approaches, interests), and **professional goals.**
        2. **Schematic representation of how interests, experiences, and plans fit together into a coherent conceptual framework.** This creative diagram should concisely portray the intellectual substance of evolving identity as a scholar-practitioner.

III. **Coursework Experiences and Plans**

    A. **Program of Study** (courses undertaken at UMD as part of the student's PhD program and a summary of relevant courses successfully completed prior to entering the PhD program).
    B. **Self-reflective description of previous and current coursework** in relation to academic, research, and professional goals, as well as the discipline of geography.

IV. **Research Experiences and Plans**

A. **Self-reflective description of previous and current research activities and accomplishments** (including research conducted prior to entry into the program). For each activity, note the specific types of competence developed (e.g., literature review, conceptual analysis, theory development, instrument and methods development, data collection, data analysis, research writing, technology applications).

B. **List of competencies for which additional preparation is needed** prior to beginning dissertation work.

14

C. **Description of planned future research activities.** For each activity, note the specific types of competence you anticipate developing (e.g., literature review, conceptual analysis, theory development, instrument development, data collection, data analysis, research writing, technological applications, etc.).

D. **List of significant research outputs** (e.g., research publications, conference presentations, technical reports, Master's thesis, major course projects, extended literature reviews, etc.).

V. **Professional Experiences**

A. **List of significant professional products** (e.g., professional publications and presentations at scientific meetings, workshops, or academic seminars, curriculum materials, software, multimedia projects, examples of innovative or exemplary teaching/counseling, leadership assessment results, etc.).

V. **Evidence of Analytical and Integrative Thinking**

A. List of course papers, extended literature reviews, theoretical analyses, research and professional publications, and other scholarly products providing **evidence of analytical and/or integrative thinking capabilities.** *These materials should collectively demonstrate both breadth and depth of understanding in areas related to your academic and professional goals.* For each item in this list, briefly describe its purpose, substance, and ways in which it required analytical and/or integrative thinking.

VI. **Initial Dissertation Planning**

A. Outline of initial thinking/planning for your dissertation research. This "idea paper" should be no more than 5 pages in length. It should address:
    1. The real-world problem or concern to be addressed in the dissertation study
    2. The kinds of research questions that might be targeted in conducting a study in this area of inquiry.
    3. The theories, concepts, research literatures, and methodological approaches that are likely to guide the dissertation study.
    4. Areas of expertise that will need to be represented on the dissertation committee.

Note: This part of the portfolio does not represent a proposal defense; therefore this paper does not bind the student to any particular course of research.

VII. **Documentation**
A. This section contains copies of written papers and poster papers and presentations the student has made at meetings and workshops. This section should contain copies of the materials listed in previous sections of the Comprehensive Portfolio.

4. Comprehensive Portfolio Assessment

In the **Comprehensive Portfolio Assessment** meeting, the focus shifts from academic and professional development to formal evaluation. The purpose of this meeting is to assess the student's readiness to proceed to the dissertation phase of the doctoral program (analogous to the traditional doctoral comprehensive exam). Discussion will normally center on the following components of the portfolio:

> Current Goal Statements
> Research and Professional Competencies for which additional preparation is needed
> Evidence of Analytical and Integrative Thinking
> Initial Dissertation Planning

At the end of the Comprehensive Portfolio Assessment meeting, the student is asked to leave the room, and the Portfolio Advising Committee discusses the student's progress and performance, and agrees upon one of three possible **Outcomes** that are based upon the evaluation criteria and scoring guidelines in Section 4.1:

Outcome 1: Pass
> The student has demonstrated readiness to proceed to the dissertation phase of the program and may do so immediately (although non-binding recommendations for modifications or additional work may be specified by the doctoral advising

15

committee); The PAC is disbanded.

Outcome 2: Conditional Pass
> The student may proceed to the dissertation phase of the program when required actions are completed -- a second meeting is not required, although a deadline for completing the required actions (between 1 month and 12 months from the date of the Comprehensive Portfolio Assessment meeting) must be specified along with precise procedures for verifying that these actions have been completed (non-binding recommendations for modifications or additional work may also be specified by the doctoral advising committee). If the student does not meet the timeline or the actions taken are insufficient, the result of the assessment is changed from Conditional Pass to Fail.

Outcome 3: Fail
> A second Comprehensive Portfolio Assessment meeting will be scheduled when required actions are completed, with the second meeting scheduled no earlier than one month and no later than 12 months from the date of the first meeting (non-binding recommendations for modifications or additional work may also be specified by the doctoral advising committee).

When the student fails to meet the expectations for the Comprehensive Portfolio Assessment (Outcome 2 or 3), the PAC shall provide the following in writing and a copy provided to the Department Graduate Office:

1. Any actions that the committee *requires* the student to complete before they are judged to have fully passed the Comprehensive Portfolio Assessment; and

2. A precise deadline for completing these requirements and how new materials are to be evaluated (i.e., by whom and in what context).

4.1 Evaluation Criteria

1. Goal Formulation:
Statements of professional and academic goals directly relevant to student's proposed program objectives. These statements should go beyond generic statements of program competencies, and apply directly to the student's personal aspirations. Goal statements should be carefully thought out, be directly relevant to the student's academic and professional situation, be realistic, and demonstrate that the student is actively considering his or her own learning and the implications for the future, and not simply "going through the motions" of taking courses and accumulating credits.

2. Discipline Breadth:
Student demonstrates the ability to grasp and synthesize core disciplinary concepts and theories, for example, as introduced in Geog600. Student thinks critically and understands problems or texts in a disciplinary (or interdisciplinary) context.

3. Research Competency:
Student demonstrates with course papers and other course work proficiency in essential methods and tools pertaining to Geographical Sciences more generally and the chosen dissertation research specifically.

4. Analytical and Integrative Thinking:
Student demonstrates with products, and in discussion with committee members, that he or she has engaged in higher order, scholarly thinking that goes beyond attaining understandings required for individual courses. Such thinking may include evaluating components and subcomponents of program courses and activities, and evaluating how each relates to others. This thinking also allows the student to arrive at understandings that go across individual courses and activities to gain broader general understandings relevant to student goals.

5. Reflective Thinking:
Student demonstrates skills at self-evaluation with respect to program objectives and goal statements. Student is able to reflect upon different activities, consider student's own products, and appropriately evaluate them, attributing more successful and less successful outcomes appropriately to student efforts, prior understandings, planning, and procedures. Based on this thinking, the student is able to identify how to improve performance and further develop skills and competencies in future endeavors. Reflective thinking should go beyond individual evaluation of products to evaluation of student overall performance in pursuit of academic and professional goals.

6. Effective Communication:
Student demonstrates, with products and in discussion with committee members, that they are able to write and speak clearly and at an appropriate level for doctoral study
4.2 Scoring Rubric and Guidelines

16

Does not meet standards (1 point in scoring rubric)

Student does not demonstrate readiness to proceed to the proposal development stage of the doctoral program.
1. Goal statements are not clear or relevant; evidence for meeting goals is not present.
2. The student does not demonstrate the breadth in the field of geography necessary for advancing to dissertation studies.
3. Research or professional competencies require additional preparation even though the coursework has been completed.
4. The student failed to demonstrate adequate evidence of analytical and integrative thinking in reflecting on the program at the end of coursework, especially with respect to upcoming dissertation work, or on integrity and ethical practice.
5. Student fails to demonstrate an ability for self-evaluation of goals and objectives, projects and writing.
6. Responses to questions are overly general and disorganized, vague, or contain factual errors. Written products disorganized, unfocused and may contain frequent grammatical errors.

Meets standards (2 points in scoring rubric)

Student demonstrates readiness to proceed to the proposal development stage of the doctoral program.
1. Goal statements are clear and relevant; evidence of goals having been met is present.
2. The student demonstrates adequate breadth in the field of geography necessary for advancing to dissertation studies.
3. Research or professional competencies have been met to an adequate degree of competence. Integrity and ethical practice are evident in research and/or professional activities.
4. The student presents adequate evidence of analytical and integrative thinking in reflecting on the program at the end of coursework, especially with respect to upcoming dissertation work, and on integrity and ethical practice.
5. Student demonstrates ability for self-evaluation of goals and objectives, projects and writing.
6. Responses to question are more general, but still accurate; analyses go beyond the obvious. Written products generally organized and focused, with few grammatical errors, showing good use of figures, citations, etc.

Exceeds standards (3 points in scoring rubric)

Student clearly demonstrates a high degree of readiness to proceed to the proposal development stage of the doctoral program.
1. Goal statements are clear and relevant; evidence of goals having been met to a high degree of competence may be present.
2. The student demonstrates substantial breadth in the field of geography necessary for advancing to dissertation studies.
3. Research or professional competencies may have been met to a high degree of competence. Integrity and ethical practice are clearly evident in research and/or professional activities.
4. The student demonstrates evidence of excellence in analytical and integrative thinking in reflecting on the program at the end of coursework, especially with respect to upcoming dissertation work integrity and ethical practice.
5. Student demonstrates excellent ability for self-evaluation of goals and objectives, projects and writing.
6. Responses to questions are specific and accurate. Written products well organized and focused with effective use of graphics, citations.

4.3 Scoring the Comprehensive Portfolio Assessment

The following Rubric Score Sheet will be used for the Comprehensive Portfolio Assessment

Evaluation Category	Score			
	Member 1	**Member 2**	**Member 3**	**PAC**
1. Goal Formulation				
2. Discipline Breadth				
3. Research Competency				
4. Analytical and Integrative Thinking				
5. Reflective Thinking				
6. Effective Communication				

Each PAC member will independently score the student's portfolio in each Evaluation Category (based on the criteria in section 4.2 above:

        1 – Does not meet expectations;

        2 – Meets expectations;

        3 – Exceeds expectations.

The PAC score will be based upon the majority score awarded by two out of three committee members (e.g., if the member scores are 1,1,2, then the PAC score = 1). Note: a scoring of (1,2,3) results in an overall score of 2.5 for a criterion.

        4.3.1 Assigning the outcome of the assessment

The following is used to assign the outcome of the comprehensive assessment.

Outcome 1: Comprehensive Portfolio Assessment is passed:

        The student receives a PAC score of 2 or greater in **all 6** Evaluation Criteria.

Outcome 2: Comprehensive Portfolio Assessment is conditionally passed:

        The student receives a PAC score of 1 in **no more than 2** Evaluation Criteria. If only 1 criterion does not meet expectations the student is conditionally passed. If two criteria do not meet expectations the PAC may choose to place the student in Outcome 3 (fail) depending on the criteria that were not passed and their overall assessment of the student.

Outcome 3: Comprehensive Portfolio Assessment is failed:

        The student receives a PAC score of 1 in **more than 2** Evaluation Criteria.

        a.   **Discontinuation**

A student who fails their second Comprehensive Portfolio Assessment (i.e. receive Outcome 3 twice) will not be allowed to continue work towards the dissertation. Students in Outcome 2 who fail to satisfy the requirements as given by their PAC in the specified time (and thus receive an Outcome 3) may also be prevented from continuing work towards a dissertation at the discretion of the PAC.

The primary purpose of this meeting is to assess the student's readiness to proceed to the dissertation phase of the doctoral program.

Student's Name _____   **G#**_____
First semester in the program_____   **Current semester** _____
Portfolio URL_____

The comments below summarize REQUIRED and RECOMMENDED actions to be taken as a result of Portfolio Review #3 (use back of this page if more space is needed):

Areas	Member 1	Member 2	Member 3	PAC
Goal Formulation				
Discipline Breadth				
Research competency				
Analytical and Integrative Thinking				
Reflective thinking				
Effective communication				

The results of the comprehensive assessment are summarized below (check one):

_____   **Student has demonstrated readiness to proceed to the dissertation phase of the program (non-binding recommendations for modifications or additional work may be specified on the back of this page).**

_____   **Student may proceed to the dissertation phase of the program when required actions are completed; a second meeting is not required (a deadline and precise procedures for verifying completion of these actions must be specified on the back of this page [deadline cannot extend   beyond   12 months from the date of the first meeting]; non-binding recommendations for modifications or additional work may also be specified).**

_____   **A second comprehensive assessment meeting will be scheduled when required actions are completed (the second meeting cannot be held later than 12 months from the date of the first meeting; non-binding recommendations for modifications or additional work may also be specified).**

Summary of candidate's strengths:

Summary of candidate's areas in need of improvement:

Student   **Date**

Chair, Doctoral Advising Committee (print last name)   **Date**

Doctoral Advising Committee (print last name)   **Date**

Doctoral Advising Committee (print last name)   **Date**

Director, Ph.D. in Education Program   **Date**

2.6   PhD Dissertation Abstracts

Spring 2005 PhD:

Title: The Role of Theology in the Production of Space in Shaker Societies

Author: Carter, Catherine

Abstract: Social space is produced by societies according to the spatial practices that exist within the society. The produced space is a set of relations between objects within the space. The set of economic relations, for example, corresponds to space in which manufacturing and trade can take place while the set of political relations characterizes the space in which governments operate. Theology is also a relation that exists within a society's space, but the space it defines is not well studied and the nature of theological space is not well understood. In some cases, theology is the dominant factor in the production of the space within which a community interacts. The relative importance of theology to its concomitant space is expressed by the architecture, icons, and symbols produced by the society. This research studies the nature of theological space and its production by examining the spatial practices of the religious sect known as the Shakers. This 19th century millennial sect worked to establish heaven on earth, building communities across the northeastern and Midwestern United States. These early planned communities were built according to the precepts of the Shaker theology. Their theology was centered in their belief that the Shaker villages would be the locus of God's kingdom on earth. The Shakers produced their space by regulating the appearance of their villages-- by conforming the village layout and architecture to the precepts of their theology and by reinforcing the tenets of their theology by restricting contact between the sect's members and citizens of the world at large-- and through the way they drew and used maps and religious art.

Title: A New Geographic Process Data Model

Author: Reitsma, Femke Emma

Abstract: Processes, although the subject matter of geography, have not been represented in a manner that aids their querying and analysis. This dissertation develops an appropriate data model that allows for such a process oriented representation, which is built upon a theory of process. The data model, called nen, focuses existing modeling approaches on representing and storing process information. The flux simulation framework was created utilizing the nen data model to represent processes; it extends the RePast agent based modeling environment. This simulator includes basic classes for developing a domain specific simulation and a set of query tools for inquiring after the results of a simulation. The methodology was then prototyped with a watershed runoff simulation.

Summer 2005 PhD:

Title: Investigating Uncertainties in Trace Gas Emissions from Boreal Forest Fires Using MOPITT Measurements of Carbon Monoxide and a Global Chemical Transport Model

Author: Hyer, Edward Joseph

Abstract: Boreal forest fires are a significant contributor to atmospheric composition in the high northern hemisphere, and are highly variable both spatially and temporally. This study uses a new emissions model [Kasischke et al., 2005] to generate input to the University of Maryland Chemical Transport Model [Allen et al., 1996], with the goal of examining and constraining the key uncertainties in current understanding of boreal forest fire behavior. Model outputs are compared with data from the MOPITT instrument as well as in situ measurements of CO. A case study of CO transport during the summer of 2000 is used to examine several key uncertainties in the emissions estimates, describing how current levels of uncertainty affect atmospheric

composition and applying atmospheric measurements can be applied to constrain uncertainty. Source magnitudes determined by inverse methods were shown to be highly sensitive to the assumed injection properties. For the boreal forest in 2000, the best agreement with observations was obtained with a pressure-weighted profile of injection throughout the tropospheric column, but detailed examination of the results makes clear that any uniform parameterization of injection will be a significant source of error when applied globally. Comparison of simulated CO distributions from daily, weekly, and monthly aggregate emissions sources demonstrated that while model data sources produced a valid representation of emissions at weekly resolution, the atmospheric distribution outside the source region has very little sensitivity to temporal variability at scales finer than 30 days. Different estimates of burned area produced large differences in simulated patterns of atmospheric CO. The GBA-2000 global product and the data sources used by Kasischke et al. [2005] gave better agreement with atmospheric observations compared to the GLOBSCAR product. Comparison of different estimates of fuel consumption indicated that atmospheric measurements of CO have limited sensitivity to spatial variability in fuels, but that current fuels maps can improve agreement with atmospheric measurements. These results provide a clear indication of how atmospheric measurements can be used to test hypotheses generated by emissions models.

Title: ANALYZING FOREST CHANGE AND POLICY IN WASHINGTON, DC SUBURBAN COUNTIES

Author: Jantz, Claire Ann

Abstract: Geographical approaches for landscape studies have emphasized the interpretation of landscape change as a cultural phenomenon, but often have neglected modern geographic techniques, such as remote sensing observations and quantitative spatial analysis, to characterize and understand landscape change. This study attempts to bridge these gaps by integrating a socio-cultural analysis of land use policy formation and quantitative assessments of land cover change to demonstrate how policy decisions can influence forest landscape patterns in suburban areas. Historical data from Montgomery County, MD and Fairfax County, VA, two counties adjacent to the Washington, DC urban core that have different governmental structures, were assembled and analyzed. A policy database was developed and analyzed using qualitative techniques, such as grounded theory and content analysis, to address questions related to policy formation and trends. Key findings included the identification of a strong link between land use policies and the broader environmental discourse, demonstrating that dominant cultural values are institutionalized in the development of land use policy. Furthermore, many policies related to forest management and preservation, particularly in recent decades, had a strong focus on protecting riparian forests. Land cover change between the late 1930s and 1998 was studied for local case study areas using time series of aerial photographs, and between 1990 and 2000 across both counties using satellite-derived land cover maps. Using a statistical technique, weights of evidence, the processes of new development, deforestation, and forest persistence were modeled. The results highlighted the role of biophysical variables, such as steep slopes and the presence of poorly drained soils, in constraining new development and enhancing forest persistence. However, the role of land use policies was also evident in enhancing forest persistence through the establishment of protected areas and riparian protection policies. This study demonstrated the impact that land use regulations can have on the evolution of forested landscape patterns within the built environment. The links between socio-cultural values and policy formation highlighted the institutional and cultural barriers that prevent rapid shifts in policy orientation, despite social and environmental problems that arise within a rapidly changing landscape.

Title: RADAR MONITORING OF HYDROLOGY IN MARYLAND'S FORESTED COASTAL PLAIN WETLANDS: IMPLICATIONS FOR PREDICTED CLIMATE CHANGE AND IMPROVED MAPPING

Author: Weiner Lang, Megan

Abstract: Wetlands provide important services to society but Mid-Atlantic wetlands are at high risk for loss, with forested wetlands being especially vulnerable. Hydrology (flooding and soil moisture) controls wetland function and extent but it may be altered due to changes in climate and anthropogenic influence. Wetland hydrology must better understood in order to predict

and mitigate the impact of these changes. Broad-scale forested wetland hydrology is difficult to monitor using ground-based and traditional remote sensing methods. C-band synthetic aperture radar (SAR) data could improve the capability to monitor forested wetland hydrology but the abilities and limitations of these data need further investigation. This study examined: 1) the link between climate and wetland hydrology; 2) the ability of ENVISAT SAR (C-HH and C-VV) data to monitor inundation and soil moisture in forested wetlands; 3) limitations inherent to C-band data (incidence angle, polarization, and phenology) when monitoring forested wetland hydrology; and 4) the accuracy of forested wetland maps produced using SAR data. The study was primarily conducted near the Patuxent River in Maryland but the influence of incidence angle was considered along the Roanoke River in North Carolina. This study showed: 1) climate was highly correlated with wetland inundation; 2) significant differences in C-VV and C-HH backscatter existed between forested areas of varying hydrology (uplands and wetlands) throughout the year; 3) C-HH backscatter was better correlated to hydrology than C-VV backscatter; 4) correlations were stronger during the leaf-off season; 5) the difference in backscatter between flooded and non-flooded areas did not sharply decline with incidence angle, as predicted; and 6) maps produced using SAR data had relatively high accuracy levels. Based on these findings, I concluded that hydrology is influenced by climate at the study site, and C-HH data should be able to monitor changes in hydrology throughout the year. Larger incidence angles should be explored when using C-HH data to monitor forested wetland hydrology, and C-band SAR has the potential to increase the ability to map forested wetlands throughout the year. The methods developed have the potential to fill the need of managers for increased hydrologic information and improved forested wetland maps.

Title: Monitoring land degradation in Southern Africa by assessing changes in primary productivity.

Author: Wessels, Konrad

Abstract: Land degradation is one of the most serious environmental problems of our time. Land degradation describes circumstances of reduced biological productivity. The fundamental goal of this thesis was to develop land degradation monitoring approaches based on remotely sensed estimates of vegetation production, which are capable of distinguishing human impacts from the effects of natural climatic and spatial variability. Communal homelands in South Africa (SA) are widely regarded to be severely degraded and the existence adjacent, non-degraded areas with the same soils and climate, provides a unique opportunity to test regional land degradation monitoring methods. The relationship between 1km AVHRR, growth season sumNDVI and herbaceous biomass measurements (1989-2003) was firstly tested in Kruger National Park, SA. The relationship was moderately strong, but weaker than expected. This was attributed to the fact that the small areas sampled at field sites were not representative of the spatial variability within 1x1km. The sumNDVI adequately estimated inter-annual changes in vegetation production and should therefore be useful for monitoring land degradation. Degraded areas mapped by the National-Land-Cover in north-eastern SA were compared to non-degraded areas in the same land capability units. The sumNDVI of the degraded areas was consistently lower, regardless of large variations in rainfall. However, the ecological stability and resilience of the degraded areas, as measured by the annual deviations from each pixel's mean sumNDVI, were no different to those of non-degraded areas. This suggests that the degraded areas may be in an alternative, but stable ecological state. To monitor human-induced land degradation it is essential to control for the effects of rainfall on vegetation production. Two methods were tested (i) Rain-Use Efficiency (RUE=NPP/Rainfall) and (ii) negative trends in the differences between the observed sumNDVI and the sumNDVI predicted by the rainfall using regressions calculated for each pixel (RESTREND). RUE had a strong negative correlation with rainfall and did not provide a reliable index of degradation. The RESTREND method identified areas in and around the degraded communal lands that exhibit negative trends in production per unit rainfall. This research made a significant contribution to the development of remote sensing based land degradation monitoring methods.

23

Title: HISTORICAL AND COMPUTATIONAL ANALYSIS OF LONG-TERM ENVIRONMENTAL CHANGE: FORESTS IN THE SHENANDOAH VALLEY OF VIRGINIA

Author: Wilson, James W.

