

## UMBC Department of Geography & Environmental Systems Summary Description

UMBC's Department of Geography & Environmental Systems consists of 14 full-time faculty, including 11 tenured or tenure-track faculty (4 Assistant Professors, 3 Associate Professors, 4 Professors), one Clinical Associate Professor, one Senior Lecturer, and one Associate Staff faculty member who serves as Director of the Cartographic Services and Geospatial Laboratory and who also teaches courses in cartography and GIS. The department has had robust support from the UMBC administration over the past decade, including support for graduate assistantships, new faculty lines, and facility renovations. In addition to the external chair hire, we anticipate one additional tenure-track hire and two replacement hires that should bring our tenure-track faculty complement from 12 to 15 over the next several years.

UMBC is a campus in the University of Maryland System and is classified by the Carnegie Foundation as a Research University with High Research Activity. The campus has 520 full-time instructional faculty, 151 full-time research faculty and 13,979 enrolled students, including 2,600 graduate students. Annual research expenditures in FY2014 were \$76.5 million, an increase from \$20 million in 1996. This includes \$65.1 million provided by federally funded programs. The campus has been ranked by U.S. News & World Report as #5 among the top national universities "*where the faculty has an unusual commitment to undergraduate teaching,*" ahead of such schools as Brown, Stanford, Vanderbilt and Yale. We are located in the suburbs of Baltimore, MD just off Route 95 and about 35 minutes from Washington D.C. and a broad array of federal, state, and local agencies as well as other research institutions along the Washington-Baltimore-Philadelphia corridor. UMBC is one of the most diverse campuses in the nation with 42% minority enrollment as of Fall 2014, and we seek to attract a diverse applicant pool for this position. Additional information about the campus may be found at <http://about.umbc.edu/umbc-facts/> and <http://research.umbc.edu/fast-facts/>.

A hallmark of the Department of Geography & Environmental Systems is its broadly integrative nature, drawing on the expertise of faculty with diverse backgrounds but with a common mission. Research interests among current regular departmental faculty span a broad range of topics in earth systems science, ecosystem science, human geography and urban geography, and human dimensions of global change, with application of geospatial technology to research questions across all areas of interest. Despite the diversity of research and teaching interests, there is a common focus on the importance of coupled natural and human systems and on landscape pattern in relation to human activities and their environmental consequences, and we see this as a broad programmatic thrust for our graduate degree offerings. Within this broader theme we also take advantage of unique opportunities at UMBC for particular foci as described below in our draft Research Strategy document. Research based in the Department of Geography and Environmental Systems involves interdisciplinary

collaborative work of local, regional and international scope.

GES faculty play key roles in the research programs of the UMBC Center for Urban and Environmental Research and Education (CUERE) and the Baltimore Ecosystem Study (BES), one of two urban Long Term Ecological Research (LTER) sites in the United States, which has its field headquarters on the UMBC campus. Other active partnerships include the Joint Center for Earth Systems Technology (JCET), which brings strong ties to NASA's Goddard Space Flight Center and includes six Affiliate Research Faculty who teach one course in our department's curriculum every two years, and the Maryland-Delaware-DC Water Sciences Center of the U.S. Geological Survey, whose offices are located on our campus just a short walk from our department. GES faculty have continued to develop robust collaborative research relationships with colleagues from other departments and Centers at UMBC (Biological Sciences, Computer Science and Electrical Engineering, Information Sciences, Physics, Civil and Environmental Engineering, Visual Arts) and with colleagues at other institutions. Department faculty also are involved as public citizens in offering their professional expertise to organizations such as the Chesapeake Bay Program Scientific and Technical Advisory Committee, the Maryland Water Monitoring Council, the National Social-Environmental Synthesis Center, NASA Goddard Space Flight Center, Washington Post Capital Weather Gang, U.S. Department of Agriculture, U.S. Geological Survey, EPA, National Geographic Society, Harvard Graduate School of Design, and Conservation International.

We currently serve an undergraduate student population of 320 majors in four degree programs (B.S. Environmental Science, B.A. Environmental Studies, B.S. and B.A. in Geography) as well as about 1600-1800 students per year in our own GES 100-level courses and another 600 in an interdisciplinary 100-level lab science course focusing on water that is taught by one of our faculty. These courses meet university distribution requirements in natural science, laboratory science, social science, and culture.

