PhD Track in Environmental Sciences and GIS through the Integrated Applied Science Program

General Goals and Objectives of the Program

The PhD track in Environmental Sciences and GIS is run under the auspices of the Integrated Applied Science Program. This track utilizes existing courses in several departments for an interdisciplinary degree that prepares students to be leaders in the new interdisciplinary work force in environmental sciences. The Environmental Sciences and GIS track is administered through the Center for Environmental Sciences, under the guidelines of the Ph.D. Program in Integrated and Applied Sciences.

Relationship of the Program to the Mission of Saint Louis University

The mission of the Saint Louis University Center for Environmental Sciences and the Integrated Applied Sciences track in environmental science and GIS is to provide a world-class research and educational environment that examines the interaction of the solid earth, hydrosphere, atmosphere, and biosphere, and how humans are interacting with these systems, often resulting in natural hazards and disasters. We aim to understand how these systems will interact under changing climate and demographics, and to improve humanity's response to these changing environmental conditions. This knowledge will be used to help alleviate suffering and improve the quality of life for populations threatened by environmental conditions, bettering society as a whole. This mission is in harmony with the mission of Saint Louis University, in the pursuit of truth for the greater glory of God and for the service of humanity. We strive for excellence in teaching, research, leadership, and community service, as described in the following pages.

The center boasts a number of world-class researchers in geology, biology, ecology, climate and atmospheric sciences, chemistry, natural hazards, urban and disaster planning and response, public health, environmental law and ethics, remote sensing, and geographic information systems (GIS). The center bridges traditional gaps between disciplines and provides an environment for students and researchers to develop projects using integrated global and regional GIS databases, field studies, and models. The center also reaches the general public through outreach programs including public kiosks at dozens of zoos, science centers, and botanical gardens worldwide, as well as providing a web site for educational and research purposes.

The center capitalizes on its unique location at the junction of four of America's biggest rivers to focus the efforts of its diverse staff to understand and promote environmentally sound judgments in the use and preservation of water resources, rivers, and flood plains, and to achieve a sustainable use of resources. Our many partnerships and sponsors help promote the best scientific research, education, and public outreach possible, bringing the results of interdisciplinary environmental sciences to government and private planners, researchers, students, and communities.

Relationship of the IAS track in Environmental Sciences and GIS to existing department, college/school and University planning priorities

Recently Saint Louis University has established several interdisciplinary programs and centers of excellence that are designed to promote research and education in fields that may span traditional disciplines, and involve mentoring from more than one department. The Integrated Applied Science Program was established to broaden student exposure to all areas of science, encourage collaboration across departments and colleges, and to better train graduate students to present their research to a more diverse audience. The program is designed to provide students with broad exposure to collaborative scientific projects. The goal of the IAS program is complimentary to the mission of the Center for Environmental Sciences, and the two compliment each other.

The mission of the Saint Louis University Center for Environmental Science is to provide a world-class research and educational environment that examines the interaction of the solid earth, hydrosphere, atmosphere, and biosphere, and how humans are interacting with these systems, often resulting in natural hazards and disasters. We aim to understand how these systems will interact under changing climate and demographics, and to improve humanity's response to these changing environmental conditions. This knowledge will be used to help alleviate suffering and improve the quality of life for populations threatened by environmental conditions, bettering society as a whole.

The center boasts affiliated faculty in geology, biology, ecology, climate and atmospheric sciences, chemistry, natural hazards, urban and disaster planning and response, public health, environmental law and ethics, remote sensing, and geographic information systems (GIS). The center bridges traditional gaps between disciplines and provides an environment for students and researchers to develop projects using integrated global and regional GIS databases, field studies, and models.

The track in Environmental Sciences and GIS, focusing on water resources, natural hazards, sustainable development and GIS, is run through the IAS Program, under the auspices of the Center for Environmental Sciences. Through faculty affiliated with the CES we are currently able to provide the necessary course work and expertise for the IAS PhD track in Environmental Sciences and GIS. Other departments that are affiliated with the center that help mentor students in the IAS Environmental Sciences and GIS PhD track include Biology, Chemistry, Public Policy, Political Science, Engineering, Law, and Public Health.