Abstract: The increase and decrease of forests is a major factor of land cover change. This study of forest change in the Shenandoah Valley builds upon the rich historiography of the region through the analysis of generalized and spatially explicit primary and secondary sources covering the period of 1700 to 2000. Combining geo-historical and geo-computational approaches produced a more robust picture of land cover change than would be possible using only one method. Comparing modern and historical reports on the timing of forest clearance and re-growth revealed that a discrepancy existed between the spatially explicit sources and existing historical interpretations regarding the timing and location of forest clearance and re-growth. Understanding this discrepancy is important for the interpretation of forest change and its implications in the Shenandoah Valley and beyond. Two main aspects of the study are the thorough interrogation and comparison of different data sources, and the subsequent analysis and interpretation of the data. Historic maps (1864, 1906, and c. 1945) and digital data sets derived from remotely sensed images (c. 1974 and c. 1992) were analyzed in a geographic information system (GIS) and compared to agricultural census data and published reports of land use and land cover change. Three major findings came out of this study. First, the spatially explicit sources produced values for the amount of cleared area that were within 0.5 to 2.7% of the same information derived from the agricultural census. Second, the maximum amount of forest clearance occurred 25 - 50 years later than existing published reports indicated. Third, the commonly held explanations of federal land acquisition and the abandonment of farms on steep slopes did not account for the observed patterns of forest re-growth. The documented variations in spatial and temporal patterns and reasons for the variations have impacts on our understanding of cultural and physical processes that took place in the region.

Fall 2005 PhD:

Title: MEASURING AND MAPPING FOREST WILDLIFE HABITAT CHARACTERISTICS USING LIDAR REMOTE SENSING AND MULTI-SENSOR FUSION

Author: Hyde, Peter

Abstract: Managing forests for multiple, often competing uses is challenging; managing Sierra National Forest's fire regime and California spotted owl habitat is difficult and compounded by lack of information about habitat quality. Consistent and accurate measurements of forest structure will reduce uncertainties regarding the amount of habitat reduction or alteration that spotted owls can tolerate. Current methods of measuring spotted owl habitat are mostly field-based and emphasize the important of canopy cover. However, this is more because of convenience than because canopy cover is a definitive predictor of owl presence or fecundity. Canopy cover is consistently and accurately measured in the field using a moosehorn densitometer; comparable measurements can be made using airphoto interpretation or from examining satellite imagery, but the results are not consistent. LiDAR remote sensing can produce consistent and accurate measurements of canopy cover, as well as other aspects of forest structure (such as canopy height and biomass) that are known or thought to be at least as predictive as canopy cover. Moreover, LiDAR can be used to produce maps of forest structure rather than the point samples available from field measurements. However, LiDAR data sets are expensive and not available everywhere. Combining LiDAR with other, remote sensing data sets with less expensive, wall-to-wall coverage will result in broader scale maps of forest structure than have heretofore been possible; these maps can then be used to analyze spotted owl habitat. My work consists of three parts: comparison of LiDAR estimates of forest structure with field measurements, statistical fusion of LiDAR and other remote sensing data sets to produce broad scale maps of forest structure, and analysis of California spotted owl presence and fecundity as a function of LiDAR-derived canopy structure. I found that LiDAR was able to replicate field measurements accurately. Additionally, I was able to statistically combine LiDAR with passive optical and RaDAR (SAR backscatter and InSAR range) data to produce broad scale maps of forest structure that are consistent and accurate relative to field data and LiDAR

24

data alone. Finally, I was able to demonstrate that these forest structural attributes predict spotted owl presence and absence as well as productivity.

Title: DISCERNING Intra-Metropolitan Patterns of Producer Service Establishment Location using Geographic Information Systems

Author: Lindsay, Francis

Abstract: The research presented in this dissertation explores the spatial distribution of producer service establishments in the Washington DC area for 1997. Producer services are a distinct and important segment of the US industrial economy. These businesses provide the intermediary goods and services that are used as inputs for many other industrial sectors. Producer service employment and sales have grown substantially during the 1990s in relation to other portions of the overall US economy, surpassing growth in most sectors including other types of services. The majority of producer service research tends to focus on these services at the national scale or comparative studies of whole metropolitan areas. This work presents the findings for two complementary producer service research problems pertinent to intra-metropolitan spatial scale research, the contribution of face-to-face interaction to the spatial concentration of these services using sales between particular producer services, and the entropy (or diversity) of services within postal code areas and how this measure correlates to the presence or absence of particular producer services. The findings indicate that there is empirical evidence of a relationship between the strength of intra-sector trade and the degree of spatial concentration of producer service establishments. This analysis also demonstrates that some producer service sectors known to have weak trade relations to other producer services do locate in areas with a lower diversity of services. The results of this research add to a growing body of research and theory that centers on interpreting the role of producer services in shaping metropolitan economies. The spatial component of producer service establishment location in research is often neglected entirely or is superficially referenced. This geographic research provides the spatial dimension of producer service activities occurring at very fine scales within a metropolitan spatial economy. The results are only applicable to the study area but the methodology is useful and offers a potential for broader utility in producer service research endeavors.

Title: Canopy Fuels Inventory and Mapping Using Large-Footprint Lidar

Author: Peterson, Birgit

Abstract: This dissertation explores the efficacy of large-footprint, waveform-digitizing lidar for the inventory and mapping of canopy fuels for utilization in fire behavior simulation models. Because of its ability to measure the vertical structure of forest canopies lidar is uniquely suited among remote sensing instruments to observe the canopy structure characteristics relevant to fuels characterization and may help address the lack of high-quality fuels data for many regions, especially in more remote areas. Lidar data were collected by the Laser Vegetation Imaging Sensor (LVIS) over the Sierra National Forest in California. Various waveform metrics were calculated from the waveforms. Field data were collected at 135 plots co-located with a subset of the lidar footprints. The field data were used to calculate ground-based observations of canopy bulk density (CBD) and canopy base height (CBH). These observed values of CBD and CBH were used as dependent variables in a series of regression analyses using the derived lidar metrics as independent variables. Comparisons of observed and predicted resulted in an r2 of 0.71 for CBD and an r2 of 0.59 for CBH. These regression models were then used to generate grids of CBD and CBH from all of the lidar waveform data in the study area. These grids, along with lidar-derived grids of canopy height, were then used as inputs to the FARSITE (Fire Area Simulator-Model) fire behavior model in a series of simulations. Comparisons between conventionally derived and lidar-based model inputs showed differences between the two sets of data. Specifically, the lidar-derived inputs contained much more spatial heterogeneity. Outputs from FARSITE using the lidar-derived inputs were also compared to outputs using input maps of CBD and CBH generated from field observations. There were significant differences between the two sets of outputs, especially in the frequency and spatial distribution of crown fire. Experiments in manipulating the effective

resolution of the lidar-based inputs confirmed that FARSITE outputs are affected by the spatial variability of the input data. Furthermore, a sensitivity analysis demonstrated that FARSITE is sensitive to potential errors in the canopy structure input grids. The results of this dissertation show that lidar can be used effectively to predict CBD and CBH for the purpose of fire behavior modeling and that investment in these lidar-based canopy structure data is worthwhile, especially for forests characterized by significant heterogeneity. This work affirms that lidar is a useful tool for future canopy fuels inventory and mapping.

Spring 2006 PhD:

Title: Effect of Relative Spectral Response on Multi-Spectral Measurements and NDVI from Different Remote Sensing Systems

Author: Fleming, David J.

Abstract: Spectrally derived metrics from remotely sensed data measurements have been developed to improve understanding of land cover and its dynamics. Today there are an increasing number of remote sensing systems with varying characteristics that provide a wide range of data that can be synthesized for Earth system science. A more detailed understanding is needed on how to correlate measurements between sensors. One factor that is often overlooked is the effect of a sensor's relative spectral response (RSR) on broadband spectral measurements. This study examined the variability in spectral measurements due to RSR differences between different remote sensing systems and the implications of these variations on the accuracy and consistency of the normalized difference vegetation index (NDVI). A theoretical model study and a sensor simulation study of laboratory and remotely sensed hyper-spectral data of known land cover types was developed to provide insight into the effect on NDVI due to differences in RSR measurements of various land cover signatures. This research has shown that the convolution of RSR, signature reflectance and solar irradiance in land cover measurements leads to complex interactions and generally small differences between sensor measurements. Error associated with cross-senor calibration of signature measurements and the method of band radiance conversion to reflectance also contributed to measurement discrepancies. The effect of measurement discrepancies between sensors on the accuracy and consistency of NDVI measurements of vegetation was found to be dependent on the increasing sensitivity of NDVI to decreasing band measurements. A concept of isolines of NDVI error was developed as a construct for understanding and predicting the effect of differences in band measurements between sensors on NDVI. NDVI difference of less than 0.05 can be expected for many sensor comparisons of vegetation, however, some cases will lead to higher differences. For vegetation signatures used in this study, maximum effect on NDVI from measurement differences was 0.063 with an average of 0.023. For sensors with well aligned RSRs such as Landsat 7 ETM+ and MODIS, NDVI differences in the range of 0.01 are possible.

Title: Detection, Evaluation, and Analysis of Global Fire Activity Using MODIS Data

Author: Giglio, Louis

Abstract: Global biomass burning plays a significant role in regional and global climate change, and spaceborne sensors offer the only practical way to monitor fire activity at these scales. This dissertation primarily concerns the development, evaluation, and use of the NASA Terra and Aqua MODIS instruments for fire monitoring. MODIS is the first satellite sensor designed specifically for global monitoring of fires. An improved operational fire detection algorithm was developed for the MODIS instrument. This algorithm offers a sensitivity to small, cool fires and minimizes false alarm rates. To support the accuracy assessment of the MODIS global fire product, an operational fire detection algorithm was developed and evaluated for the ASTER instrument, which provides higher resolution observations coincident with the Terra MODIS. The unique data set of multi-year MODIS day and night fire observations was used to analyze the global distribution of biomass burning using five different temporal metrics which included, for the first time, mean fire radiative power, a measure of fire intensity. The metrics

26

show the planetary extent, seasonality, and interannual variability of fire. Recognizing differences in fire activity between morning and afternoon overpasses, the impact of the diurnal cycle of fire activity was addressed using seven years of fire data from the VIRS sensor on-board the TRMM satellite. A strong diurnal cycle was found in all regions, with the time of peak burning varying between approximately 13:00 and 18:30 local time. Given interest in area burned among atmospheric chemical transport and carbon cycle modelers, a data set was developed utilizing the MODIS global fire and vegetation cover products to estimate monthly burned area at 1-degree spatial resolution. The methods, products and results presented in this thesis provide the global change research and fire management communities with products for global fire monitoring and are currently being used in the development of the next generation of operational satellite fire monitoring systems.

Title: Exerting Local Power Over Federal Process: Stakeholder Negotiation Process in the Canyon Forest Village Land Exchange Process 1992-2002

Author: Kearney, Barbara Ann

Abstract: This is a study of the National Forest Land Exchange process as it relates to the development of gateway communities. The study area is outside the Kaibab National Forest in Northern Arizona. This land exchange represented a collaborative partnership between the National Park Service, the Forest Service meant to consolidate private inholdings within the forest and to provide services for the Grand Canyon National Park outside park borders. The stakeholders involved in the land exchange discourse included the Forest Service, the developer, the National Park Service, the gateway communities of Tusayan, Williams, and Flagstaff, the Havasupai tribe, and environmental organizations. This study demonstrates that the public interest is dependent on scale. Using a mixed methodological approach, this study examined the impact stakeholders had on the land exchange process. A content analysis of articles and editorials written in local and regional newspapers, of public comments on the Environmental Impact Statement, and of semi-structured interviews of key participants in the land exchange debate helped to elucidate the most prominent concerns resonating with each category of stakeholder. A survey of the city of Williams, Arizona, was also conducted. Though it never came to fruition, the Canyon Forest Village land exchange demonstrated the economic issues facing gateway communities and their vulnerability to the actions and policies of public land agencies. By voicing their concerns and conducting a media campaign against the development plan, the gateway communities took control of both the land exchange process and their own economic development.

Title: Effects of scale and spatial variability on hydraulic geometry in the Potomac River Basin

Author: Read, Chung Hye Kim

Abstract: Scale issues in hydrology arise because different hydrological processes are dominant at different regional scales. Recent hydrological research suggests that the geographic scale (size) of watersheds may influence the behavior of hydraulic geometry exponents (b and f, but not m values) of stream channels. Hence, the working hypothesis of this study is that variations of hydraulic geometry exponents are not random, but that there are systematic changes as a function of geographic scale as well as of water basin and channel physical and environmental characteristics (predictor variables). To support this analysis, 43 subbasins in the Potomac River Basin ranging in size from 0.38 square miles to 1,642 square miles and representing a broad spatial diversity of predictor variables within the watershed were selected for study. Research goals were to attempt, via empirical correlations, to discern relationships between a geographic scale factor and b, f, and m values, to investigate the roles of predictor variables on b, f, and m values, and their statistical significance, and to identify the most influential predictor variables and the complexity of fluvial physical processes via stepwise multi-variable regressions. Statistical evidence was found that there is a relationship between geographic scale and hydraulic geometry exponents. In every selected predictor variable case, investigation of the correlations between b, f, and m with a single selected predictor variable in a scale context resulted in a noticeable improvement over the correlations of the hydraulic exponents with each individual predictor variable alone. The

research shows that, under higher discharges, the behavior of b, f, and m mainly result in higher m and f, with a slight increase in cross-sectional area (f with negative b) in a scale context.

Title: Correlates of Terrestrial Vertebrate Species Richness: an Evaluation of Environmental Hypotheses over the Western Continental USA

Author: Slayback, Daniel Andrew

Abstract: An explanation for the unequal distribution of life forms across the Earth's surface has been a persistent and problematic question in modern ecology ever since these patterns were first noted, over 100 years ago. Most empirical research supports one of three environmental hypotheses to explain these patterns: environmental energy (ambient environmental energy or ecosystem productivity); climatic variability; or habitat heterogeneity. This research examines these hypotheses using better datasets than those commonly considered, and using a consistent methodology that addresses often neglected statistical and analytic details. The environmental datasets used in this study are derived from time series of satellite and ground station data, including the Daymet climate data, and net primary productivity data from the GLOPEM model. Species richness is derived from the individually modeled vertebrate distributions provided by the individual state Gap Analysis Projects for the western US states of California, Oregon, Washington, Idaho, Montana, Wyoming, Utah, and Colorado, which define the spatial extent of this study. The study methodology relies upon the summary of results from many model variants for each hypothesis. These variants are constructed by creating regression models at each of four different spatial scales (8, 16, 32, and 64 km grid cells), for each class of vertebrates (amphibians, birds, mammals, reptiles, and all), and over each of the eight states considered. Preliminary studies found that ordinary least squares would be a sufficient model form, although conditional autoregressive models were extensively considered. Other preliminary work examined issues of spatial autocorrelation and variable selection. The results indicate that the energy/productivity hypothesis consistently outperforms all other hypotheses in explaining species richness, across almost all spatial scales, geographic regions, and vertebrate classes. The performance of the climatic variability and habitat heterogeneity hypotheses varies for particular states or vertebrate classes. Vertebrate data quality was important; results for Colorado and Washington were frequently unusual, suggesting an incompatibility between their modeled vertebrate distributions and those of other states. Models of reptile richness also often showed substantially different characteristics than those for other vertebrates. Overall the results provide additional support to the energy/productivity hypothesis, from a more comprehensive methodological basis.

Summer 2006 PhD:

Title: Exploring the Geography of Routine Activity Theory: A Spatio-Temporal Test Using Street Robbery

Author: Groff, Elizabeth

Abstract: Many social phenomena have a spatio-temporal dimension and involve dynamic decisions made by individuals. Investigations focusing on the spatio-temporal dimensions of human behavior have received a great deal of theoretical attention; however, empirical testing of these theories has been handicapped by a lack of micro-level data and modeling tools that can capture the dynamic interactions of individuals and the context in which they occur. This research presents a methodology for evaluating theory through the implementation of a simulation model; the assumptions of the theory are operationalized in a model, a series of experiments are run, and the outcomes are analyzed to discover if they match what the theory would predict. Specifically, the concepts of routine activity theory (RAT) (Cohen and Felson, 1979) are formalized in a computational laboratory representing Seattle, Washington. The computational environment for implementation, Agent Analyst, merges agent-based modeling (ABM) software with geographic information systems (GIS). A strategy for developing activity spaces is implemented and demonstrates how agents can move along existing street networks, and land use patterns can be used to create representational activity spaces. Three versions of a model of street robbery are developed; each version implements a different level of constraints on agent's routine activities. In one version (Simple), individuals are either at home or not at home. In another, individuals follow a temporal schedule (Temporal). Last, individual's schedules are both temporally

and spatially constrained (Activity Space). A series of experiments are conducted which compare the incidence and spatial pattern of street robbery events from each version. The results of the experiments provide strong evidence of the important role routine activities play in street robbery events. The addition of temporal and spatio-temporal schedule constraints reduces the incidence and changes the pattern of street robberies. Support for routine activity theory's premise, as time spent away from home increases street robbery will increase, is found in the Simple and Temporal, but not the Activity Space version of the model.

Title: Improving Predictive Capabilities of Environmental Change with GLOBE Data

Author: Robin, Jessica

Abstract: This dissertation addresses two applications of Normalized Difference Vegetation Index (NDVI) essential for predicting environmental changes. The first study focuses on whether NDVI can improve model simulations of evapotranspiration for temperate Northern (> 35) regions. The second study focuses on whether NDVI can detect phenological changes in start of season (SOS) for high Northern (> 60) environments. The overall objectives of this research were to (1) develop a methodology for utilizing GLOBE data in NDVI research; and (2) provide a critical analysis of NDVI as a long-term monitoring tool for environmental change. GLOBE is an international partnership network of K-12 students, teachers, and scientists working together to study and understand the global environment. The first study utilized data collected by one GLOBE school in Greenville, Pennsylvania and the second utilized phenology observations made by GLOBE students in Alaska. Results from the first study showed NDVI could predict transpiration periods for environments like Greenville, Pennsylvania. In phenological terms, these environments have three distinct periods (QI, QII, and QIII). QI reflects onset of the growing season (mid March - mid May) when vegetation is greening up (NDVI < 0.60) and transpiration is less than 2mm/day. QII reflects end of the growing season (mid September - October) when vegetation is greening down and transpiration is decreasing. QIII reflects height of the growing season (mid May - mid September) when transpiration rates average between 2 and 5 mm per day and NDVI is at its maximum (>0.60). Results from the second study showed that a climate threshold of 153 ± 22 growing degree days was a better predictor of SOS for Fairbanks than a NDVI threshold applied to temporal AVHRR and MODIS datasets. Accumulated growing degree days captured the inter-annual variability of SOS better than the NDVI threshold and most closely resembled actual SOS observations made by GLOBE students. Overall, biweekly composites and effects of clouds, snow, and conifers limit the ability of NDVI to monitor phenological changes in Alaska. Both studies did show that GLOBE data provides an important source of input and validation information for NDVI research.

Title: ENDANGERED DRY DECIDUOUS FORESTS OF UPPER MYANMAR (BURMA): A MULTI-SCALE APPROACH FOR RESEARCH AND CONSERVATION

Author: Songer, Melissa A.

Abstract: Tropical dry forests are critically endangered and largely unprotected ecosystem. I used a multi-scale research approach to study Upper Myanmar's dry deciduous forests. At the broad scale I assessed how well existing land cover data can be used to map and monitor dry forests, and estimated the extent, distribution, and level of protection of these forests. At the landscape level I assessed spatial and temporal dynamics of deforestation in and around a dry forest protected area, Chatthin Wildlife Sanctuary (CWS), investigated land use pressures driving these changes, and evaluated effectiveness of protection efforts within the sanctuary. At the local scale I studied the degree to which people rely on dry forests for subsistence and the socioeconomic variables correlated with dependence on forest products. Using MODerate Resolution Imaging Spectroradiometer (MODIS) Normalized Difference Vegetation Index (NDVI) data to delineate remaining dry deciduous forests, I found that only 24,000 km2 of this forest type remain in Upper Myanmar--only 4% inside protected areas. At 81% accuracy, this map scored higher than existing global and regional land cover classifications for predicting dry forest. Employing satellite images covering the landscape in and around CWS (Landsat MSS, TM, ETM+ and ASTER) between the years 1973-2005 , I found

that 62% of forest was lost (1.93% annual rate) primarily from agricultural conversion and hydroelectric development. Sanctuary protection has been effective in slowing decline: loss rates inside CWS were 0.49% annually (16% total). However, forest inside the sanctuary is still declining at a rate above the global average and shows evidence of impact from forest product extraction around the boundaries. Based on interviews with 784 people living in 28 subsistence-based agricultural communities located in and around CWS, I found virtually all survey respondents depended on CWS for food, medicine, housing materials, and, above all, fuel wood. Poverty and socioeconomic limitations drive extractive activities. While CWS has been effective in slowing deforestation rates, alternative use strategies that benefit people will improve prospects for long-term conservation in the area. My results demonstrate that a multi-scaled research approach is essential for understanding the drivers impacting the rapidly-declining dry forests of Upper Myanmar.

Spring 2007 PhD:

Title: Analyzing the Impact of Participatory-Planned Conservation Policies in the Negril Environmental Protection Area, western Jamaica

Author: Miller Anderson, Lovette

Abstract: This dissertation research sought to determine the ways in which the participatory-planned conservation policies influence changes in local populations' natural resource use. The research took place in the Negril Environmental Protection Area, western Jamaica and covered the period 1990 to 2005. The two major questions asked were 1) In what ways do participatory-planned conservation policies influence changes in the protected area's natural resource use? 2) How does group membership and demography influence the perception of the conservation policies and of changes in natural resource use? The research employed trend analyses, content analyses, a population survey, discriminant analyses and semi-structured interviews to answer the research questions. In general, the research finds that national socioeconomic development interests were given priority over the participatory-planned conservation policies. The changes in local populations' natural resource use were primarily due to the national socioeconomic policies that were in place prior to the protected area designation as well as those that were implemented during the study period. Second, the research finds that, in general, groups that have shared histories were homogeneous in their views of conservation and/or development. In contrast, newer entrants to the protected area were generally heterogeneous in their views of conservation and/or development. Further, the research finds that changes in the demographic characteristics of local populations significantly influence the perception of conservation and development. For example, respondents who were relatively new to the protected area generally had a positive perception of conservation and of the decline in fishing jobs. In contrast, respondents who have lived there relatively longer had a negative perception of conservation and of the decline in fishing jobs. By examining the complexity of implementing the participatory-planned conservation policies in Negril's postcolonial and non-colonial socioeconomic and political landscape, this research extends the discourse on protected areas from large, relatively low populated areas to the complex geographic landscapes that currently describe some newer protected areas.