The department offers M.S. and Ph.D. degrees in Geography & Environmental Systems with current enrollment of 13 M.S. and 15 Ph.D. students; an accelerated B.S./M.S. program; an undergraduate Certificate in GIScience; and a Professional Masters program in GIScience (current enrollment of 42) that is offered for working professionals at the Shady Grove campus in the suburbs of Washington D.C. We have a total of 10 graduate teaching assistantships funded by the university that are reserved primarily for Ph.D. students but are sometimes made available to M.S. students. All Ph.D. students are guaranteed at least two years of funding and most are supported throughout their graduate careers on some combination of externally funded research grants, teaching assistantships, fellowship awards, or agency employment. UMBC also supports a cohort of Masters students each year who are selected as Shriver Center Peacemakers. These are returning Peace Corps volunteers who participate in

service learning with 20-hour work placements that provide financial support for their graduate education. We typically have 2-3 Peaceworkers among our graduate students.

Our faculty are active researchers and committed and talented educators. We are also known on campus for excellence in mentoring and advising students, for engaging both undergraduate and graduate students in research (including authorship on refereed journal papers), and for preparing students for success in graduate school and professional careers. Five of our current and recent graduates (two graduate students and three undergraduate students) have received Fulbright fellowships for study abroad in the last two academic years.

The department today can best be described as a community committed to interdisciplinary scholarship, to high quality teaching and mentoring of undergraduate and graduate students, and to mutual success and collaboration. The department functions as a highly democratic community in which all members regardless of rank participate in governance and decision-making (e.g., hiring, curriculum, strategic planning). Our goal is to maintain the values we share while increasing our research profile, building our external visibility at the regional and national level, and recruiting a larger and more competitive applicant pool for our graduate program. We are looking to recruit as our new Chair an individual with a strong research portfolio, a commitment to excellence and diversity in graduate and undergraduate education, an interest in maintaining the cultural traits we value as a community of scholars who support each other across disciplinary boundaries, and skills in strategic planning and communication to help us achieve our goals both collectively and individually.

The department web page is <http://ges.umbc.edu/> and the list of faculty and their research and teaching interests can be found at <http://ges.umbc.edu/faculty-pages/>.

The Research Strategy document attached below was developed in response to a request from the university administration.

**1a. In your department/unit, what are the selected areas of research/creative achievement that with targeted investment will elevate the national prominence of your department/unit in the next five years?**

The Department of Geography and Environmental Systems (GES) welcomes the opportunity to share our vision for achieving national research prominence using targeted investment. Research in our department may be characterized by several cross cutting themes and approaches that drive/underpin much of our work (Fig. 1). Prominent among these is the study of Global Change. GES is relatively unique in its ability to bring both novel geospatial methods and interdisciplinary perspectives to the challenges posed by the impacts of rapidly expanding human populations, concomitant land use change, altered climates and extreme weather, sea-level rise, biodiversity loss in response to novel ecosystems, altered water quantity and quality, urban growth, human health, human migration, and shifting policy.

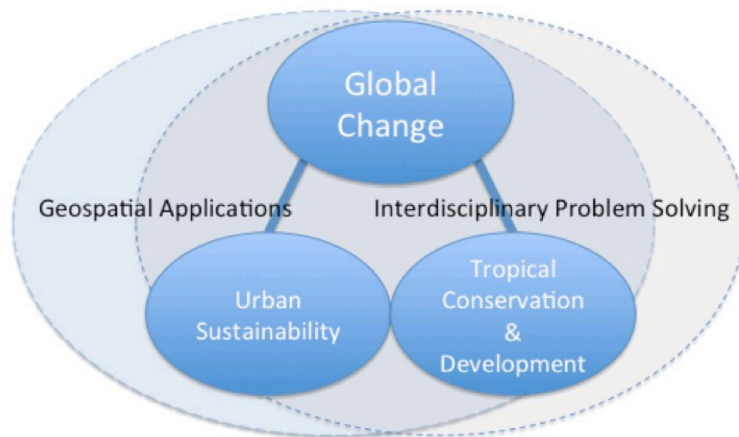


Figure 1. Prominent research themes in GES at UMBC

Within the broader themes and approaches, GES continues to develop real strength in two particular areas of inquiry: Urban Sustainability and Tropical Conservation & Development. Each area is inherently interdisciplinary and closely linked to themes of global change while also being location and context dependent. Urban areas are increasingly recognized as having their own ecology, whereas ecologically valuable tropical landscapes are increasingly dominated by humans.