Title: Dynamics of the Nonprofit Sector and Urban Delivery of Services: A Geography of Services in East Baltimore, Maryland

Author: Cooper, Evelyn

Abstract: This research examines the relationship between nonprofit human service activities and the characteristics of client service areas by race, gender, income, age, level of poverty and education. The data used for this neighborhood level study were obtained from the Internal Revenue Service the 2002 Statistics of Income (SOI) Business Masterfile (BMF). Neighborhood data, obtained from the 2000 U.S. Census are used as surrogates for potential client areas and service needs. The response of nonprofit entities is determined by examining the quantity and distribution of human services available within the neighborhood to identify disparities in services distribution. Services are analyzed within the social and economic context of the

abject poverty and homelessness that pervades East Baltimore neighborhoods that can produce underserved areas. Services are not equally distributed across the study area. The primary results of the research show that services for the homeless, services for youth, and housing services are the most prominent service activities in East Baltimore. Services are generally matched to the population according to population needs. However, there appears to be a spatial mismatch between residents' needs and services provided for substance abuse an ex-offender services. Substance abuse rehabilitation services and ex-offender rehabilitation services are least prominent of all the nonprofit service activities. The initial analysis reveals that some neighborhoods are service rich areas while others are service poor. Despite a spatial mismatch in some service activities, the distribution of services is consistent with the view that nonprofit services are located in or near concentrations of potential clients and at-risk populations. A second analysis using factor analytical techniques reveals a number of complex and intriguing relationships between neighborhood characteristics and service activities. The findings underscore the importance of the relationship between service activities and community characteristics and that some variables, race, income, gender and education level have a positive influence on human services delivery. The research findings support the argument that service distribution of nonprofits is influenced by socioeconomic characteristics, and the scope of poverty in a community.

Title: Fire Dynamics and Woody Cover Changes in the Serengeti-Mara Ecosystem 2000 to 2005 - A Remote Sensing Approach

Author: Dempewolf, Jan

Abstract: The Serengeti-Mara savanna environment in East Africa is characterized by changing levels of woody cover and a dynamic fire regime. The relative proportion of woodland to grassland savanna affects animal habitat, biodiversity, and carbon storage, and is regulated by factors such as the fire regime (frequency, intensity, seasonality), and precipitation. The main objectives of this dissertation are to determine recent changes in woody cover at a regional scale and identify fire regimes and climate associated with these changes. Understanding these relationships is important for the assessment of future trajectories of woody cover under changing climate. Required spatially coherent data layers can only be obtained at the regional scale through the analysis of remote sensing data. Woody cover changes between 2000 and 2005 were derived from field data and a time series of MODIS satellite imagery at 500 m spatial resolution. Data layers on the controlling variables (fire frequency, seasonality, intensity and rainfall) were developed using a combination of remote sensing and model-based approaches. Burned areas were mapped using daily MODIS imagery at 250 m resolution. Outputs were used to make the requisite layers depicting fire frequency and seasonality. Fire intensity was derived using a model based on empirical relationships, mainly estimating fire fuel load as a function of rainfall and grazing. The combined data layers were analyzed using regression and decision tree techniques. Results suggest woody cover in central and northern Serengeti National Park continued to increase after 2000. Woody cover decreases were strongest in the wider Maswa Game Reserve area (MSW) under low precipitation conditions and late season burning. Woody cover losses in burned areas were also higher in the low fire frequency region of the Maasai Mara National Reserve (MNR). Fire seasonality was the most important fire regime parameter controlling woody cover in burned woodland savanna areas while fire intensity was most relevant for grassland savanna areas. Continued late season burning in drought years might cause further decrease of woody cover in MSW. MNR is expected to continue to be dominated by grassland savanna at similar fire frequency and browsing levels.

Title: The emergence of a local memorial landscape in the aftermath of violent tragedy: a study of Baltimore's Dawson murders, 2002-2005

Author: Steele, Christopher Perry

Abstract: Memorial landscapes are inextricably linked to the processes of national, regional, local, and individual identity formation; and are tightly bound to notions of place and space. A rich body of literature exists in the social sciences on the structure and function of national scale memorial landscapes. A nascent body of literature on informal memorial works and landscapes is emerging in the social sciences. The current study bridges these bodies of literature by investigating the collection

of memorial interventions as elements of a single memorial landscape and by focusing on local, human-scale remembrance over a three years period. A triangulated, multi-method, qualitative research design has been applied to the investigation of the material, discursive, and representational components of the memorial landscape which has emerged in Baltimore's Oliver neighborhood in response to the murder of all seven members of the Dawson family on October 16, 2002. The memorial landscape is viewed here as the manifestation of the community's negotiation between the production of space and the making of place. The data reveal that the initial years in the formation of a local-scale memorial landscape are bound up with complex sociopolitical processes. The outcomes of this research are that the formation of the local-scale memorial landscape is a complex and dynamic expression of sociopolitical identity and power; that memory work is transformative with regard to space and place; that there is merit in a more inclusive definition of the memorial landscape; that multiple geographic scales produce the memorial landscape; and that participation in local-scale memory work diminishes over time. Future research should focus upon the variability of memory work across race, class, gender, faith and geography at the local scale. Such an investigation has the potential to yield greater degrees of understanding of complexity and ambiguity of local-scale identity formation.

Summer 2007 PhD:

Title: mapping photosynthetically active radiation (PAR) using multiple remote sensing data

Author: Zheng, Tao

Abstract: Incident Photosynthetically Active Radiation (PAR) is an important parameter for terrestrial ecosystem models. Presently, deriving PAR using remotely sensed data is the only practical approach to meet the needs for large scale ecosystem modeling. The usefulness of the currently available PAR products is constricted by their limited spatial and temporal resolution. In addition, the applicability of the existing algorithms for deriving PAR using remotely sensed data are limited by their requirements for external atmospheric information. This study develops new algorithms to estimate incident PAR using remotely sensed data from MODIS (Moderate Resolution Imaging Spectroradiometer), GOES (Geostationary Operational Environmental Satellite), and AVHRR (Advanced Very High Resolution Radiometer). The new PAR algorithms differ from existing algorithms in that the new algorithms derive surface properties and atmospheric optical properties using time-series of at-sensor radiance without external atmospheric information. First, a new PAR algorithm is developed for MODIS visible band data. The validity of the algorithm's underpinning theoretical basis is examined and associated errors are analyzed in light of their impact on PAR estimation accuracy. Second, the MODIS PAR algorithm is adapted to AVHRR in order to take advantage of the long data acquisition record of AVHRR. In addition, the scaling of remote sensing derived instantaneous PAR to daily PAR is addressed. Last, the new algorithm is extended to GOES visible band data. Two major improvements of GOES PAR algorithm over that of MODIS and AVHRR are the inclusion of the bi-directional reflectance distribution function for deriving surface reflectance, and the procedure for excluding cloud-shadowed pixels in searching for observations made under clear skies. Furthermore, the topographic impact on PAR is accessed and corrected. To assess the effectiveness of the newly developed PAR algorithms, validation efforts have been made using ground measurements made at FLUXNET sites. The validations indicate that the new PAR algorithms for MODIS, GOES, and AVHRR are capable of reaching reasonably high accuracy with no need for external atmospheric information. This work is the first attempt to develop a unified PAR estimation algorithm for both polar-orbiting and geostationary satellite data. The new algorithms developed in this study have been used to produce incident PAR over North America routinely to support the North America Carbon Program.

Summer 2007 PhD:

Title: Identifying landslide hazards in a tropical mountain environment, using geomorphologic and probabilistic approaches

Author: Roa, Jose G

Abstract: The objective of this study is the performance, assessing, comparison and validation of a set of three landslide hazard maps: The geomorphological, the multicriteria evaluation (MCE) and the probabilistic (weights of evidence); in order to evaluate its accuracy, advantages and limitations, and finally state its reliability. These approaches were tested in a tropical mountain environment located in the central Venezuelan Andes. The scale of this study is regional. A landslide inventory map was generated through aerial-photointerpretation and by the processing of two sets of Landsat imagery via contrast-widening color composite, given as result the outline of 493 landslide polygons, then given the main role played for a digital elevation model (DEM) as data input, a DEM for the study area was built through remotely sensed data obtained from the shuttle radar topographical mission (SRTM) and optical stereographic imagery provided by the advanced spaceborne thermal emission and reflection radiometer (ASTER) system. Because of the comparative nature of this study, these data was preliminary processed via density analysis in order to establish a common background on the landsliding process - passive factors relationship, which was used later to set up the criteria applied in the geomorphological and multicriteria evaluation (MCE) approaches. As a way of validation, the accuracy and error rate of the three landslide hazard maps were performed by its comparison to the landslide inventory map. It was concluded that although the geomorphological approach achieved a better landslide predictive power for this study area at a regional scale, the remaining procedures can play a complementary role, for example the MCE plays a crucial role in an early assessment of landslide hazard which highlights the needs and improving necessary to achieve a better probabilistic approach, which can be later incorporated in a more objective geomorphological assessment. Results also showed that any methodology can be improved and even empowered by the development of better and more integrated standards for factor maps collection rather that the simplification of them, in that way, further studies at regional scale must explore the remotely sensed imagery capacities for generation of data bases addressing regional susceptibility to landsliding process.

Spring 2008 PhD:

Title: IMPACT OF CLIMATE CHANGE ON WILDLAND FIRE THREAT TO THE AMUR TIGER AND ITS HABITAT

Author: Loboda, Tatiana V

Abstract: Global biodiversity is increasingly threatened by combined pressures from human- and climate-related environmental change. Projected climate change indicates that these trends are likely to continue and may accelerate by the end of this century leading to large scale modification of species habitats. Such modification will be amplified by an increase in catastrophic natural events such as wildland fire - one of the dominant disturbance agents in boreal and temperate forests of the Russian Far East (RFE). In the RFE, large fire events lead to abrupt, extensive, and long-term conversion of forests to open landscapes, thus considerably impacting the habitat of the critically endangered Amur tiger (Panthera tigris altaica). A remotely sensed data-driven regional fire threat model (FTM) is developed to assess current and projected fire threat to the Amur tiger under scenarios of climate change. The FTM is parameterized to account for regional specifics of fire occurrence in the RFE and fire impacts on the Amur tigers, their main prey, and their habitat. Fire regimes are shown to be strongly influenced by anthropogenic use of fire and the monsoonal climate of the RFE, with large fire seasons observed during uncharacteristically dry years. Even with a large proportion of human ignition sources and periodic extreme events, fire currently poses a limited threat to the Amur tiger meta-population. The observed peaks in high fire threat conditions are localized in space and time and are likely to impact a small number of individual tigers. Under the wide range of the IPCC climate change scenarios, no considerable change in fire danger is expected by the mid-21st century. However, by the end of the 21st century under the A2 (regional self-reliance) scenario of the IPCC Special Report on Emissions, fire danger over the southern part of the RFE is predicted to increase by nearly 15%. An overlap of areas of likely increase in fire danger with areas of highest tiger habitat

quality results in a 20% mean yearly increase in fire threat with a mean monthly increase of ~40% in August. The results have implications for conservation strategies aimed at securing long-term habitat availability.

Title: Identifying and Understanding North American Carbon Cycle Perturbations from Natural and Anthropogenic Disturbances

Author: Neigh, Christopher Sean

Abstract: Carbon dioxide accumulating in our atmosphere is one of the most important environmental threats of our time. Humans and changing climate, separately or in concert, have affected global vegetation, biogeochemical cycles, biophysical processes, and primary production. Recent studies have found temporary carbon stores in North American vegetation due to land-cover land-use change, but have yet to characterize regional mechanisms across the continent. This research implemented multi-resolution remote sensing data, coupled with ecosystem simulations, to determine the importance of fine-scale disturbance in our understanding of dynamics that drove and/or perturbed carbon sequestration in North America from 1982 through 2005. The research involved three components: 1) identified large regions with natural and anthropogenic vegetation disturbances; 2) determined causes of disturbances with high-spatial resolution data and mapped associative fine-scale land cover dynamics; and 3) used prior empirical observations in simulations to quantify mechanisms that altered carbon pathways. Investigation of normalized difference vegetation index data from the NOAA series of Advanced Very High Resolution Radiometers found regions in North America that experienced marked increases in photosynthetic capacity at various times from 1982 to 2005. Inspection of anomalies with multi-resolution data from Landsat, IKONOS, aerial photography, and ancillary data revealed a wide range of causes: climatic influences; severe drought and subsequent recovery; irrigated agriculture expansion; insect outbreaks followed by logging and subsequent regeneration; and forest fires with subsequent regeneration. Fine-scale land cover change dynamics were included in Carnegie-Ames-Stanford approach simulations to enhance replication of carbon cycle processes found in empirical observations. Integration of multi-resolution remote sensing data, with carbon ecosystem process modeling, improved regional understanding and accounting of dynamic fine-scale spatial-temporal North American ecosystem carbon balance by a total of ~10 – 250 teragrams of carbon. Coarse resolution simulations could fail to identify important local scale drivers which impact regional carbon balance.

Title: Towards an integrated system for vegetation fire monitoring in the Amazon basin

Author: Schroeder, Wilfrid

Abstract: Biomass burning is a major environmental problem in Amazonia. Satellite fire detections represent the primary source of information for fire alert systems, decision makers, emissions modeling groups and the scientific community in general. Those various users create a growing demand for good quality fire data of higher spatial and temporal resolution that can only be achieved via integration of multiple satellite fire detection products. The main objective of this dissertation was to develop an integrated fire product capable of improved monitoring and characterization of fire activity in Brazilian Amazonia. Two major active fire detection algorithms based on MODIS and GOES data were used to meet the users demand for fire information. Large differences involving the performance of the MODIS and GOES fire products required the quantification of omission and commission errors in order to allow for appropriate treatment of individual detections produced by each data set. Relatively small omission errors due to cloud obscuration were estimated for Brazilian Amazonia. Regional climate conditions result in reduced cloud coverage in areas of high fire activity during the peak of the dry season, therefore minimizing the effects of cloud obscuration on fire detection omission errors. Clear sky omission and commission errors were largely dependent on the vegetation and background conditions. Relatively large commission errors occurring in high percentage tree cover areas suggested that fire detection algorithms must either be regionalized or incorporate additional tests to provide more consistent fire information across a broader range of surface conditions. Integration of MODIS and GOES fire products using a physical parameter describing fire energy (i.e., fire radiative power) was proven difficult due to limitations involving the interplay

between sensor characteristics and the types of fires that occur in Amazonia. As part of this research, a new integrated product was generated based on binary fire detection information derived from MODIS and GOES data, incorporating adjustments to reduce commission and omission errors and optimizing the complementarities among individual detections. These findings made a significant contribution to fire monitoring science in Amazonia and could play an important role in the development of future fire detection algorithms for tropical regions.

Title: Estimating High Spatial Resolution Clear-Sky Land Surface Longwave Radiation Budget from MODIS and GOES Data

Author: Wang, Wenhui

Abstract: The surface radiation budget (SRB) is important in addressing a variety of scientific and application issues related to climate trends, hydrological and biogeophysical modeling, and agriculture. The three longwave components of SRB are surface downwelling, upwelling, and net longwave radiation (LWDN, LWUP, and LWNT). Existing surface longwave radiation budget (SLRB) datasets have coarse spatial resolution and their accuracy needs to be greatly improved. This study develops new hybrid methods for estimating instantaneous clear-sky high spatial resolution land LWDN and LWUP from the Moderate Resolution Imaging Spectroradiometer (MODIS, 1km) and the Geostationary Operational Environmental Satellites (GOES, 2-10 km) data. The hybrid methods combine extensive radiation transfer (physical) and statistical analysis (statistical) and share the same general framework. LWNT is derived from LWDN and LWUP. This study is the first effort to estimate SLRB using MODIS 1 km data. The new hybrid methods are unique in at least two other aspects. First, the radiation transfer simulation accounted for land surface emissivity effect. Second, the surface pressure effect in LWDN was considered explicitly by incorporating surface elevation in the statistical models. Nonlinear models were developed using the simulated databases to estimate LWDN from MODIS TOA radiance and surface elevation. Artificial Neural Network (ANN) models were developed to estimate LWUP from MODIS TOA radiance. The LWDN and LWUP models can explain more than 93.6% and 99.6% of variations in the simulated databases, respectively. Preliminary study indicates that similar hybrid methods can be developed to estimate LWDN and LWUP from the current GOES-12 Sounder data and the future GOES-R data. The new hybrid methods and alternative methods were evaluated using two years of ground measurements at six validation sites from the Surface Radiation Budget Network (SURFRAD). Validation results indicate the hybrid methods outperform alternative methods. The mean RMSEs of MODIS-derived LWDN, LWUP, and LWNT using the hybrid methods are 16.88, 15.23, and 17.30 W/m2. The RMSEs of GOES-12 Sounder-derived LWDN and LWUP are smaller than 23.70 W/m2. The high spatial resolution MODIS and GOES SLRB derived in this study is more accurate than existing datasets and can be used to support high resolution numerical models.

Summer 2008 PhD:

Title: Estimation of land surface radiation budget from MODIS data

Author: Kim, Hye-Yun

Abstract: Land Surface Radiation Budget (SRB) is responsible for the available energy between the Earth and atmosphere system. Net radiation is the driving force for the transportation and exchange of all matter at the interface between the Earth's surface and the atmosphere, and therefore, significantly affects the climatic forming and change. Accurate estimation of shortwave net radiation (Sn), cloudy-sky allwave net radiation (Rn), and daily integrated Sn at high spatial resolution is essential in regional and global land surface models. The current SRB products have fine temporal and coarse spatial resolutions not suitable for land applications. New hybrid algorithm for Sn estimation has been developed in this study. Sn is estimated from MODIS data under both clear- and cloudy-sky conditions without requiring coarser resolution ancillary data. Therefore, estimated Sn retains the spatial resolution of the raw input data. Surface all-wave (both shortwave and longwave) net radiation (Rn) controls the input of latent and sensible heat flux into the atmosphere over the Earth's surface. Meteorological datasets are spatially limited and satellite data have the advantage of global spatial coverage; however, difficulty in accurately

35

estimating cloudy-sky longwave net radiation (Ln) undermines efforts to estimate cloudy-sky all-wave net radiation. This study presents methods for estimating cloudy-sky Rn using Sn and other surface variables at 1 km spatial resolution. Daily integrated Sn is closely related to carbon, water and energy flux simulations. A daily integrated Sn product with a 1-km spatial resolution supports recent high resolution numerical climate and ecosystem simulations. This study describes a method for estimating daily integrated Sn in 1 km resolution based on instantaneous Sn data. All these algorithms have been validated using seven sites of a SURFace RADiation budget observing network (SURFRAD) in United States, instantaneous Sn is also compared with GEWEX/SRB and ISCCP data. The new hybrid algorithm developed in the study can be easily implemented to generate operational global products. These finer spatial resolution datasets capture the specific sequence of the redistribution of the available energy at the Earth's surface; therefore, they support recent high resolution land surface models.

Fall 2008 PhD:

Title: Transforming Espacios Culturales into Cultural Spaces: How the Salvadoran Community is Establishing Evangelical Protestan Churches as Transtional Institutions in the Washington D.C. Metropolitan Area

Author: Luna, Ronald W

Abstract: Transnationalism is a theoretical concept that explains the current migration patterns that are in stark contrast to the prevailing theories of Acculturation and Assimilation. Migration can no longer be described as a linear process. Transnational "migrants" have a foot in both worlds. No matter where their legal citizenship lies, they have a dual social citizenship. Transnationalism is used not just to identify how immigrants maintain their culture in the host country but just as importantly, how they establish and maintain social and economic linkages between both countries. Transnationalism lacks a cohesive definition and a way to test whether it is present. The Salvadoran Evangelical Protestant Churches in the Washington D.C. Metropolitan Area serves as case study to examine how the transnationalism process occurs. Key findings include understanding first how transnational communities are established in the host country, as well as how transnational institutions such as Salvadoran Evangelical Protestant Churches began their process of transnationalism in the home country. Furthermore, the Salvadoran Evangelical Protestant Churches reflect and parallel the overall transnational Salvadoran historical and demographic trends. In addition, Salvadoran Evangelical Protestant Churches reinforce the process of transnationalism in the Washington D.C. Metropolitan Area through memory, ethnic identity, transmigration, networks, and cultural space. It is important to understand that ethnic churches are a major facilitator of transnationalism in the host country; however, there are many other transnational institutions that reinforce the process of transnationalism. This study examines independently each element, which contributes to the process of transnationalism: memory, ethnic identity, transmigration, networks, and cultural space. The research concludes by redefining transnationalism as the process that by which transmigrants create economic, political, social, or cultural networks by participating directly or indirectly in transmigration. Furthermore, transnationalism refers to the process by which migrants become transnational agents when they create linkages at various scales, over time, and across space between the host and home countries and vice versa.

Title: Changes in Amazon Forest Structure from Land-Use Fires: Integrating Satellite Remote Sensing and Ecosystem Modeling

Author: Morton, Douglas

Abstract: Fire is the dominant method of deforestation and agricultural maintenance in Amazonia, and these land-use fires frequently escape their intended boundaries and burn into adjacent forests. Initial understory fires may increase forest flammability, thereby creating a positive fire feedback and the potential for long-term changes in Amazon forest structure. The four studies in this dissertation describe the development and integration of satellite remote sensing and ecosystem modeling

36

approaches to characterize land-use fires and their consequences in southern Amazon forests. The dissertation contributes three new methods: use of the local frequency of satellite-based active fire detections to distinguish between deforestation and maintenance fires, use of satellite data time series to identify canopy damage from understory fires, and development of a height-structured fire sub-model in Ecosystem Demography, an advanced ecosystem model, to evaluate the impacts of a positive fire feedback on forest structure and composition. Conclusions from the dissertation demonstrate that the expansion of mechanized agricultural production in southern Amazonia increased the frequency and duration of fire use compared to less intensive methods of deforestation for pasture. Based on this increase in the frequency of land-use fires, fire emissions from current deforestation may be higher than estimated for previous decades. Canopy damage from understory fires was widespread in both dry and wet years, suggesting that drought conditions may not be necessary to burn extensive areas of southern Amazon forests. Understory fires were five times more common in previously-burned than unburned forest, providing satellite-based evidence for a positive fire feedback in southern Amazonia. The impact of this positive fire feedback on forest structure and composition was assessed using the Ecosystem Demography model. Scenarios of continued understory fires under current climate conditions show the potential to trap forests in a fire-prone structure dominated by early-successional trees, similar to secondary forests, reducing net carbon storage by 20-46% within 100 years. In summary, satellite and model-based results from the dissertation demonstrate that fire-damaged forests are an extensive and long-term component of the frontier landscape in southern Amazonia and suggest that a positive fire feedback could maintain long-term changes in forest structure and composition in the region.