Currently over one half of the global population lives in cities, and this proportion is only expected to grow. Considering the extent of their modifications to local and regional climate, air quality, water quantity and quality, and biotic dispersal, the resulting built environment is one facet of environmental impacts in the epoch now recognized as the Anthropocene. Such impacts are not distributed uniformly across and within cities, and thus have social costs and political implications. The department’s close affiliation with both UMBC’s Center for Urban Environmental Research and Education and the Baltimore Ecosystem Study (BES) has provided ready access to many researchers concerned with Baltimore’s urban ecology, but we

believe our faculty have the potential to take on a leadership role in this regard, shaping the future of the BES and augmenting our department's reputation independent of the LTER program.

Our department brings disciplinary traditions such as ecology and biogeography, hydrology and geomorphology, atmospheric science, natural resource management, urban geography, environmental history, political ecology, and environmental justice to the study of urban systems. The analytic power of this line of inquiry is amplified when these traditions work in concert with each other. Examples of interdisciplinary urban work include a study of the interplay between urban mosquitoes as vectors of disease and as indicators of socio-economic inequities; use of prison inmates to study plant community assembly in vacant lots and remnant gardens; and a project linking the structure and composition of urban forest patches and urban soundscapes to invasive species, animal habitat, and local community engagement with public green spaces. Each of these projects represents efforts by GES faculty to enhance research efforts in urban sustainability and break new ground by crossing disciplinary boundaries—collaborating with artists, economists, or computer scientists.

Although we have expertise in conservation and development more broadly, recent faculty hires in GES have concentrated experience in Costa Rica, Jamaica, Ecuador, Peru, and Brazil. The tropics are widely recognized as centers of high biodiversity and global ecological value, increasingly threatened by expanding development pressure. This broad region also shares a history of colonialism, development challenges, and political struggle that informs present-day economic and environmental activities. Achieving conservation goals in managed ecosystems systems requires participation from governments, landholders, and other stakeholders where biodiversity policy inherently clashes with social policy. Such conflicts challenge traditional concepts of discrete societal or ecological spheres in which the other is normally excluded. GES faculty are working to reframe conventional conservation and development policy that ignores social context and the importance of global poverty. By investigating issues such as the local interpretation of conservation efforts, patterns of land tenure, and rural to urban migration by impoverished populations, our faculty enhance the ecological, social, and political sustainability of conservation and development efforts. Local communities are increasingly linked to global markets, and this poses new challenges for sustaining ecological systems in the tropics and the health and livelihoods of human populations. In this context, GES faculty are well positioned to investigate the inextricably joined societal and natural processes that drive conservation issues in the tropics.

A hallmark of the department's research in human and natural environmental systems is the use of novel geospatial approaches to achieve new insight. Geospatial technology continues to inform our work through the development of new techniques such as terrain and forest canopy models derived from Unmanned Aerial Vehicles (UAVs), dropsondes to understand hurricane intensification, patterns of urban development through time, terrain modifications from Light Detection and Ranging (LiDAR), spatially explicit models predicting nutrient discharges to Chesapeake Bay, agent-based models of land conversion, the influence of land use patterns on estuarine water birds, and a system for understanding regional representation in studies used to characterize global change. Faculty in our department have already achieved national renown for innovative geospatial approaches, and we will continue to bring cutting edge techniques to future endeavors.

Our department is exceptionally well positioned to address many problems associated with Global Change with an interdisciplinary perspective, incorporating both natural/physical and social sciences, that is crucial to long term sustainability. It is difficult to overstate the importance that different disciplinary perspectives play in this inquiry. GES faculty are currently engaged in multi-disciplinary efforts that address complex environmental problems and push intellectual boundaries. In addition, both graduate and undergraduate students, well trained in interdisciplinary problem solving, help to bolster our reputation nationally and internationally. As an example of our success in training new researchers, GES has produced five Fulbright scholars in the past two years.