Spring 2009 PhD:

Title: SEASONAL AND INTERANNUAL VARIABILITY OF EMISSIONS FROM CROP RESIDUE BURNING IN THE CONTIGUOUS UNITED STATES

Author: McCarty, Jessica

Abstract: Crop residue burning is a global agricultural practice used to remove excess residues before or after harvest. Crop residue burning in the contiguous United States (CONUS) has been documented at the regional and state-level by governmental organizations and in the scientific literature. Emissions from crop residue burning in the CONUS have been found to impair local and regional air quality, leading to serious health impacts and legal disputes. Currently, there is no baseline estimate for the area and emissions of crop residue burning in the CONUS. A bottom-up model for emissions calculations is employed to calculate CO_2, CO, CH_4, NO_2, SO_2, PM2.5, PM10, and Pb emissions from crop residue burning in the CONUS for the years 2003 through 2007. These atmospheric species have negative impacts on air quality and human health and are important to the carbon cycle. Spatially and temporally explicit cropland burned area and crop type products for the CONUS, necessary for emissions calculations, are developed using remote sensing approaches. The majority of crop residue burning and emissions in the CONUS are shown to occur during the spring (April - June) and fall harvests (October - December). On average, 1,239,000 ha of croplands burn annually in the CONUS with an average interannual variability of ± 91,200 ha. In general, CONUS crop residue burning emissions vary less than ±10% interannually. The states of Arkansas, California, Florida, Idaho, Texas, and Washington emit 50% of PM10, 51% of CO_2, 52% of CO, and 63% of PM2.5 from all crop residue burning in the CONUS. Florida alone emits 17% of all annual CO_2, CO, and PM2.5 emissions and 12% of annual PM10 emissions from crop residue burning. Crop residue burning emissions in the CONUS account for as little as 1% of global agricultural emissions and as much as 15% of all agricultural burning emissions estimates in North America, including Mexico and Canada. The results have implications for international, federal, and state-level reporting and monitoring of air quality and greenhouse gas and carbon emissions aimed at protecting human health, mitigating climate change, and understanding the carbon cycle.

Summer 2009 PhD:

Title: Socio-demographic Variables as Risk Factors for Neurologic Disease due to Infection by West Nile Virus

Author: Pugh, Lashale D.

Abstract: The primary question asked by this research was "Can socio-demographic characteristics be considered risk factors for neurological disease due to West Nile Virus?" Based on the results of this research, the answer is yes. Socio-demographic characteristics identified as risk factors are related to educational attainment, income, age of housing and poverty. Socio-economic variables were useful in discriminating between high moderate and low infection rates and showed modest capabilities of estimating actual rates. One of the most important findings of the research was the public health officials own ideas about the greatest obstacle to preventing the spread of WNV in their jurisdictions. General consensus is that more resources be made available to properly combat this pathogen. More staff and funds to pay workers and provide support for every aspect of surveillance, prevention and control are deemed necessary. Specifically, there is a great need for personnel with specialized training. The support and encouragement of public health organizations is needed to attract individuals into academic fields that will prepare them for infectious disease epidemiology which is crucial to the field. Local level response may have been dictated by resource availability as opposed to the perceived threat. Surprisingly, length of time in the current position was more closely related to lower infection rates than length of surveillance. This suggests that more experienced public health workers likely have some knowledge or experience which was not made known through the survey. Policy implications suggest increased education for public health officials, especially encouragement of more experienced workers to share their knowledge and experiences with less experienced workers.

Title: Using a Socio-Cultural Framework to Evaluate Farmland Preservation Policy Success in Maryland

Author: Russo, Richard Anthony

Abstract: The intent of Maryland's farmland preservation policy has remained constant over the past three decades -- to preserve productive farmland and woodland for the continued production of food and fiber for all of Maryland's citizens. Therefore, thirty years after this statutory goal was made, how effective have Maryland's farmland preservation programs been in reaching this goal? This study addresses the absence of cultural and social analysis in the evaluation of farmland preservation program success in Maryland's metropolitan counties. In utilizing a socio-cultural framework of analysis, this study shows that farmland preservation policies (in their drafting, implementation, and evaluation) are a cultural process, the outcomes of which create and sustain a particular social space and cultural landscape. Theories on the social production of space and landscape are relevant to the task of farmland preservation and agricultural economic development in metropolitan areas. The failure of farmland preservation policy in Maryland has, in part, been the failure to take culture seriously. Quantitative indicators show that Maryland's state farmland preservation program has achieved moderate success in securing a productive agricultural land base over its first three decades, but has not been successful in preserving farming as a viable "way of life," has not stopped the erosion in the value of agricultural sales, and has not reversed the marketplace alienation between producers and consumers in the state.

Fall 2009 PhD:

Title: AN APPROACH TO ESTIMATE GLOBAL BIOMASS BURNING EMISSIONS OF ORGANIC AND BLACK CARBON FROM MODIS FIRE RADIATIVE POWER

Author: Ellicott, Evan Andrew

Abstract: Biomass burning is an important global phenomenon affecting atmospheric composition with significant implications for climatic forcing. Wildland fire is the main global source of fine primary carbonaceous aerosols in the form of organic carbon (OC) and black carbon (BC), but uncertainty in aerosol emission estimates from biomass burning is still rather large. Application of satellite based measures of fire radiative power (FRP) has been demonstrated to offer an alternative approach to estimate biomass consumed with the potential to estimate the associated emissions from fires. To date, though, no study has derived integrated FRP (referred to as fire radiative energy or FRE) at a global scale, in part due to limitations in temporal or spatial resolution of satellite sensors. The main objective of this research was to quantify global biomass burning emissions of organic and black carbon aerosols and the corresponding effect on planetary radiative forcing. The approach is based on the geophysical relationship between the flux of FRE emitted, biomass consumed, and aerosol emissions. Aqua and Terra MODIS observations were used to estimate FRE using a simple model to parameterize the fire diurnal cycle based on the long term ratio between Terra and Aqua MODIS FRP and cases of diurnal satellite measurements of FRP made by the geostationary sensor SEVIRI, processing sensor VIRS, and high latitude (and thus high overpass frequency) observations by MODIS. Investigation of the atmospheric attenuation of MODIS channels using a parametric model based on the MODTRAN radiative transfer model indicates a small bias in FRE estimates which was accounted for. Accuracy assessment shows that the FRE estimates are precise (R^2 = 0.85), but may be underestimated. Global estimates of FRE show that Africa and South America dominate biomass burning, accounting for nearly 70% of the annual FRE generated. The relationship between FRE and OCBC estimates made with a new MODIS-derived inversion product of daily integrated biomass burning aerosol emissions was explored. The slope of the relationship within each of several biomes yielded a FRE-based emission factor. The biome specific emission factors and FRE monthly data were used to estimate OCBC emissions from fires on a global basis for 2001 to 2007. The annual average was 17.23 Tg which was comparable to previously published values, but slightly lower. The result in terms of global radiative forcing suggests a cooling effect at both the top-of-atmosphere (TOA) and surface approaching almost -0.5 K which implies that biomass burning aerosols could dampen the warming effect of green house gas emissions. An error budget was developed to explore the sources and total uncertainty in the OCBC estimation. The results yielded an uncertainty value of 58% with specific components of the process warranting future consideration and improvement. The uncertainty estimate does not demonstrate a significant improvement over current methods to estimate biomass burning aerosols, but given the simplicity of the approach should allow for refinements to be made with relative ease.

Title: SPATIAL AND SEASONAL DISTRIBUTION OF CARBON DIOXIDE EMISSIONS FROM FOSSIL-FUEL COMBUSTION; GLOBAL, REGIONAL, AND NATIONAL POTENTIAL FOR SUSTAINABLE BIOENERGY FROM RESIDUE BIOMASS AND MUNICIPAL SOLID WASTE

Author: Gregg, Jay Sterling

Abstract: Combustion of fossil fuels releases carbon dioxide (CO_2) into the atmosphere, and has led to an increase in the atmospheric concentration of CO_2. CO_2 is a greenhouse gas, and the increase in concentration leads to an increase in global temperatures and global climatic change. Fossil-fuel consumption, along with cement production, is responsible for 80% of anthropogenic carbon emissions and consumption of fossil fuels continues to increase. Despite its importance to the global climate and the global carbon cycle, data for fossil fuel CO_2 emissions are traditionally maintained only on national levels and annual time steps. A method is developed to improve the spatiotemporal resolution to the leading energy consuming countries of the world. The method uses energy consumption datasets as well as other ancillary datasets to apportion national annual emissions totals into sub-national and monthly emissions datasets by fuel type. Emissions patterns are highly variable both temporally and spatially by fuel type, and detailed information on the distribution of emissions

improves our understanding of the global carbon cycle and leads to better understanding of the spatial and seasonal distribution of the drivers of global change. </br> In the endeavor to develop alternatives to fossil fuels, advanced biomass energy has garnered much attention because of its renewable nature and its potential to approach carbon-neutrality. As co-products, agricultural and forestry residues as well as municipal solid waste (MSW) are potential low-cost and sustainable biomass feedstocks for energy production. The role of residue biomass within the future global energy portfolio is projected and quantified under the context of environmental and economic sustainability. The potential for residue biomass is projected for the next century under a reference (business-as-usual) scenario and a scenario that includes a hypothetical climate policy that limits carbon emissions. While residue biomass alone cannot replace fossil fuels, a substantial amount of energy potentially could come from this resource, particularly in a global economic market under a climate policy that caps CO_2 emissions from fossil fuels.

Title: The Changing Spatial Distribution of the Population of the Former Soviet Union

Author: Heleniak, Timothy Edmund

Abstract: When it existed, the Soviet Union was a closed economic and migration space with tightly-controlled movement of goods, people, and ideas across its borders. It was also an ethnically complex region with 130 different nationalities, fifty-three with territorially-based ethnic homelands, of which fifteen became the successor states to the Soviet Union. The breakup of the Soviet Union, the transition towards market economies, and the liberalization of the societies have together greatly impacted the lives of people in the region. Many found themselves in countries or regions with dramatically shrunken economies or as ethnic minorities in newly independent states and many have chosen migration as a strategy of adaptation to the new circumstances in which they found themselves. Using established migration theory, this dissertation examines the causes of migration among the fifteen successor states since 1991. The main test was to compare the relative impact of economic factors versus ethnic factors driving migration movements in the post-Soviet space. The results showed that while some of the movements could be classified as people migrating to their ethnic homelands, a majority could be explained by neoclassical economic theories of migration and the large income differentials that have resulted from the economic transition. Other theories that have been found to explain migration in other world migration systems were found to also be applicable in the former Soviet Union.

Title: Improving Satellite Leaf Area Index Estimation Based On Various Integration Methods

Author: Wang, Dongdong

Abstract: Leaf Area Index (LAI) is an important land surface biophysical variable that is used to characterize vegetation amount and activity. Current satellite LAI products, however, do not satisfy the requirements of the modeling community due to their large uncertainties and frequent missing values. Each LAI product is currently generated from only one satellite sensor data. There is an urgent need for advanced methods to integrate multiple LAI products to improve the product's accuracy and integrality for various applications. To meet this need, this study proposes four methods, including the Optimal Interpolation (OI), Bayesian Maximum Entropy (BME), Multi-Resolution Tree (MRT) and Empirical Orthogonal Function (EOF), to integrate multiple LAI products. Three LAI products have been considered in this study: Moderate Resolution Imaging Spectroradiometer (MODIS), Multi-angle Imaging SpectroRadiometer (MISR) and Carbon cYcle and Change in Land Observational Products from an Ensemble of Satellites (CYCLOPES) LAI. As the basis of data integration, this dissertation first validates and intercompares MODIS and CYCLOPES LAI products and also evaluates their geometric accuracies. The CYCLOPES LAI product has smoother temporal profiles and fewer spatial variations, but tends to produce spurious large errors in winter. The Locally Adjusted Cubic-spline Capping algorithm is revised to smooth multiple years' average and variance. Although OI, BME and MRT based methods have been used in other fields, this is the first research to employ them in integrating multiple LAI products. This dissertation also presents a new integration method based on EOF to solve the problem of large data volume and inconsistent temporal

resolution of different datasets. High resolution LAI reference maps generated with ground measurements are used to validate these algorithms. Validation results show that all of these four methods can fill data gaps and reduce the errors of the existing LAI products. The data gaps are filled with information from adjacent pixels and background. These algorithms remove the spurious large temporal and spatial variation of the original LAI products. The combination of multiple satellite products significantly reduces bias. OI and BME can reduce the RMSE from 1.0 (MODIS) to 0.7 and reduce the bias from +0.3 (MODIS) and -0.2 (CYCLOPES) to -0.1. MRT can produce similar results with OI but with significantly improved efficiency. EOF also generates the results with the RMSE of 0.7 but zero bias. Limited ground measurement data hardly prove which methods outperform the others. OI and BME theoretically produce statistically optimal results. BME relaxes OI's linear and Gaussian assumption and explicitly considers data error, but bears a much higher computational burden. MRT has improved efficiency but needs strict assumptions on the scale transfer function. EOF requires simpler model identification, while it is more "empirical" than "statistical". The original contributions of this study mainly include: 1) a new application of several different integration methods to incorporate multiple satellite LAI products to reduce uncertainties and improve integrality, 2) an enhancement of the Locally Adjusted Cubic-spline Capping by revising the end condition, 3) a novel comprehensive comparison of MODIS C5 LAI product with other satellite products, 4) the development of a new LAI normalization scheme by assuming the linear relationship between measurement error and LAI natural variance to account for the inconsistency between products, and finally, 5) the creation of a new data integration method based on EOF.

Spring 2010 PhD:

Title: THE EFFECTS OF CHANGES IN LAND COVER AND LAND USE ON NUTRIENT LOADINGS TO THE CHESAPEAKE BAY USING FORECASTS OF URBANIZATION

Author: Roberts, Allen Derrick

Abstract: This dissertation examined the effects of land cover and land use (LC/LU) change on nutrient loadings (mass for a specified time) to the Chesapeake Bay, after future projections of urbanization were applied. This was accomplished by quantifying the comprehensive impacts of landscape on nutrients throughout the watershed. In order to quantify forecasted impacts of future development and LC/LU change, the current (2000) effects of landscape composition and configuration on total nitrogen (TN) and total phosphorus (TP) were examined. The effects of cover types were examined not only at catchment scales, but within riparian stream buffer to quantify the effects of spatial arrangement. Using the SPAtially Referenced Regressions On Watershed Attributes (SPARROW) model, several compositional and configurational metrics at both scales were significantly correlated to nutrient genesis and transport and helped estimate loadings to the Chesapeake Bay with slightly better accuracy and precision. Remotely sensed forecasts of future (2030) urbanization were integrated into SPARROW using these metrics to project TN and TP loadings into the future. After estimation of these metrics and other LC/LU-based sources, it was found that overall nutrient transport to the Chesapeake Bay will decrease due to agricultural land losses and fertilizer reductions. Although point and non-point source urban loadings increased in the watershed, these gains were not enough to negate decreased agricultural impacts. In catchments forecasted to undergo urban sprawl conditions by 2030, the response of TN locally generated within catchments varied. The forecasted placement of smaller patches of development within agricultural lands of higher nutrient production was correlated to projected losses. However, shifting forecasted growth onto or adjacent to existing development, not agricultural lands, resulted in projected gains. This indicated the importance of forecasted spatial arrangement to projected TN runoff from the watershed. In conclusion, comprehensive landscape analysis resulted in differences in simulations of current and future nutrient loadings to the Chesapeake Bay, as a result of urbanization and LC/LU change. With eutrophication from excess nutrients being the primary challenge to the estuary, information gained from the estimation of these effects could improve the future management and regulation of the Chesapeake Bay.

Title: Tackling Uncertainties and Errors in the Satellite Monitoring of Forest Cover Change

Author: Song, Kuan

Abstract: This study aims at improving the reliability of automatic forest change detection. Forest change detection is of vital importance for understanding global land cover as well as the carbon cycle. Remote sensing and machine learning have been widely adopted for such studies with increasing degrees of success. However, contemporary global studies still suffer from lower-than-satisfactory accuracies and robustness problems whose causes were largely unknown. Global geographical observations are complex, as a result of the hidden interweaving geographical processes. Is it possible that some geographical complexities were not expected in contemporary machine learning? Could they cause uncertainties and errors when contemporary machine learning theories are applied for remote sensing? This dissertation adopts the philosophy of error elimination. We start by explaining the mathematical origins of possible geographic uncertainties and errors in chapter two. Uncertainties are unavoidable but might be mitigated. Errors are hidden but might be found and corrected. Then in chapter three, experiments are specifically designed to assess whether or not the contemporary machine learning theories can handle these geographic uncertainties and errors. In chapter four, we identify an unreported systemic error source: the proportion distribution of classes in the training set. A subsequent Bayesian Optimal solution is designed to combine Support Vector Machine and Maximum Likelihood. Finally, in chapter five, we demonstrate how this type of error is widespread not just in classification algorithms, but also embedded in the conceptual definition of geographic classes before the classification. In chapter six, the sources of errors and uncertainties and their solutions are summarized, with theoretical implications for future studies. The most important finding is that, how we design a classification largely pre-determines what we eventually get out of it. This applies for many contemporary popular classifiers including various types of neural nets, decision tree, and support vector machine. This is a cause of the so-called overfitting problem in contemporary machine learning. Therefore, we propose that the emphasis of classification work be shifted to the planning stage before the actual classification. Geography should not just be the analysis of collected observations, but also about the planning of observation collection. This is where geography, machine learning, and survey statistics meet.

Title: MANAGEMENT MATTER? EFFECTS OF CHARCOAL PRODUCTION MANAGEMENT ON WOODLAND REGENERATION IN SENEGAL

Author: Wurster, Karl

Abstract: In Senegal, as in many parts of Africa, nearly 95% of its growing urban population depends on charcoal as their primary cooking energy. Extraction of wood for charcoal production is perceived to drive forest degradation. The Senegalese government and international donor agencies have created different forest management types with the ultimate goal of sustainably managing forests. This research combines local ecological knowledge, ecological surveys and remote sensing analysis to better understand questions related to how extraction for charcoal production and forest management affect Senegalese forests. Information derived from 36 semi-structured interviews suggests that the forests are degrading, but are depended on for income, grazing and energy. Interviewees understand the rules governing forest management types, but felt they had limited power or responsibility to enforce forest regulations. Ecological survey results confirmed that plots harvested for charcoal production are significantly different in forest structure and tree species composition than undisturbed sites. Across harvested and undisturbed and within forest management types the Combretum glutinosum species dominated (53% of all individuals and the primary species used for charcoal production) and demonstrated robust regenerative capacity. Few large, hardwood or fruiting trees were observed and had insufficient regenerative capacity to replace current populations. Species diversity was higher in co-managed areas, but declined after wood was harvested for charcoal production. Proximity to villages, roads and park edges in harvested and undisturbed plots and within forest management types had little impact on forest structure and tree diversity patterns with the harvesting of trees for charcoal spread consistently throughout the landscape. Remote sensing analysis with the MISR derived k(red) parameter demonstrated its ability to accurately classify broad land classes and showed potential when differentiating between pre- and post-harvest conditions over a three year time period, but could not accurately detect subtle changes in forest cover of known harvest time since last harvest in a single MISR scene. This

research demonstrated the utility of multidisciplinary research in assessing the effects of charcoal production and forest management types on Senegalese forests; concluding that the effects of charcoal production on forest characteristics and regenerative capacity are consistent throughout all forest management types.

Spring 2011 PhD:

Title: Modeling L-Band Microwave Emission From Soil-Vegetation System

Author: Joseph, Alicia T.

Abstract: During a field campaign covering the 2002 corn growing season, a dual polarized tower mounted L-band (1.4 GHz) radiometer (LRAD) provided brightness temperature (T¬B) measurements at preset intervals, incidence and azimuth angles. These radiometer measurements were supported by an extensive characterization of land surface variables including soil moisture, soil temperature, vegetation biomass, and surface roughness. During the period from May 22, 2002 to August 30, 2002 a range of vegetation water content (W) of 0.0 to 4.3 kg m-2, ten days of radiometer and ground measurements were available. Using this data set, the effects of corn vegetation on surface emissions are investigated by means of a semi-empirical radiative transfer model. Additionally, the impact of roughness on the surface emission is quantified using T¬B measurements over bare soil conditions. Subsequently, the estimated roughness parameters, ground measurements and horizontally (H)-polarized TB are employed to invert the H-polarized transmissivity (γh) for the monitored corn growing season.

Title: QUANTIFICATION OF ERROR IN AVHRR NDVI DATA

Author: Nagol, Jyoteshwar Reddy

Abstract: Several influential Earth system science studies in the last three decades were based on Normalized Difference Vegetation Index (NDVI) data from Advanced Very High Resolution Radiometer (AVHRR) series of instruments. Although AVHRR NDVI data are known to have significant uncertainties resulting from incomplete atmospheric correction, orbital drift, sensor degradation, etc., none of these studies account for them. This is primarily because of unavailability of comprehensive and location-specific quantitative uncertainty estimates. The first part of this dissertation investigated the extent of uncertainty due to inadequate atmospheric correction in the widely used AVHRR NDVI datasets. This was accomplished by comparison with atmospherically corrected AVHRR data at AErosol RObotic NETwork (AERONET) sunphotometer sites in 1999. Of the datasets included in this study, Long Term Data Record (LTDR) was found to have least errors (precision=0.02 to 0.037 for clear and average atmospheric conditions) followed by Pathfinder AVHRR Land (PAL) (precision=0.0606 to 0.0418), and Top of Atmosphere (TOA) (precision=0.0613 to 0.0684). `Although the use of field data is the most direct type of validation and is used extensively by the remote sensing community, it results in a single uncertainty estimate and does not account for spatial heterogeneity and the impact of spatial and temporal aggregation. These shortcomings were addressed by using Moderate Resolution Imaging Spectrometer (MODIS) data to estimate uncertainty in AVHRR NDVI data. However, before AVHRR data could be compared with MODIS data, the nonstationarity introduced by inter-annual variations in AVHRR NDVI data due to orbital drift had to be removed. This was accomplished by using a Bidirectional Reflectance Distribution Function (BRDF) correction technique originally developed for MODIS data. The results from the evaluation of AVHRR data using MODIS showed that in many regions minimal spatial aggregation will improve the precision of AVHRR NDVI data significantly. However temporal aggregation improved the precision of the data to a limited extent only. The research presented in this dissertation indicated that the NDVI change of ~0.03 to ~0.08 NDVI units in 10 to 20 years, frequently reported in recent literature, can be significant in some cases. However, unless spatially explicit uncertainty metrics are quantified for the specific spatiotemporal aggregation schemes used by these studies, the significance of observed differences between sites and temporal trends in NDVI will remain unknown.

43

Title: MAPPING FOREST STRUCTURE AND HABITAT CHARACTERISTICS USING LIDAR AND MULTI-SENSOR FUSION

Author: Swatantran, Anuradha

Abstract: This dissertation explored the combined use of lidar and other remote sensing data for improved forest structure and habitat mapping. The objectives were to quantify aboveground biomass and canopy dynamics and map habitat characteristics with lidar and /or fusion approaches. Structural metrics from lidar and spectral characteristics from hyperspectral data were combined for improving biomass estimates in the Sierra Nevada, California. Addition of hyperspectral metrics only marginally improved biomass estimates from lidar, however, predictions from lidar after species stratification of field data improved by 12%. Spatial predictions from lidar after species stratification of hyperspectral data also had lower errors suggesting this could be viable method for mapping biomass at landscape level. A combined analysis of the two datasets further showed that fusion could have considerably more value in understanding ecosystem and habitat characteristics. The second objective was to quantify canopy height and biomass changes in in the Sierra Nevada using lidar data acquired in 1999 and 2008. Direct change detection showed overall statistically significant positive height change at footprint level (ΔRH100 = 0.69 m, +/- 7.94 m). Across the landscape, ~20 % of height and biomass changes were significant with more than 60% being positive, suggesting regeneration from past disturbances and a small net carbon sink. This study added further evidence to the capabilities of waveform lidar in mapping canopy dynamics while highlighting the need for error analysis and rigorous field validation Lastly, fusion applications for habitat mapping were tested with radar, lidar and multispectral data in the Hubbard Brook Experimental Forest, New Hampshire. A suite of metrics from each dataset was used to predict multi-year presence for eight migratory songbirds with data mining methods. Results showed that fusion improved predictions for all datasets, with more than 25% improvement from radar alone. Spatial predictions from fusion were also consistent with known habitat preferences for the birds demonstrating the potential of multi- sensor fusion in mapping habitat characteristics. The main contribution of this research was an improved understanding of lidar and multi-sensor fusion approaches for applications in carbon science and habitat studies.

Title: FOREST LOSS AND FRAGMENTATION IN SOUTHERN BAHIA, BRAZIL: IMPLICATIONS FOR THE EXTINCTION RISK OF GOLDEN-HEADED LION TAMARINS (Leontopithecus chrysomelas)

Author: Zeigler, Sara Lynn

Abstract: Golden-headed lion tamarins (GHLTs; Leontopithecus chrysomelas) are Endangered arboreal primates endemic to the Atlantic Forest of Brazil, where continuing loss of forest and its connectivity are major threats. The objectives of my research were to assess the vulnerability of GHLTs to habitat loss, fragmentation, and threats related to small population size in the context of past, current, and future trends in range-wide forest cover in Brazil's Atlantic Forest. I did this by conducting a supervised classification of Landsat 5TM remotely-sensed imagery to define past and current forest cover in the region, analyzing connectivity patterns in a graph theoretical framework, projecting recent deforestation patterns into the future using a multi-layer perceptron neural network, and modeling GHLT metapopulaton viability using population viability analysis. I found that forest cover has declined throughout the range of the species by 13% over the last 20 years, and only one habitat patch is large enough on its own to support a genetically viable GHLT population able to recover from extrinsic threats such as fire and disease. Functional landscape connectivity, which is important for population persistence, acquisition of resources, and maintenance of genetic diversity, is low at the distance and movement cost thresholds likely associated with this arboreal species that is rarely seen in non-forest matrix. The majority of remaining forest cover throughout the species' range is found in patches that are either (1) too small to support even a single group of GHLTs or (2) found at low elevations, in areas of high human population density, or in close proximity to previously cleared areas--conditions that are associated with past deforestation patterns and that make current habitat vulnerable to loss. Finally, I found that many of the known GHLT populations have a moderate to high risk of local extinction even over short time scales and assuming no further forest loss, and their presence may represent extinction debt. Continued deforestation will accelerate population declines and local extinction events. The results of my dissertation research suggest that GHLTs and their habitat face significant threats and low viability in the future because of both ultimate and proximate drivers of extinction.

Fall 2011 PhD:

Title: Using the urban regime framework to analyze flood hazard mitigation at the local scale

Author: Waite, Jacqueline Leigh

Abstract: The tally of injuries and property losses to extreme weather and flooding seems to be only growing in recent years. Global circulation changes and regional climate changes coupled with land use and land cover changes are creating more potentially hazardous spaces and places. The U.S. federal government sets guidelines for preparing for disasters and provides the bulk of disaster relief and recovery funding. In this country, however, the authority for instituting specific adaptation and hazard mitigation strategies lies with local governments. Local governments are responsible for guiding land-use decisions, for zoning and building codes, and for enforcing other strategies mandated by the federal government, such as the purchasing of flood insurance for homes with federal government-backed mortgages. Much of the research involves how and to what extent hazards policies can be best introduced and applied at local levels given competing economic, infrastructural, and social priorities. What has not been clearly established in the hazards research literature is a connection between established hazard mitigation objectives and urban policy-making in the years following a major disaster. The city of Tulsa, Oklahoma is a test case for deepening our understanding of the relationship between the two. This study uses an expanded version of the urban regime framework to ground data collection and analysis in the framework's three main focus areas: agenda, capacity, and relationships. The framework is expanded to include the environmental and natural resource dimensions of agenda setting, and pays special attention to spatial and locational dimensions of flood control. Planning documents, financial records and print media data sources are coded and analyzed for themes and patterns. Findings suggest that successful implementation of hazard mitigation goals and principles in Tulsa led to new questions about `balanced growth' development, land-use planning, and resource use that have implications for hazard mitigation sustainability. This study finds that some insights offered by the urban regime theory are helpful to this particular question and possibly other questions in the hazards/disaster research agenda.

Title: Semantic integration of geospatial concepts - a study on land use land cover classification systems

Author: Wei, Hua

Abstract: In GI Science, one of the most important interoperability is needed in land use and land cover (LULC) data, because it is key to the evaluation of LULC's many environmental impacts throughout the globe (Foley et al. 2005). Accordingly, this research aims to address the interoperability of LULC information derived by different authorities using different classificatory approaches. LULC data are described by LULC classification systems. The interoperability of LULC data hinges on the semantic integration of LULC classification systems. Existing works on semantically integrating LULC classification systems has a major drawback in finding comparable semantic representations from textual descriptions. To tackle this problem, we borrowed the method of comparing documents in information retrieval, and applied it to comparing LULC category names and descriptions. The results showed significant improvement comparing to previous works. However, lexical semantic methods are not able to solve the semantic heterogeneities in LULC classification systems: the confounding conflict - LULC categories under similar labels and descriptions have different LULC status in reality, and the naming conflict - LULC categories under different labels represent similar LULC type. Without confirmation of their actual land cover status from remote sensing, lexical semantic method cannot achieve reliable matching. To discover confounding conflicts and reconcile naming conflicts, we developed an innovative method of applying remote sensing to the integration of LULC classification systems. Remote sensing is a means of observation on actual LULC status of individual parcels. We calculated parcel level statistics from spectral and textural data, and used these statistics to calculate category similarity. The matching results showed this approach fulfilled its goal - to overcome semantic heterogeneities and achieve more reliable and accurate matching between LULC classifications in the majority of cases. To overcome the limitations of either method, we combined the two by aggregating their output similarities, and achieve

better integration. LULC categories that post noticeable differences between lexical semantics and remote sensing once again remind us of semantic heterogeneities in LULC classification systems that must to be overcome before LULC data from different sources become interoperable and serve as the key to understanding our highly interrelated Earth system.

Spring 2012 PhD:

Title: Land Use/Land Cover Change and its impacts on Streams and Estuarine Water Quality in the Galveston Bay Watershed, Texas

Author: Baruah, Angira

Abstract: The nature of society's relationship with coastal environments is illustrated well by Galveston Bay watershed in Texas, which is an important economic, recreational, and environmental asset. However, the watershed has been altered by growth in the port of Houston and by human populations and industry. High rates of inter-basin transfer of water was observed from the USGS stream gauging station data for those stations lying within the highly urbanized area with increasing trends in river discharge. Land use and land cover classification for the lower Galveston Bay watershed from 1989-2009 showed an increase in urban growth followed by a decrease in agriculture and forest cover. Land cover data for four selected catchments: Brays Bayou, Greens Bayou, East Fork San Jacinto and West Fork San Jacinto within the Galveston Bay watershed were combined for "space for time-substitution" analysis to increase the number of observations and check for correlations between percent land cover and stream hydrology and stream chemistry with significant results. Variations in percent urban, forest, pasture and wetlands explained most of the variability in water yield followed by rainfall which had a small but significant effect. Results of the analysis clearly demonstrated increasing water yields and nutrient inputs with increasing urban land use. Population changes explained the increasing trends in water yields for the highly urbanized catchments of Brays Bayou and Greens Bayou. Similarly, highly significant positive relationships were observed between river nutrients and total population for Brays Bayou, Greens Bayou, and the West Fork San Jacinto catchments. Results from this research show that anthropogenic changes in the watershed have a significant impact on the river flow and stream water quality. Continued development and future population growth in the highly urbanized areas near Houston will cause increasing water demand from adjacent watersheds resulting in higher downstream flows in the estuary. Increasing freshwater flow in the estuaries results in higher nutrient loading and Bay stratification. Higher rates of stratification caused by rising temperatures as a result of global warming and larger freshwater flow along with increased nutrient inputs will increase the vulnerability of the Galveston Bay to severe eutrophication during the warm summer months.

Title: ESTIMATING LAND SURFACE ALBEDO FROM SATELLITE DATA

Author: He, Tao

Abstract: Land surface albedo, defined as the ratio of the surface reflected incoming and outgoing solar radiation, is one of the key geophysical variables controlling the surface radiation budget. Surface shortwave albedo is widely used to drive climate and hydrological models. During the last several decades, remotely sensed surface albedo products have been generated through satellite-acquired data. However, some problems exist in those products due to instrument measurement inaccuracies and the failure of current retrieving procedures, which have limited their applications. More significantly, it has been reported that some albedo products from different satellite sensors do not agree with each other and some even show the opposite long term trend regionally and globally. The emergence of some advanced sensors newly launched or planned in the near future will provide better capabilities for estimating land surface albedo with fine resolution spatially and/or temporally. Traditional methods for estimating the surface shortwave albedo from satellite data include three steps: first, the satellite observations are converted to surface directional reflectance using the atmospheric correction algorithms; second, the surface bidirectional reflectance distribution function (BRDF) models are inverted through the fitting of the surface reflectance composites; finally,

the shortwave albedo is calculated from the BRDF through the angular and spectral integration. However, some problems exist in these algorithms, including: 1) "dark-object" based atmospheric correction methods which make it difficult to estimate albedo accurately over non-vegetated or sparsely vegetated area; 2) the long-time composite albedo products cannot satisfy the needs of weather forecasting or land surface modeling when rapid changes such as snow fall/melt, forest fire/clear-cut and crop harvesting occur; 3) the diurnal albedo signature cannot be estimated in the current algorithms due to the Lambertian approximation in some of the atmospheric correction algorithms; 4) prior knowledge has not been effectively incorporated in the current algorithms; and 5) current observation accumulation methods make it difficult to obtain sufficient observations when persistent clouds exist within the accumulation window. To address those issues and to improve the satellite surface albedo estimations, a method using an atmospheric radiative transfer procedure with surface bidirectional reflectance modeling will be applied to simultaneously retrieve land surface albedo and instantaneous aerosol optical depth (AOD). This study consists of three major components. The first focuses on the atmospheric radiative transfer procedure with surface reflectance modeling. Instead of executing atmospheric correction first and then fitting surface reflectance in the previous satellite albedo retrieving procedure, the atmospheric properties (e.g., AOD) and surface properties (e.g., BRDF) are estimated simultaneously to reduce the uncertainties produced in separating the entire radiative transfer process. Data from the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard Terra and Aqua are used to evaluate the performance of this albedo estimation algorithm. Good agreement is reached between the albedo estimates from the proposed algorithm and other validation datasets. The second part is to assess the effectiveness of the proposed algorithm, analyze the error sources, and further apply the algorithm on geostationary satellite - the Spinning Enhanced Visible and InfraRed Imager (SEVIRI) onboard Meteosat Second Generation (MSG). Extensive validations on surface albedo estimations from MSG/SEVIRI observations are conducted based on the comparison with ground measurements and other satellite products. Diurnal changes and day-to-day changes in surface albedo are accurately captured by the proposed algorithm. The third part of this study is to develop a spatially and temporally complete, continuous, and consistent albedo maps through a data fusion method. Since the prior information (or climatology) of albedo/BRDF plays a vital role in controlling the retrieving accuracy in the optimization method, currently available multiple land surface albedo products will be integrated using the Multi-resolution Tree (MRT) models to mitigate problems such as data gaps, systematic bias or low information-noise ratio due to instrument failure, persistent clouds from the viewing direction and algorithm limitations. The major original contributions of this study are as follows: 1) this is the first algorithm for the simultaneous estimations of surface albedo/reflectance and instantaneous AOD by using the atmospheric radiative transfer with surface BRDF modeling for both polar-orbiting and geostationary satellite data; 2) a radiative transfer with surface BRDF models is used to derive surface albedo and directional reflectance from MODIS and SEVIRI observations respectively; 3) extensive validations are made on the comparison between the albedo and AOD retrievals, and the satellite products from other sensors; 4) the slightly modified algorithm has been adopted to be the operational algorithm of Advanced Baseline Imager (ABI) in the future Geostationary Operational Environmental Satellite-R Series (GOES-R) program for estimating land surface albedo; 5) a framework of using MRT is designed to integrate multiple satellite albedo products at different spatial scales to build the spatially and temporally complete, continuous, and consistent albedo maps as the prior knowledge in the retrieving procedure.

Title: Analyze Municipal Annexations: Case Studies in Frederick and Caroline Counties of Maryland, 1990-2010

Author: Pomeroy, Jennifer Yongmei

Abstract: Municipal annexations play an important role in converting undeveloped land to development, influencing landscape change. However, the existing literature does not explore the links between annexation and development. An additional inadequacy is the failure to consider environment/landscape aspect of annexation. Therefore, this dissertation proposes a new theoretical framework that is drawn upon political ecology and structuration theory to examine annexation phenomenon processes: environmental/landscape sensitivity and its causal social structures. Frederick and Caroline counties in Maryland from 1990 to 2010 were the two case-study areas because both counties experience increased annexation activities and are representative of suburban and exurban settings at rural - urban continuum of the United States. The data used in this qualitative research were collected from multiple data sources, including key-person interviews, a review of Maryland's

annexation log, annexation applications and meeting minutes, and observations at public meetings. Triangulating content analysis, discourse analysis, and social network analysis, this research finds that environmental/landscape is not considered more widely in annexation practices. Although environmental mitigation measures are considered at site level if a property has site environmental elements, the overall environmental/landscape sensitivity is low. It is also found that the economic-centered space remains dynamic in the annexation processes determining annexation approvals and low-density zoning. In addition, the triangulated analyses reveal that current social structures are not conducive to environmental-conscious landscape planning because environmentally oriented non-profit organizations and residents are injected at a later stage of annexation process and is not being fully considered in the evaluation process. Power asymmetry in current annexation structures is due to a lack of environmental voice in annexation processes. The voice of such groups needs to be institutionalized to facilitate more tenable annexation practices.

Title: ENHANCEMENT OF A CANOPY REFLECTANCE MODEL FOR UNDERSTANDING THE SPECULAR AND SPECTRAL EFFECTS OF AN AQUATIC BACKGROUND IN AN INUNDATED TIDAL MARSH

Author: Turpie, Kevin Ross

Abstract: The presence of water produces unique specular and spectral characteristics in an inundated tidal marsh canopy. The aquatic substrate can affect conventional attempts to retrieve canopy characteristics, such as structure information (e.g., canopy height, leaf area index, etc.) or plant species composition. The background reflectance can also influence spectral analysis of plant characteristics based on hyperspectral data. A model to account for the aquatic substrate would be useful to understanding spectral field measurements and remote sensing of this type of land cover. To that end, an existing vegetation canopy reflectance model is combined with an aquatic background model to account for the effects of an aquatic substrate on the top-of-canopy bidirectional reflectance. The aquatic background model attempts to account for the optical effects of an inundated marsh substrate through the inclusion of first-principle models of water reflectance. The enhanced model is applied to multi-angular reflectance measured along transects of a brackish marsh canopy. This allows us to explore whether the enhanced model can be used in retrieving the leaf area index (LAI) using non-destructive, above- canopy measurements. Then the original and the enhanced canopy reflectance models are compared with multi-angular reflectance data to test whether the change is effective in capturing specular effects of an inundated canopy. Furthermore the reflectance data and model are used to identify the influence of the background on the spectral characteristics of the canopy pertaining to vegetation. The spectral signature produced by the aquatic background model is quite different from the spectra of dry or unsaturated soil, which would be associated with terrestrial applications. The aquatic background model signature is used to explain the features seen in a field spectroscopy experiment, where canopy inundation levels were artificially raised. This project demonstrates the utility of developing a vegetation canopy model with an aquatic background and identifies challenges and directions for improved performance.

Title: The impact of agricultural irrigation on land surface characteristics and near surface climate in China

Author: Zhu, Xiufang

Abstract: It is well known that land cover and land use change can significantly influence the climate system by modulating surface-atmosphere exchanges. Land management, such as irrigation, also has a profound influence on the climate system. Irrigation can alter the water and energy flux from ground surface to the atmosphere and further influence near surface climate. Considering its dramatic expansion during the last century, the widespread use of irrigation has had an ongoing impact on our climate system. However, until now, this relationship between increased irrigation and its effect on climate system has not been well examined. The main objective of this dissertation is to quantify the irrigation impacts on land surface characteristics and near surface climate over China by using both observational (remote sensing and meteorological observation) and modeling studies with four specific questions: Where are the irrigated areas in China? What might have happened in the past? What will happen as a result of irrigation expansion in the future? And what is the relationship between the land cover land use change (LCLUC) impact and the irrigation impact on near surface climate in China? To answer these

questions, I 1) developed three irrigation potential indices and produced a high resolution irrigation map of China; 2)analyzed and compared meteorological and remote sensing observations in irrigated and non-irrigated agriculture areas of China; 3) simulated both irrigation and LCLUC impact on land surface energy balance components (i.e., land surface temperature, latent flux, and sensible flux) and near surface climate (i.e., air temperature, water vapor, relative humidity) of China in the past (1978-2004) and also in two future time periods (2050 and 2100) by using the Community Land Model and compared the impact of irrigation with that of LUCC. Meteorological observations in Jilin Province show that the temperature differences between highly and lightly irrigated areas are statistically significant. The differences are highly correlated with the effective irrigation area (EIA) and sown area of crop (CSA). Results from satellite observations show that highly irrigated areas corresponded to lower albedo and daytime land surface temperature (LST), and higher normalized difference vegetation index (NDVI) and evapotranspiration (ET). The difference between highly and lightly irrigated areas is bigger in drier areas and in drier years. The modeling studies show that the irrigation impact on temperature is much less in the future than in the 20th century and that irrigation impacts more on the maximum air temperature than on the minimum air temperature. Both contemporary and future irrigation simulations show, nationally, irrigation decreases daily maximum temperature (Tmax) but increase daily minimum temperature (Tmin). Daily mean temperature (Tmean) decreases in contemporary irrigation simulations but increases in most of the cases in future irrigation simulations. In the 20th century, nationally, the spray irrigation leads to a decrease in Tmax of 0.079K and an increase in Tmin of 0.022K. Nationally, the spray irrigation leads to a decrease in Tmax between 0.022K and 0.045K and an increase in Tmin between 0.019K and 0.057K under future scenarios. This study demonstrates that the irrigation patterns (flood irrigation and spray irrigation) have statistically significant impacts on local climate. Moreover, this study suggests that, in the national respective, the impacts of changes in land management on climate are not comparable to the impacts of changes in land cover land use. This dissertation on irrigation and its impact is the first study which focuses solely on China using observational and modeling methods. The results from this dissertation contribute to a better understanding of the irrigation impact on near-surface climate which can improve our knowledge of how human activities influence climate, guide future policies aimed at mitigating or adapting to climate change, and help design a precise model to project the impact of irrigation on the climate system and irrigation requirements in the future. It can also be useful in assessing future food and water security issues.

Summer 2012 PhD:

Title: Impacts of Conflict on Land Use and Land Cover in the Imatong Mountain Region of South Sudan and Northern Uganda

Author: Gorsevski, Virginia

Abstract: The Imatong Mountain region of South Sudan makes up the northern most part of the Afromontane conservation `biodiversity hotspot' due to the numerous species of plants and animals found here, some of which are endemic. At the same time, this area (including the nearby Dongotana Hills and the Agoro-Agu region of northern Uganda) has witnessed decades of armed conflict resulting from the Sudan Civil War and the presence of the Ugandan Lord's Resistance Army (LRA). The objective of my research was to investigate the impact of war on land use and land cover using a combination of satellite remote sensing data and semi-structured interviews with local informants. Specifically, I sought to 1) assess and compare changes in forest cover and location during both war and peace; 2) compare trends in fire activity with human population patterns; and 3) investigate the underlying causes influencing land use patterns related to war. I did this by using a Disturbance Index (DI), which isolates un-vegetated spectral signatures associated with deforestation, on Landsat TM and ETM+ data in order to compare changes in forest cover during conflict and post-conflict years, mapping the location and frequency of fires in subsets of the greater study area using MODIS active fire data, and by analyzing and summarizing information derived from interviews with key informants. I found that the rate of forest recovery was significantly higher than the rate of disturbance both during and after wartime in and around the Imatong Central Forest Reserve (ICFR) and that change in net forest cover remained largely unchanged for the two time periods. In contrast, the nearby Dongotana Hills experienced relatively high rates of disturbance during both periods; however, post war period losses were largely offset by gains in forest cover, potentially indicating opposing patterns in human population movements and land use activities within these two areas. For the Agoro-Agu Forest Reserve (AFR) region northern Uganda, the rate of forest recovery was much higher during the second period, coinciding with
49

the time people began leaving overcrowded Internally Displaced Persons (IDP) camps. I also found that fire activity largely corresponded to coarse-scale human population trends on the South Sudan and northern Uganda side of the border in that post-war fire activity decreased for all areas in South Sudan and northern Uganda except for areas near the larger towns and villages of South Sudan, where people have begun to resettle. Fires occurred most frequently in woodlands on the South Sudan side, while the greatest increase in post-war, northern Ugandan fires occurred in croplands and the forested area around the Agoro-Agu reserve, Interviews with key informants revealed that while some people fled the area during the war, many others remained in the forest to hide; however, their impact on the forests during and after the conflict has been minimal; in contrast, those interviewed believed that wildlife has been largely depleted due to the widespread access to firearms and lack of regulations and enforcement. This study demonstrates the utility of using a multi-disciplinary approach to examine aspects of forest dynamics and fire activity related to human activities and conflict and as such contributes to the nascent but growing body of research on armed conflict and the environment.