**1b. For each area identified, provide any justification/evidence (e.g., federal, state funding priority area, professional association priority) supporting the prominence of these areas.**

The importance of Global Change to society hardly requires justification (except perhaps to Congress), and research support continues to exist for such endeavors. Many federal agencies including USAID, NASA, NOAA, USEPA, USDA (including USFS), DOD, NIH, NPS, and FWS have supported and continue to produce RFPs that involve Global Change foci, and major foundations such as MacArthur, Gates, and FORD also emphasize these issues. Not only are many of the problems themselves multidisciplinary, agencies and foundations increasingly encourage, if not require, integration of social and natural sciences to address them. From the Coupled Human and Natural Systems directorate, to the interdisciplinary emphasis of the Urban LTER program, and requisite broader impact statements, NSF continues to prioritize cross-disciplinary research. Indeed, emphasis on the integration of social science at USDA and USEPA, and many foundations has also pursued similar themes. GES faculty are particularly well positioned to take advantage of coupled approaches to global change science.

Our department is also seeking to increase collaborative networks within our region through greater connection with traditional partners such as NASA, USDA, USGS, NOAA, the State of Maryland, various county agencies, and the City of Baltimore's Parks and People Foundation, as well as forging new or emerging research alliances with Maryland Department of Corrections, Baltimore Greenspace, Conservation International, Maryland SeaGrant, the Susquehanna River Basin Commission, the Smithsonian Environmental Research Center, Tropical Research Institute, and the National Zoo to foster new opportunities, and to train students (who represent us in the broader field) to become a primary reservoir for research-oriented, environmental recruitment.

We believe our integrative and collaborative vision can serve as a model for moving forward and increasing research capacity to better position ourselves to compete for limited research funds. Moreover, our comfort with multi-disciplinary inquiry make us ideal colleagues for inter-unit collaborations that enhance the greater University's ability to compete for extramural resources.

**2. Briefly describe the specific resources that would be needed by your unit to approach the goals you identified above?**

We recognize that environmental sustainability is already a core component of the University's strategic vision, and we have benefited from continued investment even as we have

expanded undergraduate enrollments and developed a thriving graduate program. Moving forward, we anticipate several key needs over the next five years.

First and foremost, support for faculty hires will be critical to our continued growth and research success. We appreciate and welcome the support of the administration in our current search for an external Chair, and we will seek to replace two faculty who are expected to retire within the next three years (Parker and Bennett). Replacement hires on both of these lines as tenure-track faculty will help ensure the continued elevation of our department to national prominence, as well as maintaining an intellectual balance within the department between work on social and natural systems.

It is already well established and widely recognized that our department suffers from a shortage of office and lab space. We are leveraging a variety of resources to re-allocate and optimize our current use of space, but new hires will further strain our space needs and may even limit our ability to recruit top talent. As a near-term solution, we are pursuing a potential opportunity to expand our current lab space by occupying the south end of the basement of Math/Psych during the backfill process resulting from the completion of the Performing Arts building and the remodeling of Fine Arts. We anticipate that such an expansion will address many of our near term space needs.

A third crucial element of our current need is to hire a Lecturer position in addition to the tenure-track replacement hires. Over the course of the past 10 years, GES has been willing to increase enrollment in our 100-level service courses without requesting pressure enrollment money for part-time instruction. As a result, we are rather unusual in that all of our five to six introductory sections per term (~1500 to 1800 FTE/yr) are currently taught by tenure-track faculty with only three TAs spread across courses. We view this model as competing with our efforts to deliver high-quality graduate instruction and promote greater research achievement by our faculty. A lecturer would create flexibility and freedom among regular faculty to develop and teach innovative upper-level and graduate courses and to engage in greater amounts of extracurricular research.

The final element in our plan involves acquiring 3-5 additional GA lines to support research and teaching within the department, and to enhance our ability to recruit top students to our program. Our graduate program is still quite new in comparison with others in our fields, and this position presents a challenge for recruiting excellent graduate students because we have had little opportunity to establish a reputation. Our faculty members' research strengths have helped us begin to overcome this challenge, and outstanding students in our first few cohorts have helped spread the word of about our innovative program. Additional GA lines would be essential for helping us overcome this recruiting challenge, while the grad students we recruit as a result will, in turn, support our research efforts and help draw positive attention to our program.

## List of faculty research projects

- Urban Water Innovation Network (U-WIN): Transitioning toward sustainable urban water systems (NSF Sustainability Research Network, 14-university partnership)
- Geomorphic effects of dam removal on the Patapsco River (NOAA)
- Biodiversity and structural characteristics of forest patches along an urban-rural gradient (in partnership with Baltimore Greenspace)
- Riparian indicators of eco-hydraulic function for improved watershed management and monitoring (MD SeaGrant)
- Tracking the effects of urbanization on stream communities through time (MD SeaGrant)
- Analytical approaches for detecting community response to environmental gradients in streams along urban-rural gradients (USGS, Mass. Dept Fish and Game)
- The influence of network structure and connectivity on stream community assembly (NSF)
- The role of riparian hydrology and geomorphology in contributing to regional greenhouse gas emissions (USDA-CSREES)
- 2012-2016 NSF Coupled Natural-Human Systems Grant, Co-PI
- USDA Northeast Integrated Pest Management Grant, Co-PI
- [GLOBE](#): Online tools for global synthesis of local knowledge
- [Ecosynth](#): Inexpensive tools for scanning landscapes in 3D
- [Anthromes](#) (anthropogenic biomes): global analysis of human/ecosystem interactions
- [Anthropogenic Ecotope Mapping](#): High-resolution ecological mapping of anthropogenic landscapes
- [Measuring long-term changes in land use and biogeochemistry across rural China](#)
- Hurricane intensity change (NASA grant: Hurricanes and Severe Storms Sentinel)
- Extratropical transition of Atlantic hurricanes
- Severe storms in the Mid Atlantic
- Mapping subsistence agriculture and smallholder coffee landscapes in Central America to model adaptive capacity and vulnerability to climate change
- The influence of land tenure on forest change: lessons for conservation incentives and climate change policy in Ecuador
- The influence of conservation management on poverty in Central America
- Challenges of trans-boundary environmental governance: the Mesoamerican Biological Corridor
- Watershed Diagnostics for Improved Adoption of Management (U.S. Department of Agriculture, National Integrated Water Quality Program, September 1, 2012 - August 31, 2014)
- Forests in Limbo: the evolution of forestry governance regimes in Costa Rica (NSF Geography & Regional Sciences, In Review)
- Assessment of stream restoration impacts on urban sediment load and comparison with TMDL guidelines (Chesapeake Bay Trust; July 1, 2014 – March 31, 2016)
- Coastal SEES Collaborative Research: Restoration, redevelopment, revitalization and nitrogen in a coastal watershed (NSF Coastal SEES Program; July 1, 2014 – June 30, 2017)
- Quantifying remobilization rates of legacy sediment from Maryland Piedmont floodplains (Maryland Water Resources Research Center)



- Implications of restoration design for hydrologic response in urban streams (Maryland Sea Grant Graduate Fellowship, awarded to Garth Lindner)
- Collaborative Research: Regional Climate Variability and Patterns of Urban Development – Impacts on the Urban Water Cycle and Nutrient Transport (NSF Water Sustainability and Climate Program; January 1, 2011 – December 31, 2015)
- Baltimore Ecosystem Study, Ecological Research Phase III: Adaptive Processes in the Baltimore Socio-Ecological System – From the Sanitary to the Sustainable City (NSF LTER Program)
- Evolution of public lands (state parks and forests) in Maryland
- Critical Analysis of the Anthropocene Concept
- Population Dynamics of Migratory Shorebirds
- Phenology of Dragonfly Migration
- Biogeographic Connectivity of Migratory Songbirds
- Internship in Resource Management in National Parks in Urban Landscapes, National Park Service, (2013-2015)
- The Role of Dendritic Network Typology and Environmental Filtering in Shaping the Ecology of Spatially Structured Communities, NSF Biological Sciences (2010-2015)
- Integrating Climate Change into the Restoration of the Chesapeake Bay and Watershed, NOAA (2010-2015)
- [Maryland Green Prisons Initiative](#)
- Community Responses to Land Use and Climate Change
- Metacommunities in River Networks
- Multi-Scale Diversity in Built Ecosystems
- Community Assembly and Stream Restoration