Title: DETERMINING CONSERVATION PRIORITIES AND PARTICIPATIVE LAND USE PLANNING STRATEGIES IN THE MARINGA-LOPORI-WAMBA LANDSCAPE, DEMOCRATIC REPUBLIC OF THE CONGO

Author: Nackoney, Janet

Abstract: Deforestation and forest degradation driven largely by agricultural expansion are key drivers of biodiversity loss in the tropics. Achieving sustainable and equitable management of land and resources and determining priority areas for conservation activities are important in the face of these advancing pressures. The Congo Basin of Central Africa contains approximately 20% of the world's remaining tropical forest area and serves as important habitat for over half of Africa's flora and fauna. The Government of the Democratic Republic of the Congo (DRC) is currently laying the foundation for a national land use plan for conservation and sustainable use of its forests. Since 2004, the African Wildlife Foundation (AWF) has led efforts to develop a participatory land use plan for the Maringa-Lopori-Wamba (MLW) Landscape located in northern DRC. The landscape was recognized in 2002 as one of twelve priority landscapes in the Congo Basin targeted for the establishment of sustainable management plans. This dissertation focuses on the development of geospatial methods and tools for determining conservation priorities and assisting land use planning efforts in the MLW Landscape. The spatio-temporal patterns of recent primary forest loss are analyzed and complemented by the development of spatial models that identify the locations of 42 forest blocks and 32 potential wildlife corridors where conservation actions will be most important to promote future viability of landscape-wide terrestrial biodiversity such as the bonobo (*Pan paniscus*). In addition, the research explores three scenarios of potential agricultural expansion by 2050 and provides spatially-explicit information to show how trade-offs between biological conservation and human agricultural livelihoods might be balanced in land use planning processes. The research also describes a methodological approach for integrating spatial tools into participatory mapping processes with local communities and demonstrates how the resulting spatial data can be used to inform village-level agricultural land use for resource planning and management. Conclusions from the work demonstrate that primary forest loss is intensifying around agricultural complexes and that wildlife corridors connecting least-disturbed forest blocks are most vulnerable to future forest conversion. Conservation of these areas is possible with the development of land use plans in collaboration with local communities.

Title: TOWARDS A BETTTER UNDERSTANDING OF FOREST CHANGE PROCESSES IN THE CONTIGUOUS U.S.

Author: Schleeweis, Karen Grace

Abstract: Estimates of forest canopy areal extent, configuration and change have been developed from satellite based imagery and ground based inventories to improve understanding of forest dynamics and how they interact with other earth systems across many scales. The number of these types of studies has grown in recent years. Yet, few have assessed the multiple change processes underlying observed forest canopy dynamics across large spatio-temporal extents. To support these types of

assessments, a more detailed and integrated understanding of the geographic patterns of the multiple forest change processes across the contiguous US (CONUS) is needed. This study examined a novel data set from the North American Forest dynamics (NAFD) project that provides a dense temporal record (1984-2005) of forest canopy history across the U.S., United States Forest Service (USFS) ground inventory data, and ancillary geospatial data sets on forest change processes (wind, insect, fire, harvest and conversion to suburban/urban land uses) across the CONUS to develop a more robust understanding of the implications of the shifting dynamics of forest change processes and our ability to measure their effect on forest canopy dynamics. A geodatabase of forest change processes was created to support synoptic and specific quantitative analysis of change processes support through space and time. Using the geodatabase, patterns of forest canopy losses from NAFD and USFS data and the underlying causal process were analyzed across multiple scales. This research has shown that the overlap of multiple disturbance processes leads to complex patterns across the nation's forested landscape that can only be fully understood in relation to forest canopy losses at fine scales. Regional statistics confounded the direction and magnitude of forest canopy loss from multiple change processes operating on the landscape. Data gaps and uncertainty associated with process data prevent a full quantitative analysis of the proportion of forest area affected by each forest change process considered here. Fine scale data were critical for interpreting the highly variable NAFD canopy change observations and their ability to capture the continuously changing spatial and temporal characteristics of forest change processes across the CONUS.

Title: A GENERALIZED APPROACH TO WHEAT YIELD FORECASTING USING EARTH OBBSERVATIONS: DATA CONSIDERATIONS, APPLICATION, AND RELEVANCE

Author: Inbal Becker-Reshef

Abstract: In recent years there has been a dramatic increase in the demand for timely, comprehensive global agricultural intelligence. The issue of food security has rapidly risen to the top of government agendas around the world as the recent lack of food access led to unprecedented food prices, hunger, poverty, and civil conflict. Timely information on global crop production is indispensable for combating the growing stress on the world's crop production, for stabilizing food prices, developing effective agricultural policies, and for coordinating responses to regional food shortages. Earth Observations (EO) data offer a practical means for generating such information as they provide global, timely, cost-effective, and synoptic information on crop condition and distribution. Their utility for crop production forecasting has long been recognized and demonstrated across a wide range of scales and geographic regions. Nevertheless it is widely acknowledged the EO data could be better utilized within the operational monitoring systems and thus there is a critical need for research focused on developing practical robust methods for agricultural monitoring. Within this context this dissertation focused on advancing EO-based methods for crop yield forecasting and on demonstrating the potential relevance for adopting EO-based crop forecasts for providing timely reliable agricultural intelligence. This thesis made contributions to this field by developing and testing a robust EO-based method for wheat production forecasting at state to national scales using available and easily accessible data. The model was developed in Kansas (KS) using coarse resolution NDVI time series data in conjunction with out-of-season wheat masks and was directly applied in Ukraine to assess it transferability. The model estimated yields within 7% in KS and 10% in Ukraine of final estimates 6 weeks prior to harvest. The relevance of adopting such methods to provide timely reliable information to crop commodity markets was demonstrated through a 2010 case study.

2.7 Graduate Program Benchmarks

Benchmark	Time	Action
1. Completion of required coursework	As soon as possible or not later than end of 2nd year of study depending on background.	Completion of required coursework is needed prior to the Comprehensive Portfolio Assessment
2. Successful completion of the Comprehensive Portfolio Assessment (CPA)	As soon as possible or not later than end of 1st or 2nd year of study depending on background.	Failure to pass CPA may result in discontinued funding and/or dismissal
3. Defense of Dissertation Proposal	End of 2nd or 3rd years depending on background.	Termination of funding if not proposal is not defended in a specified time.
4. Advancement to Candidacy. Completion of steps 1 – 3 represent the Department's requirements for Advancing to Candidacy	End of 2nd or 3rd years depending on background.	Failure to advance by the end of 3rd or 4th year results in termination of funding and may result in dismissal.
5. Positive annual review	Annually	Negative review may result in termination of funding. Two successive reviews automatically results in termination from program
6. Completion of dissertation	Five years from entrance into program	

2.8 Graduate Course Offerings

Fall 2012	Title	Instructor	Description
632	Economic Geography	Silva	An advanced graduate level introduction to the effects of geography on economic activities and the effects of economic incentives, institutions, and activities on the nature and sustainability of human and environmental geographic systems.
636	Qualitative Methods	Geores	Use of qualitative methods for qualitative geographic research. Design procedures and analysis of qualitative studies are the focus of the course. Includes readings and trying out various methods. Students will be able to present their own research and use it as an example throughout the course.
642	Ecosystem Processes and Human Habitability	Prince	Biological and biogeographical processes relevant to the capability of the earth's biota to support the demands of its human populations.
673	GIS Modeling	Yeo	Process modeling and spatial analysis within the GIS context. Introduces theoretical fundamentals and conceptual approaches to frame and represent geographical phenomena and spatial decision making.
748F	Forest Modeling	Hurtt	Dynamic modeling of forest including time series, spatial extents and use of scale
788N	Nature and Practice of Science	Kellner	Introduces students to the nature and practice of science in physical and human geography, including practical methods for research productivity, professional, societal and ethical obligations of scientists, the philosophy of science and the scientific literature. Students will prepare and critically evaluate research proposals.
Spring 2013	**Title**	**Instructor**	**Description**
600	Introduction to Human Geography	Kasischke	Introduces students to current trends and developments in human geography in the areas of geography as social science, space and place, and human dimensions of global change, and to research procedures in this field.
606	Quantitative Spatial Analysis	Huang	Multivariate statistical method applications to spatial problems. Linear and non-linear correlation and regression, factor analysis, cluster analysis. Spatial statistics including: trend surfaces, sequences, point distributions. Applications orientation.
614	Human Dimensions of Global Change	Geores	The intersection of human and biophysical systems from the vantage point of the impact of human actions on the environment are examined. The impact of the biophysical environment on humans is also discussed.
646	Watershed Hydrology, Modeling and Policy	Yeo	Introduction to physical watershed hydrology/nonpoint water pollution, basic concepts of computer simulation models for watershed science, and conservation issues related to watershed management.
671	Remote Sensing Instruments and Observations	Goward	Detailed examination of land remote sensing instruments, observatories and resultant measurements in the optical portion of the EM spectrum. Includes computer-based exercises that examine the importance of data geo-registration and radiometric calibration in land measurements.

676	Advanced Programming for Geography and Remote Sensing	Giglio	Comprehensive instruction is provided in the advanced use of a commercial programming language and analysis tool used for scientific programming and data visualization, with an emphasis on applications in geography and remote sensing or GIS.
788R	Land Cover Characterization Using Multi-spectral ….	Hansen	Students will be introduced to the image processing steps required for characterizing land cover extent and change. Key components of land cover characterization, including image interpretation, algorithm implementation, feature space selection, thematic output definition, and scripting will be discussed and implemented.

2.9   Graduate Outcomes Assessment Rubrics

	Portfolio Stage	Proposal Development	Middle Stage	Dissertation Defense	Postgraduate Stage
Assessment points	End of 1st or 2nd years	End of 2nd or 3rd years	After advancement to candidacy	End of 4th or 5th years	After graduation
Mechanisms	Portfolio rubric; Annual Report	Proposal defense rubric	Middle stage rubric; Annual Reports	Dissertation Defense rubric	Exit survey
Benchmarks	80% of the students shall pass their Portfolio Comprehensive Review within 2 years. 80% of the individual questions on the Portfolio Comprehensive Rubric shall achieve a rating of Meets Expectations or better. 90% of the students receive a satisfactory annual progress report (where applicable)	80% of students defend their proposal within 3 years 80% of the individual question rubrics on the Proposal Defense Rubric shall achieve a rating of Meets Expectations or better. 90% of the students receive a satisfactory annual progress report (where applicable)	At least 50% of students shall either attend or present a paper at a regional, national or international conference. At least 50% of students shall submit a paper (as first or second author) to a peer-reviewed journal. At least 75% of all students shall fulfill either (1) or (2) above (i.e. 75% of all students must have *either* attended, presented or submitted a paper). 90% of the students receive a positive annual review.	At least 90% will defend their Dissertation with 4 or 5 years (depending on initial track) from entry into the Program At least 50% will have had a paper accepted for publication at the time of their defense. 90% of the individual questions on the Dissertation Defense Rubric shall achieve a rating of Meets Expectations or better.	At least 80% will have obtained employment relevant to his/her degree within 6 months of completion of the degree. At least 80% of the questions on the exit survey receive a score of 2 ("Meets Expectations") or better.
Feedback Mechanism	Evaluation/recommendations from Graduate Committee at final Spring Faculty meeting. Review of previous years actions at this meeting. Implementation by Graduate Committee in the following Fall semester (subject to Faculty Committee approval).				

2.10 PhD placement

Employment of recently graduated PhDs					
Last Name	**First Name**	**Degree Sought**	**Date of Exit**	**Occupation**	**Company**
Carter	Catherine	PhD	200501	Artist	Self Employed
Reitsma	Femke	PhD	200501	Asst. Professor	University of Edinburgh
Hyer	Edward	PhD	200507	Research Scientist	Naval Research Lab
Jantz	Claire	PhD	200507	Asst. Professor	Shippensburg University
Lang	Megan	PhD	200507	Research Scientist	USDA
Wessels	Konrad	PhD	200507	Research Scientist	Univ of Pretoria
Wilson	James	PhD	200507	Asst. Professor	Old Dominion University
Hyde	Peter	PhD	200508	???	
Peterson	Birgit	PhD	200508	Research Scientist	USGS Sioux Falls Data Ctr
Lindsay	Francis	PhD	200508	Administrator	NASA HQ
Kearney	Barbara	PhD	200601	CountyStat Analyst	County Government
Fleming	David	PhD	200601	Chief Scientist, Director Geospatial Intelligence	Northrup-Grumman Aerospace Systems
Slayback	Daniel	PhD	200601	Research Scientist	NASA GSFC
Read	Chung Hye Kim	PhD	200601		National Geospatial-Intelligence Agency
Giglio	Louis	PhD	200601	Research Associate Prof	UMD DOGS
Songer	Melissa	PhD	200607	Conservation GIS Lab Manager	National Zoo
Groff	Elizabeth	PhD	200607	Assistant Professor	Temple Univ
Robin	Jessica	PhD	200607	NSF Program Officer	NSF
Anderson Miller	Lovette	PhD	200701	Geographer and Senior Consultant	SocioEcological Research & Consulting
Cooper	Evelyn	PhD	200701	Assistant Dean	UMD AGNR
Dempewolf	Jan	PhD	200701	Research Assistant Prof	UMD DOGS

Steele	Christopher	PhD	200701	Assoc Vice Provost	UMBC
Zheng	Tao	PhD	200707	Associate Professor	Central Mich Univ
Roa	Jose	PhD	200708	Professor	Univ Andes, Venezuela
Schroeder	Wilfred	PhD	200801	Research Scientist	NOAA
Wang	Wenhui	PhD	200801	Research Scientist	NOAA
Neigh	Chris	PhD	200801	Research Scientist	NASA Goddard Space Flight Center
Loboda	Tatiana	PhD	200801	Assistant Professor	UMD DOGS
Kim	Hye Yun	PhD	200807	Research Scientist	NOAA
Morton	Doug	PhD	200808	Research Scientist	NASA
Luna	Ronald	PhD	200808	Lecturer, UG Dir	UMD DOGS
McCarty	Jessica	PhD	200901	Research Scientist	Mich Tech Research Inst
Pugh	Lashale	PhD	200907	Assistant Professor	Youngstown State Univ
Russo	Richard	PhD	200907	Assistant Professor	Frostburg State Univ
Ellicott	Evan	PhD	200908	Research Assistant Prof	UMD DOGS
Gregg	Jay	PhD	200908	Research Scientist	Tech Univ of Denmark
Heleniak	Tim	PhD	200908	Director	Amer Geographical Society
Wang	Dongdong	PhD	200908	Research Assistant Prof	UMD DOGS
Roberts	Allen	PhD	201001	faculty	Auburn Univ
Song	Kuan	PhD	201001	Postdoc Fellow	UMD DOGS
Wurster	Karl	PhD	201001		USAID
Zeigler	Sara	PhD	201101	Postdoc Fellow	Virginia Tech
Nagol	Jyoteshwar	PhD	201101	Research Assistant	UMD DOGS
Joseph	Alicia	PhD	201101	Research Scientist	NASA GSFC
Swatantran	Anuradha	PhD	201101	Research Assistant Prof	UMD DOGS
Waite	Jackie	PhD	201108	Director Educ Affairs	Nat'l Council for Geog. Educ
Wei	Hua	PhD	201108		ESRI, Redlands HQ

He	Tao	PhD	201201	Research Associate	UMD DOGS
Pomeroy	Jennifer	PhD	201201	Lecturer	Shippensburg University
Baruah	Angira	PhD	201201	Contractor	USGS??
Turpie	Kevin	PhD	201201	Research Scientist	NASA
Zhu	Xiufang	PhD	201201	Research Scientist	Beijing Normal Univ
Schleeweis	Karen	PhD	201207	Techniques Analyst	US Forest Service
Becker-Reshef	Inbal	PhD	201207	Research Assistant Prof	UMD DOGS
Gorsevski	Virginia	PhD	201207		looking
Nackoney	Janet	PhD	201207	Research Assistant Prof	UMD DOGS

3 Research Program

3.1 Faculty Citations

Total Number of Journal Citations (No self cites) Fall 2012	Number of Faculty
0-500	6
500-1,000	1
1,001 – 2,000	1
2,000 – 3,000	2
3,001 – 4,000	4
….	0
Over 7,000	2
H-Index	Number of Faculty
0-10	6
11-20	1
21-30	4
31-40	3
Over 40	2

3.2 Faculty Awards

- Faculty member selected as Dean of College of Behavioral and Social Sciences
- The University's Landmark award for longtime international service to Campus. (Townshend)
- Faculty member received NASA's Exceptional Public Service Medal (Justice)
- Martha Maiden lifetime achievement award for services to the environmental science information community (Townshend)
- John Wesley Powell Award, USGS highest award for "civilians". (Goward)
- Two faculty have won the William T. Pecora Award, highest NASA/Department of Interior Award for Remote Sensing. (Goward and Townshend)
- Faculty member awarded the American Society of Photogrammertry and Remote Sensing (ASPRS) SAIC Estes Memorial Teaching Award (Goward)
- Zayad International Prize for the Environment (Hurtt)

58

- Drs Paul Torrens and Julie Silva were awarded prestigious NSF Faculty Early Career Development (CAREER) Awards
- Dr. Paul Torrens was awarded the Presidential Early Career Award for Scientist and Engineers (PECASE), awarded by President George W. Bush, the White House Office of Science and Technology, and the National Science Foundation in 2008. First PECASE for Geography.
- Drs Tatiana Loboda with Julie Silva, and Inbal Becker-Reshef have been awarded NASA Land-Cover Land-Use Change (LCLUC) grants for Early Career Scientists
- Dr. Shunlin Liang named an Institute for Electrical And Electronics Engineers (IEEE) Fellow, effective Jan 2013
- Honorary Fellow of the UK Remote Sensing and Photogrammetry Society (Townshend)
- Two of our faculty (Townshend and Liang) have been named Honorary, Guest or Adjunct Professors at prestigious Chinese institutions including Beijing Normal University, University if Wuhan, Institute of Geographical Sciences and Natural Resources Research and the Institute if Remote Sensing Applications CAS, Chinese Academy of Agricultural Sciences , and Center for Earth Observations and Digital Earth, Chinese Academy of Sciences

3.3   Faculty Research Interest Bios

Dubayah, Ralph

My main areas of interest are ecosystem characterization for carbon modeling, habitat and biodiversity studies, land surface energy and water balance modeling, spatial analysis and remote sensing science. A common goal of my research is to develop and apply emerging technologies of spatial data acquisition and analysis, especially lidar remote sensing and computational methods, to address environmental issues at policy-relevant scales. I have been an investigator for numerous NASA projects, including two Interdisciplinary Science Investigations (IDS), on the use of remote sensing for hydrological and ecosystem modeling. I was the principal investigator of the Vegetation Canopy Lidar (VCL), a NASA mission to measure the three-dimensional structure of the Earth's forests. I have served on various national and international organizations, including the Remote Sensing Committee of the American Geophysical Union, the NSF Geography and Regional Science Panel, and the Research Advisory Committee for the Organization for Tropical Studies (OTS). I am an Associate Editor for the Journal of Geophysical Research (Biogeosciences), on the Editorial Boards for Remote Sensing of Environment and Remote Sensing. I currently chair the Ecosystem Structure Working Group for NASA's Terrestrial Ecology program and co-chair the Science Study Group for NASA's DESDynI mission.

Areas of Interest:
- Remote sensing of ecosystem structure
- terrestrial carbon balance
- biodiversity
- active remote sensing (lidar and radar)
- spatial analysis and modeling
- surface energy balance

Geores, Martha

When asked for my ethnic identity I always say "rural". With that I mean that nature and society are part of one system. I am from rural Maine, although I have traveled widely and lived outside Maine for longer than I lived there, culturally I am a rural Mainer. My interest in culture and natural resource management stems from being an agriculturalist, living in a forested area owned by paper companies, on land being mined for sand and gravel, and representing the interests of lobstermen on the Maine coast. I earned my BA in Sociology from Bates College, and a JD from NYU. I practiced law for 11 years, first as an

59

attorney for Pine Tree Legal Services representing low income people, concentrating on Constitutional Rights, then in a private practice. Becoming tired of law, I went to the University of North Carolina at Chapel Hill to study geography. I did my dissertation work in the Black Hills National Forest on the impact of community ownership on management of the National Forest. I joined the faculty of the Department of Geography at University of Maryland College Park in 1993 where my teaching and research interests center around the intersection of social and physical systems. I am presently also Associate Chair.

Areas of Interest:
- Society and Sustainability
- Natural Resource Use
- Human Dimensions of Global Change
- Sacred Space
- Social Construction of Space

Goward, Samuel

Dr. Goward pursues biophysical applications of land remotely sensed data. He has been actively involved in the land observation missions since the 1970s, specifically focused on Landsat and AVHRR. His recent research has focused on evaluating North American forest disturbance and regrowth from the historical Landsat observation record for the North American Carbon Program (NACP). He currently is serving as a member of the NACP science steering group. He served as the Landsat Science Team Leader for Landsat 7 and continues as a member of the US Geological Survey Landsat Science Team today. In addition he served as the Co-Chair for the USGS National Land Satellite Land Remote Sensing Data Archive (NLSLRSDA) advisory committee. In recognition of his long-standing commitment to land observations and the Landsat mission, Dr. Goward has received the USGS John Wesley Powell award, the USGS/NASA William T. Pecora award and the ASPRS SAIC Estes Teaching award. He continues to serve as an associate editor for Remote Sensing of Environment.

Areas of Interest:
- Land Remote Sensing
- Biophysics
- Global Change

Matthew Hansen

Prof. Matthew Hansen is a remote sensing scientist with a research specialization in large area land cover and land use change mapping. His research is focused on developing improved algorithms, data inputs and thematic outputs which enable the mapping of land cover change at regional, continental and global scales. Such maps enable better informed approaches to natural resource management, including deforestation and biodiversity monitoring and can also be used by other scientists as inputs to carbon, climate and hydrological modeling studies. Prof. Hansen's work as an Associate Team Member of NASA's MODIS Land Science Team included the algorithmic development and product delivery of the MODIS Vegetation Continuous Field land cover layers. His current research includes taking the global processing model for MODIS and applying it to the Landsat archive. Exhausting mining of the Landsat archive has been used to map forest disturbance in the Congo Basin, Indonesia, European Russia, Mexico, Quebec and the United States. The methods developed in these efforts will be used to test global-scale disturbance mapping with Landsat data. Other current research efforts focus on improving global cropland monitoring capabilities, for example global soybean cultivated area estimation using MODIS, Landsat and RapidEye data sets.

Areas of Interest:
- Land cover
- Global-scale remote sensing
- Monitoring of land surface change

Klaus Hubacek

Dr Klaus Hubacek is an ecological economist with a research focus on conceptualizing and modelling the interaction between human and environmental systems and developing and modelling scenarios of future change. Klaus has worked extensively with stakeholders in participatory research projects and lead large interdisciplinary research teams. He has published more than 150 articles in journals, books and research reports on topics such as climate change adaptation and mitigation, participatory modelling, management of ecosystems services, land use change and governance. Klaus has conducted studies for a number of national agencies in Austria, China, Japan, UK, and U.S. and international institutions such as the European Statistical Office (EUROSTAT), the International Union for Conservation and Nature (IUCN), and the World Bank. Currently, he is on the advisory board for the City of Shanghai Climate Center in China and for the Sustainable Land Management Program of the German Federal Ministry of Education and Research; he serves on the editorial board of a number of scientific journals and is council member of the International Input-Output Association.

Areas of Interest:

- Ecological Economics
- Sustainable Consumption and Production
- Mitigation and adaptation
- Land Use Governance
- Ecosystem Services
- Natural Resource Management

George Hurtt

Professor Hurtt received his Ph.D from Princeton University in 1997. From 1998-2010, Dr. Hurtt worked at the University of New Hampshire in the Institute for the Study of Earth Oceans and Space and Department of Natural Resources, finally becoming Chair of the Natural Resources and Earth System Science Ph.D. Program, UNH's largest doctoral program, and Director the Complex Systems Research Center, UNH's main center focused on Earth System Science. In 2010, Dr. Hurtt joined the University of Maryland Department of Geography as Professor & Research Director, and in 2011 he was named Associate Director of the Joint Global Change Research Institute. In 2012, he became Associate Director of Research Innovations at the National Socio-Environmental Synthesis Center (SESYNC). Dr. Hurtt is involved in multiple collaborative research projects including the North American Carbon Program, NASA's Vegetation Structure Working Group, NASA's Carbon Monitoring System, and DOE's Integrated Earth System Modeling project. He currently leads an international effort on global land-use harmonization in preparation for the IPCC 5th assessment, and a NASA interdisciplinary science investigation focused on the role of natural disturbances on the Earth's coupled carbon-climate-human system. He is Science Team Leader for the NASA Carbon Monitoring System, Chair of the NASA Terrestrial Ecology Modeling Working Group, Chair of the ORNL DAAC User's Working Group, Associate Editor of Global Biogeochemical Cycles, Contributing Faculty Member to the Global Change Ecology section of Faculty of 1000, Guest Editor of Earth System Dynamics, and a Member of the University of Maryland Council on the Environment.

Areas of Interest:
- Ecological theory and its applications
- Structure, function, and dynamics of ecological systems
- Land-use, land-cover, and climate change
- Integrated models and observations of coupled natural-human systems
- Sustainability science

Chris Justice

Professor Justice received his Ph.D. from the University of Reading, United Kingdom. In 2001 he became Professor and Research Director in the Geography Department of the University of Maryland and in 2010 became Dept Chair. He is a member of the NASA Moderate Imaging Spectroradiometer (MODIS) Science Team and is responsible for the MODIS Fire Product. He is CoChair

of the NASA LANCE User Working Group. He is a member of the NASA JPSS/NPOESS Preparatory Project (NPP) Science Team. He is co-chair of the GOFC/GOLD-Fire Implementation Team, a project of the Global Terrestrial Observing System (GTOS), and a member of the Integrated Global Observation of Land (IGOL) Steering Committee. He is on the Strategic Objective Team for USAID's Central Africa Regional Project for the Environment. He is Co-Chair of the GEO Global Agricultural Monitoring Task. His current research is on land cover and land use change, the extent and impacts of global fire, global agricultural monitoring, and their associated information technology and decision support systems.

Areas of Interest:
- Global Change Research
- Land Use and Land Cover Change
- Satellite-based Agricultural Monitoring
- Satellite-based Fire Monitoring
- Terrestrial Observing Systems/Remote Sensing

Eric Kasischke

My research focuses on the impacts of fire on boreal ecosystems. Key research questions that we are addressing include: (1) what factors control variations in the fire regime across the North American boreal region? (2) how do fires impact carbon cycling in this region, in particular, how much carbon is consumed during fires in ecosystems with deep organic soils; (3) what factors control recovery of vegetation following fires, especially in areas with novel patterns of post-fire succession? and (4) how vulnerable are boreal ecosystems to the impacts of changes to climate and the fire regime? To address these questions, my research involves field based studies and the use of geospatial data sets developed from remotely-sensed data. The goal of this research is to provide the basis for improvements to terrestrial ecosystem models in order to be able to assess the impacts of fire across time and space. I conduct interdisciplinary research with scientists within the Department and from other institutes in Canada and Alaska. My research focuses on boreal forests and peatlands in interior Alaska and western Canada. I have recently spearheaded an effort to define the next large-scale field campaign that will be sponsored by NASA's Terrestrial Ecology Program – the Arctic-Boreal Vulnerability Study (ABoVE).

Areas of Interest:
- Boreal Forest Fire Ecology
- Carbon Cycling
- Applied Remote Sensing
- Synthetic Aperture Radar

James Kellner

I am interested in the structure and dynamics of forests and trees over large geographic areas, especially in tropical systems. My approach combines environmental remote sensing with field studies, quantitative methods, and modeling to address questions in both basic and applied science from ecological and evolutionary perspectives. One of my goals is to find ways to grapple with classical questions in ecology and evolutionary biology in forests at large spatial scales, but without sacrificing the traditional focus of investigations on individuals, populations and communities. Some current questions that my students and I are addressing include: (1) How important are natural and anthropogenic disturbance in mediating the carbon (C) balance of tropical forests? Are tropical forests a source or sink of C, and do the answers to this question depend on soil fertility? (2) What factors determine the success or failure of biological invasions? How can we best use this information to inform conservation and management of landscapes with threatened and endangered species? How do we balance the desires of different stakeholders, including indigenous and traditional perspectives? (3) Is foliar chemistry in tropical rain forest landscapes an expression of local environmental conditions or genetic adaptation? Are lineages with more individuals supported by greater functional variation in foliar chemistry and gene products? Most of my recent work has focused on forests in Central America and the Hawaiian Islands.

Areas of Interest:
- biogeography

62

- carbon and other element cycles
- conservation
- forest disturbance
- Hawaiian Islands
- tropical forest ecology and evolution

Shunlin Liang

Dr. Liang received the Ph.D. degree in remote sensing and GIS from Boston University, Boston, MA. He was a Postdoctoral Research Associate with Boston University from 1992 to 1993 and a Validation Scientist with the NOAA/NASA Pathfinder AVHRR Land Project from 1993 to 1994. He is currently a Professor. His main research interests focus on estimation of land surface variables from satellite observations, studies on surface energy balance, and assessing the climatic, ecological and hydrological impacts of afforestation in China. He authored the book Quantitative Remote Sensing of Land Surfaces (Wiley, 2004) and edited the book Advances in Land Remote Sensing: System, Modeling, Inversion and Application (Springer, 2008), and co-edited the book "Advanced Remote Sensing: Terrestrial Information Extraction and Applications" (Academic Press, 2012). Dr. Liang is a co-chairman of the International Society for Photogrammetry and Remote Sensing Commission VII/I Working Group on Fundamental Physics and Modeling. He is an Associate Editor of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, and also a guest editor of several remote sensing journals.

Areas of Interest:

- Land product generation from satellite data
- Land surface energy balance
- Impacts of vegetation change
- Data assimilation with satellite products

Tatiana Loboda

Dr. Tatiana Loboda is an Assistant Professor at the Geography Department of the University of Maryland at College Park. Her research interests include wildland fire, biodiversity, climate change, and their interactions with other human and physical factors on the landscape. Her research is mostly focused on boreal forest and tundra biomes, although she has also been involved in studies of temperate and tropical ecosystems. Dr. Loboda uses remote sensing and modeling to study fire extent and impact on ecosystems, biodiversity, and human health in the present and to develop potential scenarios of climate-induced changes of these systems in the future. This research is focused on developing deeper understanding of potential impact of climate change on future quality of life and overall habitability of the planet.

Areas of Interest:
- Multi-scale impacts of socio-economic and environmental factors on wildland fire occurrence and its characteristics
- Impacts of land use and land cover change on human health
- Impact of climate change on arctic ecosystems: implications for the indigenous people and area's biodiversity

Stephen Prince

Dr. Stephen Prince is a full Professor in the Geographical Sciences Department of the University of Maryland, His expertise is in vegetation remote sensing using a wide range of satellite sensors, with special experience in dryland degradation and desertification throughout the world involving monitoring and modeling land surface processes. Dr. Prince has worked on the carbon cycle at regional to global scales using remotely sensed data and field measurement, on global vegetation dynamics, and on methods to map desertification and relate it to its human causes. He chaired the International Geosphere-Biosphere Programme (IGBP) Data Information System (DIS) Global Primary Production Data Initiative (GPPDI) and was Principal Investigator in the IGBP Global Analysis, Integration and Modeling (GAIM) Ecosystem Model-Data Intercomparison (EMDI) program. He has assisted the UN Food and Agriculture Organization (FAO) and UNCCD in the establishment of ecosystem

monitoring systems in West & Southern Africa and in the FAO GLADA program (Global Land Degradation Assessment in drylands) He was the NASA Project Team Leader for the HAPEX-Sahel international measurement campaign 1991-1993 in Niger, West Africa. Previously he has taught Plant Ecology at the University of London, UK. Dr Prince is the author of over 100 peer reviewed articles.

Areas of Interest:
- Dryland ecohydrology and plant functional proprieties at regional to global scales.
- Studies in arid, semi-arid and dry-subhumid regions of Sub-Saharan Africa, SW USA, Middle East and global.

Julie Silva

Dr. Silva's research investigates the regional effects of globalization on poverty, inequality, and social exclusion in both advanced and developing countries. She has conducted research on these topics in the US and southern Africa. Using quantitative and qualitative methods, she addresses questions about uneven development between people and between places. She also examines different theoretical approaches to inequality and poverty, which range from mainstream economic theories to human rights and global justice perspectives. She has authored or co-authored papers on these topics in Economic Geography, Environmental Science & Policy, Geographical Journal, Growth and Change, Professional Geographer, and Regional Studies. Prior to beginning her graduate studies, she worked in the private sector using public participatory GIS to evaluate children and family service organizations and served as a Peace Corps volunteer in Gabon. Her dissertation won the AAG Economic Geography Specialty Group Dissertation Award in 2006. She received the J. Warren Nystrom Award from the Association of American Geographers in 2007 and a Faculty Early Career Development (CAREER) Award from the U.S. National Science Foundation, Geography and Spatial Sciences Program in 2008.

Areas of Interest:
- Economic Globalization
- Human Dimensions of Global Change
- Inequality, Uneven Development and Global Justice
- Mixed Methodologies
- Spatial Econometrics

Paul Torrens

Dr. Paul M. Torrens is an Associate Professor in the Department of Geographical Sciences, and Director of the Geosimulation Research Laboratory, where he works with students to develop next-generation technologies and applications at the confluence of GIS, computing, and human geography. This work has been funded by the U.K. Economic and Social Research Council, the U.S. National Science Foundation, the Herberger Foundation, Science Foundation Arizona, Autodesk, Inc., and Alias Research. Paul's research earned him a Faculty Early Career Development Award from the U.S. National Science Foundation in 2007 and he was awarded the Presidential Early Career Award for Scientists and Engineers by President George W. Bush in 2008. The Presidential Early Career Award is the highest honor that the U.S. government bestows upon young scientists.

Areas of Interest:
- Modeling and simulation
- GIS
- behavioral geography
- urban geography
- cyberspace

John Townshend

Dr. Townshend earned his BSc (1967) and PhD (1971) in geography from University College London. Dr. Townshend has held academic positions at the University of Dar es Salaam, Tanzania, the University of Reading, UK and Clark University in

Worcester, Massachusetts. He also held a senior National Academy of Sciences fellowship at NASA's Goddard Space Flight Center. He has held affiliate positions at the University of Maryland's Institute for Advanced Computing Studies and the Earth System Science Interdisciplinary Center. Dr. Townshend is a member of the Science Advisory Committee of the College of Global Change and Earth Sciences, Beijing Normal University and the Scientific Steering Committee of the Institute for Global Change Studies, Tsinghua University. He serves as a member of the editorial board of the International Journal of Digital Earth and is a member of the executive committee of the International Society for Digital Earth. He is chair of the advisory committee to the United Nations Environment Programme's Division of Early Warning and Assessment for North America. He has served on several committees of the National Research Council. Under his leadership as chair (1989-1995 and 2001-2009), the Department of Geography earned a reputation as one of the leading US geography departments. His current research focuses on the rates and causes of vegetation cover change, especially deforestation, through the use of remotely sensed data from satellites, funded primarily through NASA grants. He is also the principal investigator of the Global Land Cover Facility, which houses the largest open access non-governmental online collection of Landsat data in the world. He is the author of more than 100 articles in the refereed literature and more than 30 book chapters.

In-Young Yeo

Dr. In-Young Yeo is an assistant professor in the Geographical Sciences Department of the University of Maryland. Her research focuses on understanding the interrelationship between land and water at various spatial scales and developing frameworks to support decision making for mitigation and adaptation. Currently, she leads a research projects to improve wetland mapping and to assess wetland function for water quality improvement in Chesapeake Bay Watershed. She also investigates the impacts of climate change and management practices on water quality at the local agricultural watershed in the coastal plain of the Chesapeake Bay Watershed. Combining various geospatial and historical data, she is studying changes in forest land covers and their dynamics in Southern USA, and analyzing their hydrological effects at regional scales. She is currently collaborating with other land surface modelers and geophysicists to understand the surface water dynamics at the continental scales, by improving current hydrological models with remote sensing data. Her research has been supported by NASA, NOAA, USDA, and UMD.

Areas of Interest:
- Spatial Hydrology and Watershed System
- Land Use/Cover Changes and Modeling
- Spatial Optimization and Decision Support Systems
- Geographic Information Sciences
- Environmental Management and Planning

4 Service

4.1 Faculty Major Service Roles

- Chair, University Senate, 2011-2012 Academic Year (Kasischke)
- Chair, BSOS APT Committee, 2012-2013 Academic Year (Hurtt)
- Associate Director, Joint Global Change Research Institute (Hurtt)
- Associate Editor of *Global Biogeochemical Cycles* (Hurtt)
- Associate Editor for the *International Journal of Wildland Fire* (Loboda)
- Associate Editor *IEEE Transactions on Geosciences and Remote Sensing* (Liang)
- Co-Editor *Annals of Geographic Information Systems* (Liang)
- Founding Associate Editor of *Journal of Geophysical Research-Biogeosciences* (Kasischke)
- Associate Editor *Journal of Geophysical Research-Biogeosciences* (Dubayah)
- Editorial Board *Remote Sensing of Environment and Remote Sensing* (Dubayah)
- Associate Editors for *Canadian Journal of Remote Sensing* (Hansen and Sun)
- Science Team Leader, NASA Carbon Modeling System (Hurtt)
- Science Team Leader, NASA VIIRS Land (Justice)
- Chair, NASA Terrestrial Ecology Modeling Working Group (Hurtt)
- Chair, Oak Ridge National Lab DAAC User Working Group (Hurtt)
- Co-Chair NASA Above Science Definition Team (Kasischke)
- Co-Chair Group on Earth Observations (GEO) Agricultural Monitoring Task (Justice)
- Co-Chair Global Observation of Forest Cover- Global Observations of Land Cover Dynamics (GOFC-GOLD) Fire Implementation Team (Justice)
- Council member, UMD Council on the Environment (Hurtt)
- Council member - International Input-Output Association (IIOA) (Hubacek)
- 7 faculty currently serve on journal editorial boards (Liang, Goward, Hubacek Kasischke, Prince, Torrens, Townshend)

6 Organizational and Fiscal Matters

6.1 Plan of Organization

<div align="center">

PLAN OF ORGANIZATION
OF THE
DEPARTMENT OF GEOGRAPHICAL SCIENCES

College of Behavioral and Social Sciences
University of Maryland
College Park Campus

Approved at the 3/7/2008 Faculty Meeting
Revisions approved at the 5/23/2012 Faculty Meeting

</div>

Overview

The Department of Geographical Sciences has as its goals the achievement of excellence in its research activities, in its teaching programs at both the undergraduate and graduate levels and in service to the University, State, Nation and World. This departmental Plan of Organization is designed to facilitate these goals within a framework of shared governance.

Changes to the Plan of Organization

Changes to the Plan of Organization will be made based on a majority vote of the Department Committee. Changes can be made at any meeting of the Department Committee. The Plan of Organization Committee shall meet at least once every five years, and make recommendations for changes to the Plan of Organization based on changes to College and/or University policies. Recommendations for changes to the Plan of Organization can also be brought forward by any member of the Department Committee.

Departmental Governance and Administration

The Department is strongly committed to shared governance and all departmental committees are set up to provide guidance to the Chair of the Department. The Chair of the Department reviews the recommendations from the committees and makes the final decision. While there have been very few cases in recent years where the Chair of the Department has found it necessary to act against the advice of the committees, the final decision rests with the Chair.

There are several key Administrative positions, both faculty and staff, in the Department who assist the Chair in oversight of academic, research and administrative functions. The following are broad outlines of these key administrative positions. More detailed responsibilities can be found in the specific Terms of Reference documents for each administrative position. As a group, the Departmental Directors and Associate Chair advise the Chair and are responsible for basic administration of the Academic Program. The Chair has the authority to appoint *ad hoc* committees as needed to provide advice on the administration of the department.

Chair of the Department

The **Chair of the Department** is a faculty[1] member appointed by the Dean of the College of Behavioral and Social Sciences (BSOS) to administer the Department. The members of the Department faculty provide advice to the Dean in the selection of the Chair, starting with making recommendations for members of the search committee via the Department Advisory Committee (see Section 4.3.2). The duties of the Chair are: to administer the Department, including its fiscal operations and supervision of administrative staff, to represent the interests of the Department to the University and College and to the broader communities external to the University, and, in consultation with faculty members, to assign and monitor teaching duties. All members of the Department, including students, have the right to approach the Chair in the event of any dispute or disagreement to seek a resolution.

Academic Program Administration

All positions listed below are appointed by the Chair of the Department for a term of three years and can be renewed.

The **Associate Chair of the Department** is a faculty member responsible for the academic program, including the summer and winter-term programs and also serves as Acting Chair in the Chair of the Department's absence. The Associate Chair administers funds for teaching by non-faculty Instructors, Teaching Assistants and Advising Office staff. The funds consist of an allocation from State funds, revenues generated from winter and summer term activities, and any additional funds from the University for teaching. The Associate Chair appoints part-time Instructors as needed and oversees the Teaching Assistants, including orientation, allocations to classes and assessment of performance. During the spring semester of each year, the Associate Chair is responsible for providing the Department Advisory Committee with lecturer nominees for membership of the Undergraduate, Graduate, and MPS GIS Committees and the Diversity Task Force.

The **Undergraduate Director** administers the undergraduate program, in consultation with the Undergraduate Committee and the Teaching Committee (see section 4.2). The Undergraduate Director is responsible for all matters relating to the undergraduate degrees including ensuring balanced and appropriate academic programs are provided. The Undergraduate Director is responsible for oversight of all Undergraduate Advising in the department. The Director is the primary point of contact between the Department and the College and Campus administrations on undergraduate matters and is the first point of contact for undergraduate students with needs not resolved by their Instructors. The Undergraduate Director is responsible for organizing elections for undergraduate student membership on the Department Committee (2 members), Department Advisory Committee, and Plan of Organization. During the spring semester of each year, the Undergraduate Director is responsible for providing the Department Advisory Committee with undergraduate student nominees for the Undergraduate Committee and the Diversity Task Force. The Undergraduate Director will announce these committee members to all undergraduate students and ask for volunteers to serve. The Undergraduate Director will also solicit nominees from faculty and lecturers and research faculty involved in teaching. The Undergraduate Director is the coordinator for the Geography Club (GTU).

The **Graduate Director** is a faculty member who administers the Graduate Program, in consultation with the Graduate Committee. The Graduate Director is responsible for all matters relating to the graduate degrees, including admissions, assignment of graduate students' advisors, monitoring progress of students, certification of completion of various steps in each student's program, and is the first point of contact of graduate students with needs not resolved by the Advisor. The Graduate Director is responsible for promoting the Graduate Program externally with the goal of attracting high quality graduate applicants. The Director is responsible for oversight of all Graduate Advising in the department. The Graduate Director and the student's Advisor are the prime points of departmental contact for graduate students. The Graduate Director is the point of contact between the Department, the College, and the Graduate School on matters pertaining to graduate studies.

---

[1] In this document, "faculty" refers to tenured/tenure-track faculty unless prefixed by "research".

The **Director of the Masters of Professional Studies in Geospatial Information Sciences** (MPS GIS) directs the MPS GIS program in conjunction with departmental administration and in consultation with the MPS GIS Organizational Committee. The Director of the MPS GIS is responsible for all matters relating to the MPS GIS graduate degree, including admissions, advising, monitoring progress of students, certification of completion of various steps in each student's program, and is the first point of contact of graduate students. The Director of MPS GIS supervises the other MPS GIS lecturers and is responsible for ensuring that the proper number and balance of courses are being offered. The Director of the MPS GIS organizes and conducts the election of a MPS GIS graduate student to serve on the Department Committee. The Director of the MPS GIS solicits volunteers to serve on the MPS GIS Organization Committee and provides a recommendation to the Department Advisory Committee.

The **Honors Director** is a faculty member who administers the Department Honors program. The Honors Director is responsible for all matters relating to the Honors program, including recruiting and accepting Honors applicants and working with the assigned Honors advisor to help design and review the honors project.

Research Administration

The **Research Director** is a faculty member responsible for departmental issues that impinge on research, including recommendations on such Department-provided services as grant financial administration, research computer services and other facilities. The Director assists the Department in matters of research strategy including coordination of multiple submissions to single grant opportunities and encouraging inter-faculty and cross-campus research projects. The Director reviews research facilities, including research laboratories, computer hardware and software, and available college and university resources. The Director recommends any necessary changes to the departmental research administrative procedures. The Director helps develop the departmental research outreach media, including web page content, brochures and posters, and makes recommendations to the departmental administration for any changes. The Director ensures new Research Faculty, RAs, and FRAs receive adequate orientation to the Department, holds career development meetings, and serves as their primary point of contact, after their research group leader or Principal Investigator. The Director reviews and approves PHT Time Entry/Faculty Leave for Research Faculty, plays a central role in appointment and promotion of researchers (see separate department policy docs). The Director conducts an exit interview when a research faculty member leaves the Department. The Research Director is an *ex officio* non-voting advisory member of the Research Faculty Committee and FRA Committee. The Research Director, having assumed the responsibilities of the former Research Committee, will form *ad hoc* committees as needed to provide input necessary to address issues of department relevance.   This position is appointed by the Chair of the Department for a term of three years and can be renewed.   This position is appointed by the Chair of the Department for a term of three years and can be renewed.

Business Administration

The **Director of Administration** is responsible for all administrative services provided for all members of the Department including faculty, research faculty, administrative staff and graduate assistants. Administrative services include supervision of departmental finances, personnel, office and laboratory space, shared computer resources (including hardware and software), all other physical resources, reception and secretarial services, and committee executive tasks.   These functions are performed by the Director of Administration and administrative staff. The Director of Administration is also responsible for organizing separate elections for the (a) Administrative Staff and (b) Lecturers for memberships on the following committees: *Department Committee[2], Department Advisory Committee, and Plan of Organization Committee*. During the spring semester of each year, the Director of Administration is responsible for providing the Department Advisory Committee with staff nominees for the Undergraduate and Graduate Committees and the Diversity Task Force.

---

[2] The number of members elected to the Departmental Committee will be based on proportional representation.

Committee Structure

Certain responsibilities are delegated to committees by the Chair of the Department, in accordance with current policies of the College and Campus. There are two types of Committees; ***Departmental Standing Committees*** where the committee membership is appointed by the Chair of the Department based on recommendations from the Department Advisory Committee; and ***Elected Committees*** where the membership is elected by members of the Department, based on departmental and campus policy. *Ad-hoc* committees or Task Forces are formed as needed, and report to the related Department Standing or Elected Committees. Where appropriate, membership of the committees will include faculty, research faculty, staff, lecturers, graduate students, and undergraduate students. The Chair of the Department and Director of Administration are *ex officio* non-voting and advisory members of all standing committees. Serving on Committees is considered as service to the Department and productivity of committee chairs and members is recognized as part of the departmental merit process.

Departmental Standing Committees

The Department has eleven standing committees or task forces, the most senior of which is the Department Committee. The standing committees report to the Department Committee. As appropriate, the Chair of the Department appoints faculty, lecturers, and administrative staff to the standing committees after reviewing recommendations from the Department Advisory Committee. Research faculty, graduate students, and undergraduate students elect or nominate voting members to a number standing committees. Three of the Department's standing committees consist of the entire group that is being represented – these are the Research Faculty Committee, the Faculty Research Assistant Committee, and the Graduate Student Committee. These three committees elect their own chair every year. Other standing committee chairs are appointed by the Department Chair for a term of two years, where the next committee chair is chosen from existing committee members to provide continuity. All departmental standing committee meetings are open to all members of the Department, unless issues involving individuals are being discussed. The agenda and minutes are the responsibility of the Committee Chairperson and are circulated to all Department employees and graduate students by email and the minutes are posted on the Department's web pages.

The principal activities of each departmental standing committee include the review specified components of the department's academic programs, including related policies and procedures, and when appropriate, make recommendations for changes. Recommendations for changes will be reviewed and voted upon by the Department Committee. When accepted by the Department Chair, implementation of recommendations approved by the Department Committee is the responsibility of administrative staff, under the supervision of the Department Administrator (see section 3 above).

Roles and Terms of Reference of Departmental Standing Committees.

Department Committee (formerly Faculty Committee)

This is the primary governing committee of the Department. All other departmental standing committees report to the Department Committee. Voting membership of the Department Committee is as follows; all faculty, all Directors, a set number of full-time lecturers and research faculty (calculated annually based on a defined proportion) to include the Chair of the Research Faculty Committee, the Chair of the Faculty Research Assistants Committee as a voting member for that group, one member of the Department staff, two undergraduate students, and three graduate students. The undergraduate and graduate student members of the Department Committee will be elected by their respective student bodies.

The Department Committee is responsible for:

- Advising the Chair of the Department and providing a forum for the Chair to introduce new items for consideration by the Department. All changes in procedures and policies made by the Chair are announced to this committee.

70

- Hearing initiatives, policies, procedures and other items introduced by the College and Campus with relevance to members of the Department, and considering initiatives, policies, procedures and other items brought to the meeting by the Directors (listed in section 2); the departmental standing and *ad hoc* subcommittees; or by a voting member of the Department Committee. Items other members of the department wish to have raised must first be brought to the attention of departmental administration, or a voting member of the Department Committee, who will decide whether, or not, to bring the item forward for consideration.
- Voting on motions for proposed policy changes, including those that impact Departmental organization. Motions for changes to the Plan of Organization will have the specific location where the motion should be inserted or text that will be replaced listed as part of the Motion.
- Providing a forum for introduction by any member of the Department of new items for consideration.

Teaching Committee (formerly Teaching Team)

The Teaching Committee is responsible for providing guidance and recommendations for the Department's overall teaching program. The Committee membership consists of all teaching faculty members. The Teaching Committee is Chaired by the Associate Chair and meets annually in a one half-day retreat before the start of the Spring Semester, and at other times as needed.

The Teaching Committee is responsible for:

- Reviewing the schedule of classes developed by the Administration to ensure proper distribution of courses across undergraduate and graduate programs.
- Reviewing and updating the two year course plan and ensuring courses in the plan are taught, or if no longer needed, are replaced.
- When appropriate, making recommendations to the Graduate and Undergraduate Committees for changes in Department policies and procedures related to teaching.

The Teaching Committee consists of four Teaching Teams representing the major teaching concentrations of the Department (GIS, Geospatial Intelligence & Remote Sensing, Development & Sustainability, and Environmental Systems & Natural Resources). A faculty member from each of these four basic areas is appointed by the Chair for a two year period and is responsible for organizing small Teaching Teams consisting of those faculty, research faculty, and lecturers teaching in a given concentration area. These teaching teams will meet once per year, or as requested by the Associate Chair and are responsible for:

- Providing input on the balance and content of the undergraduate and graduate classes in their area of concentration,
- Proposing course teaching rotations among faculty, research faculty who are teaching, and full-time/regular lecturers, and
- Recommending guidelines for the sharing of basic course materials between members of the team as well as part-time and occasional instructors.

The findings and recommendations of the teaching teams are reported to the Graduate and Undergraduate Committees. Recommendations from the Teaching Teams are reviewed by these committees and as appropriate brought to the Teaching Committee or Department Committee. The Associate Chair will attend each of the Teaching Team meetings.

Undergraduate Committee

The Undergraduate Committee is responsible for reviewing and providing advice regarding the Undergraduate Academic Program. The Committee membership consists of faculty members and representatives from research faculty, lecturers, staff, and graduate students. Faculty membership consists of a faculty member from each of the four basic areas

71

(Human, Physical Methods and Integrated). The Undergraduate Director, the Honor's Director, and the Undergraduate Advisor are *ex officio* voting and advisory members of this Committee.

The Undergraduate Committee is responsible for:

- Reviewing and recommending changes in undergraduate program curriculum, including program content and policy.
- Reviewing and making recommendations on recruitment of undergraduate majors.
- Selecting the Chair and members of the *ad hoc* Undergraduate Assessment Committee, for the area to be assessed each year. This *ad hoc* committee will carry out the required Undergraduate Learning Assessment each year and generate the corresponding annual report.
- Recommending ways to improve the undergraduate program, such as internships, research experiences, and undergraduate Teaching Assistantships.
- Reviewing new or changed course and program proposals for undergraduate students prior to submission to the Department Committee for approval before forwarding to the Vice President's Advisory Committee (VPAC). Considering any impacts on the two year course plan and schedule of classes.
- Reviewing teaching facilities, including teaching laboratories (hardware and software) and classrooms and make recommendations as appropriate.
- Contributing to the departmental outreach media regarding the undergraduate program, including web page content, brochures and posters, and making recommendations to the departmental administration for changes.
- Producing an annual report documenting the major actions taken by the committee, including recommendations forwarded to the Department Committee.

Graduate Committee

The Graduate Committee is responsible for reviewing and making recommendations on the Graduate Program. The Committee membership consists of faculty members and representatives from research faculty, lecturers, staff, and graduate students. The Graduate Director, the Academic Director and the Program Director of the MPS GIS program are *ex officio* voting and advisory members of the Graduate Committee.

The Graduate Committee is responsible for:

- Reviewing and recommending modifications in graduate course curricula, program, and policies.
- Reviewing and recommending modifications to graduation requirements.
- Reviewing and recommending changes to the financial support for graduate students, including Graduate Teaching, Administrative and Research Assistant stipends.
- Producing the Graduate Learning Assessment and corresponding annual report.
- Reviewing and making recommendations on recruitment of graduate students.
- Reviewing new or changed course and program proposals for graduate students prior to submission to the Faculty Meeting or Vice President's Advisory Committee (VPAC). Considering any impacts on the two year course plan and schedule of classes.
- Recommending policy regarding graduate student teaching, TA reviews, and TA job duties, including recommending policy regarding integration and mentoring of part-time graduate instructors into the teaching program.
- Providing recommendations on levels of financial compensation provided to all graduate teaching and research assistants.
- Contributing to the departmental outreach media regarding the graduate program, including web page content, brochures and posters, and making recommendations to departmental administration for changes.
- Producing an annual report documenting the major actions taken by the committee, including recommendations forwarded to the Department Committee.

MPS GIS Organizational Committee (formerly MPS Advisory Committee)

The MPS GIS Organizational Committee is responsible for reviewing and making recommendations on the structure of the MPS GIS program. The Committee membership will be drawn from faculty members and lecturers who teach methods courses, and will include a graduate student from the MPS GIS program. The Associate Chair, and the Director of the MPS GIS program are *ex officio* voting and advisory members of the MPS GIS Organizational Committee.

The MPS GIS Organization Committee is responsible for:

- Reviewing and recommending modifications in course curricula, final project, program, and policies.
- Reviewing and recommending modifications to graduation requirements.
- Reviewing the departmental outreach media regarding the MPS GIS program, including web page content, brochures and posters, and making recommendations to the Program Director for changes.
- Producing an annual report documenting the major actions taken by the committee, including recommendations forwarded to the Department Committee.

Diversity Task Force (none during Fall 2012 semester)

The Diversity Task Force is responsible for developing strategies to improve diversity in the Department. The Task Force membership consists of faculty members and representatives from research faculty, faculty research assistants, lecturers, staff, and graduate students, and undergraduate students.

The Diversity Task Force is responsible for:

- Identifying diversity-related issues and priorities for other Department committees.
- Working with the College (BSOS) and the University to develop internship opportunities for minority high-school and undergraduate students.
- Recommending recruitment strategies for both undergraduate and graduate students and initiatives to improve diversity.
- Recommending departmental activities needed for compliance with Campus rules, directives and initiatives related to diversity.
- Providing review of the state of diversity in the Department when requested by the Chair of the Department, College or University.
- Producing an annual report documenting the major actions taken by the task force, including recommendations forwarded to the Department Committee.

Awards Committee

The Awards Committee is responsible for seeking award opportunities and candidates for Department, College, Campus, and external national and international awards.   The committee membership consists of three senior Faculty, including research faculty and a member of the department who can represent the interests of the undergraduate students. The Awards Committee is a closed committee because individuals are discussed. Members of the committee are normally not nominated for awards in the years that they serve.

The Awards Committee is responsible for:

- In the Fall semester, reviewing potential Campus, National and International and discipline awards and nominating faculty, including research faculty and lecturers, and staff for awards as appropriate and available.
- Reviewing existing Department awards and proposing changes and additions, as necessary.
- In the Spring semester selecting, with the advice of the Undergraduate and Graduate Directors, awardees for Department student awards, including the Anderson, O.E. Baker, Harper, Alumni Writing Award.

73

- In the Spring semester selecting, with advice from the Research Director, the Department Faculty Research Assistant Award.
- Nominating Alumni for appropriate awards.
- Representing the Department at various Campus and College award ceremonies and making recommendations for additional Departmental representation at the same.

Research Faculty Committee

The Research Faculty Committee is responsible for coordinating the views and recommendations of the Research Faculty. Committee membership is comprised of all Research Faculty, including Research Associates, Assistant, Associate and Senior Research Professors, and Visiting Research Scientists. The Research Director is a non-voting member of the Committee.

The Research Faculty Committee will be responsible for:

- Representing the interests of the Research Faculty.
- Reviewing and when appropriate, making recommendations for changes to departmental policies and procedures affecting the Research Faculty.
- Making recommendations for courses to be taught by Research Faculty.
- Electing Research Faculty members to the Department Committee on an annual basis as advised by the Director of Administration, based on proportional representation.
- Electing the members of the Faculty Research Merit Pay Committee.
- Providing nominations for a member of the Graduate and Awards Committee and the Diversity Task Force to the Department Advisory Committee in the spring semester of each year.
- Producing an annual report documenting the major actions taken by the committee, including recommendations forwarded to the Department Committee.

The Chair of the Research Faculty Committee is the primary point-of-contact for the Chair of the Department and the Research Director on matters concerning research faculty. The Chair of the Research Faculty Committee is a voting member of the Department Committee.

Faculty Research Assistant Committee (formerly FRA Advisory Committee)

The Faculty Research Assistant Committee is responsible for coordinating faculty research assistant career priorities with departmental priorities and involving faculty research assistants in departmental activities. Committee membership is comprised of all Faculty Research Assistants (FRAs) in the Department.

The Faculty Research Assistant Committee is responsible for:

- Representing the professional development interests of the FRAs;
- Reviewing and when appropriate, making recommendations for changes to departmental policies and procedures affecting the Faculty Research Assistants. .
- Electing a member of the Department Advisory Committee and the Plan of Organization Committee
- Providing a nomination for a member of the Graduate Committee and the Diversity Task Force to the Department Advisory Committee in the spring Semester of each year.

Producing an annual report documenting the major actions taken by the committee, including recommendations forwarded to the Department Committee.

The Chair of the Faculty Research Assistants' Committee is the primary point-of-contact for the Department Chair and the Research Director on matters concerning Faculty Research Assistants. The elected Chair of the FRA Committee will be the voting representative to the Department Committee.

Graduate Student Committee

The Graduate Student Committee is responsible for coordinating graduate student career priorities with departmental priorities and involving graduate students in departmental activities. Committee membership consists of all Graduate Students in the Department. The Graduate Student Committee will elect its own Chair on annual basis. The Graduate Student Committee is responsible for

Representing the educational development interests of the Graduate Students

- Acting as a forum for graduate student concerns, including providing recommendations on departmental policies and procedures affecting the graduate students.
- Electing a member to serve on the Faculty Advisory and Plan of Organization Committees
- Providing nominations for a member of the Graduate Committee and Diversity Task Force to the Department Advisory Committee in the spring Semester of each year.
- Producing an annual report documenting the major actions taken by the committee, including recommendations forwarded to the Department Committee.

The Chair of the Graduate Student Committee is the primary point-of-contact for the Department Chair, the Graduate Director, and the Director of Administration on matters concerning Graduate Students. The elected Chair of the Graduate Student Committee will be one of the two voting representatives to the Faculty Meeting.

For graduate students, one elected member of the Department Committee should be from the MPS GIS program (whose election is supervised by the Director of the MPS GIS program). The other two members will be elected by the Graduate Student Committee. One elected member should be a Graduate Research Assistant (GRA)/Fellow and the other a Graduate Teaching Assistant (GTA) to better represent the broad needs of graduate students. If the GSC Chair is a GRA/Fellow, the graduate students will then elect a GTA to serve as the second voting member. If the GSC Chair is a GTA, then the graduate students will elect a GRA/Fellow to serve as the second voting member of the Department Committee. As voting members of the Department Committee, both elected students will attend Department Committee Meetings and Department Retreats.

Graduate Review Committee

The Graduate Review Committee (GRC) is responsible for providing guidance for admissions of new students to the PhD program and for reviewing the academic progress of PhD students on an annual basis. GRC membership includes all faculty members, research faculty members who are a co-advisor to a PhD student, and those research faculty members who are interested in becoming co-advisors to a PhD student.

The Graduate Review Committee is responsible for:

- Reviewing the applications for admission to the PhD program at the beginning of the spring semester each year, and providing recommendations for admission to the Graduate Director.
- Reviewing the annual progress of each PhD student at the end of the spring semester each year, and providing recommendations to the Graduate Director as to whether or not each student is making satisfactory progress towards completion of the requirements for the PhD degree.

The Chair of Graduate Committee and the Graduate Director are responsible for reviewing all faculty recommendations on graduate applications prior to the annual meeting of faculty to discuss the applicants.

Roles and Terms of Reference of Elected Committees

The Department has five committees where the members are elected, except for the Appointment, Promotion and Tenure Committee, where only the Chair is elected. These committees are not open to the public as they may deal with

confidential matters. Each constituency, faculty, research faculty, staff, and graduate students, elects their own representatives to the appropriate committees.

Plan of Organization Committee

The Plan of Organization Committee consists of three faculty members (at least one Full/Associate Professor and one Assistant Professor), one member of the research faculty, one member of the administrative staff, one faculty research assistant one graduate student and one undergraduate student. The departmental administration is responsible for maintaining the Plan of Organization based on changes approved by the Department Committee and Chair of the Department. The formal committee is elected and convenes for review of the entire Plan of Organization as necessary and at least once every five years, as called for by University policy. The Chair of the Department is a non-voting member of the committee.

Department Advisory Committee (formerly Faculty Advisory Committee)

The Departmental Advisory Committee consists of three faculty members, (with at least one Full/Associate Professor and one Assistant Professor), one research faculty member, one administrative staff member, one faculty research assistant, one graduate student, and one undergraduate student.

As called for by the university policy, the Department Advisory Committee is responsible for

- Consulting on a regular basis with the Department Chair on matters of interest and concern to the department, including budget decisions, facility planning and serving as a conduit for information between the Chair and the Department.
- In consultation with members and committees of the Department, nominating a slate of candidates from which the Chair may appoint members for service on all Department committees.
- When required, providing slates of candidates from the Department from which the Dean of BSOS may appoint representatives to participate in the search, nomination, and review of candidates for the Department Chair.

The Department Advisory Committee serves a three-year term and meets at least once a year or as necessary to review departmental priorities. The Department Advisory Committee is the committee of last resort for individuals or groups in the Department with matters of concern that are not dealt with by other means of consultation.

Appointment, Promotion, and Tenure (APT) Committee

The APT Committee consists of all tenured faculty members.   The Committee elects its chair annually for a term that begins on 1 January. Sub-committees prepare promotion packages and the entire committee at or above promotion rank considers and votes on the case. Further details of the operation of this committee are found in the Departmental Promotion and Tenure policy.

Faculty Merit Committee

The Faculty Merit Committee consists of three faculty members – one Assistant Professor and two from the Associate/Full Rank. The Committee reviews faculty activity reports for the calendar year and provides the Chair of the Department with a merit evaluation for each faculty member using the criteria contained in the Department's Faculty Merit Pay Review Plan.

Research Faculty Merit Committee

The Research Faculty Merit Committee is an elected committee of two research faculty and the Research Director. The Committee reviews the faculty activity reports for the calendar year for Research faculty and provides the Chair of the Department with a merit evaluation for each research faculty member, Research Associate and above, using the criteria approved by the Department Committee.

Roles and Terms of Reference of Search Committees

The Department Chair will appoint a Search Committee to identify suitable candidates for any open tenure/tenured track position within the Department. Members of a Search Committee will typically include four tenured/tenured track faculty and a graduate student, all appointed by the Department Chair. The Department Chair will also appoint the Chair of the Search Committee.

The Search Committee will be responsible for:

- Complying with all campus policies regarding interviewing and hiring processes
- Reviewing and approving the description for the open position
- Reviewing all applications for the open position
- Identifying a set of applicants for phone interviews and conducting these interviews
- Identifying a short list of applicants for on-campus visits and interviews
- Conducting interviews during on-campus visits by candidates
- Providing recommendations to the Department Chair on the suitability of the candidates who were interviewed during a campus visit.

The Chair of the Search Committee will be responsible for coordinating the committee's activities with Department Administration and preparing the report of the Search Committee that is submitted to the Department Chair.

Performance Assessment and Promotion

Faculty

- The Chair of the Department meets with all Assistant and Associate Professors every spring to review their Faculty Activity Report and to discuss their progress with respect to the Department's criteria for promotion.
- Assistant Professors are each assigned a mentor from amongst the Full Professors.
- Assistant Professors are subject to a 3 year review, conducted in the sixth semester following their first appointment to the Department.
- Assistant Professors undergo a tenure review in their sixth year as required by University and departmental policies.
- Tenured faculty members undergo a five year review undertaken by a two faculty member review committee selected by the Chair of the Department.
- Every year the Chair of the Department consults with the full professors on the suitability of each Associate Professor in the Department for promotion to Full Professor.

Research Faculty

The Research Director holds annual meetings with each member of the Research Faculty (Research Associate and above) in the spring semester to review their Faculty Activity Reports and to discuss their professional progress and plans.

Details about the promotion process for research faculty can be found in the Departmental Research Faculty Appointment and Promotion policy.

Staff and Lecturers

All regular administrative staff members are required to undergo a performance and development review (PRD) with their supervisors. The Associate Chair will meet with full-time lecturers on an annual basis and at this time to provide a review of their performance.
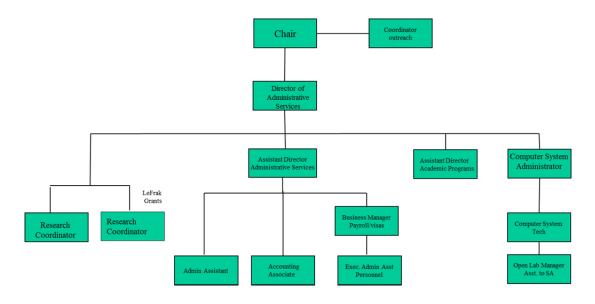
Faculty Research Assistants

All Faculty Research Assistants are required to undergo a performance and development review (PRD) with their supervisors to review their performance, progress and plans.

Details about the promotion process for FRAs can be found in the Departmental Faculty Research Assistant Appointment and Promotion policy.

6.2   Administrative Organizational Chart

Department of Geographical Sciences New Organizational Chart

8 Conclusion

8.1 Broad Hiring Strategy

Research and Hiring Strategy

Human Science Theory	Theoretical Modeling	Physical Science Theory

Human Dimensions of Global Change

Integrated Geographic Science

Biophysical Dimensions of Global Change

Population Dynamics

Livelihoods
Human Welfare

Climate Change / Impacts

Economic Development / Poverty

Land Use inc. Ag / Food Supply

Hydrology

Water Resources

Biogeochemical Cycles

Urbanization

Sustainability / Consumption

Societal Adaptation to Global Change

Coupled Human / Environment Modeling

Biogeography / Ecology & Conservation

Geographic Tools/ GI Science

Qualitative Methods   GIS   Remote Sensing   Data and Info Systems

Quantitative Methods   Modeling

Gaps