Justification of the Environmental Sciences and GIS PhD track in the IAS Program: Research and Training in Water Resources and Natural Hazards

The Earth's natural environment is rapidly changing on a global scale and our nation must strive to understand these changes in order to be able to adapt to our environment and survive, benefiting society as a whole. Just as the environment is changing, the nature of science is becoming increasingly interdisciplinary, and we need to forge educational and research programs across disciplines to train the next generation of scientists to think in terms of systems, instead of along traditional disciplinary lines. Saint Louis University has recently established the interdisciplinary Center for Environmental Sciences, bringing together resources and expertise from several disparate sources in the University, creating a world-class center of excellence in environmental sciences. Establishment of the center has created opportunities for interdisciplinary research, adding value to pre-existing teaching, education, and outreach that will grow to serve not only the university community, but also local, state, national, and international audiences in diverse aspects of understanding environmental science.

The interdisciplinary PhD track in Environmental Sciences and GIS focuses student's efforts on two of the world's most critical environmental problems, water resources, and natural hazards. The water resources and global environmental change emphasis area includes access for the students to groups and laboratories dedicated to river and flood systems, GIS and remote sensing, water quality and supply, and water-borne disease that affects much of the world's population. Water and other resources are becoming increasingly scarce with increasing global population, and we need to understand how to find and use more resources while polluting less. Our unique location at the junction of four of America's largest rivers will be used to highlight water and river systems and flood plain regulation. For instance, there is great national interest in preserving flood plains, with implications for preservation of unique ecosystems and protection of communities housing hundreds of thousands of people.

Our climate is changing rapidly, both from natural and anthropogenic factors, and we must understand what these changes will be, and how we can best anticipate changes to the hydrosphere and be ready to respond. Global temperatures and sea level are rising, patterns of precipitation are changing, and severe storms are becoming stronger, more frequent, and impacting human populations with greater intensity and frequency. Diverse groups of faculty in the center can address various aspects of how to deal with climate change and its impact on people (such as atmospheric, hydrological, cultural, economic), and the Environmental Sciences and GIS PhD track exposes students to the science from related fields (atmospheric sciences, policy) needed to be leaders in the next decade when the world will need to respond to the geologic changes caused by climate change. Faculty in the center teach students to address these issues holistically in an open academic environment, finding better mechanisms to deal with the threats.

As populations grow people are increasingly moving into the path of disaster, by moving into hazardous areas such as flood plains, hurricane-prone coastal environments, flanks of volcanoes, and high-shake zones in earthquake prone areas. Other populations suffer from disease and health threats from water-borne pathogens, and still others may be at threat from acts of bioterrorism. A second focus area of research in Environmental Sciences and GIS by faculty in the Center for Environmental Science is aimed at how we can minimize the risk to populations who are pressured to move into hazardous areas. Researchers at SLU have a vast expertise in natural hazards, and the Environmental Sciences and GIS track brings them together to teach students, providing a national strength in natural hazards, able to teach students the underlying physical causes of how natural phenomena become hazardous and disastrous, and how to mitigate the effects of these processes.

In this section we describe the major interdisciplinary program focus areas in the Environmental Sciences and GIS track that represent research fields in which faculty place students to complete the research phase of their training. Ph.D. students spend the first 2 years of the program in intensive interdisciplinary course work, then focus for the following 2 years on research. Students in the Environmental Sciences and GIS track gain expertise in the use of Geographic Information System (GIS) technologies, and are exposed to course work and research in interdisciplinary fields that overlap their research in water and natural hazards.

Research Emphasis 1) Water Resources and Global Environmental Change.

Water is our most precious resource, needed for sustaining all life, yet has also become our most threatened resource with pollution, overuse, and increased urbanization of areas threatened by floods (e.g., Kusky, 2008g). Wars have been and will be fought over the ability to obtain fresh water, and water rights pose difficult political issues in places where it is scarce, like the American West and Middle East. Since we live in a finite world with a finite amount of fresh water, and the global population is growing rapidly, it is likely that fresh water will become an increasingly important topic for generations to come. Less than 1% of the planet’s water is groundwater, yet the volume of groundwater is 35 times the volume of freshwater in lakes and streams. Americans and other nations have come to realize that groundwater is a vital resource for their nation’s survival, and are only recently beginning to appreciate that much of the world’s ground water resources are being overpumped or have become contaminated by natural and human-aided processes. Forty percent of drinking water in the United States comes from groundwater reservoirs, with 80 billion gallons of groundwater pumped out of these reservoirs every day. Researchers now in the CES has been involved in devising new, cutting-edge remote-sensing and GIS techniques of assessing surface and ground water potential and resources around the world for the past 15 years, publishing scientific articles, books, and reports to U.S. and foreign government agencies on water resources and relationships to biodiversity and human patterns of use (e.g., Kusky et al., 1995, 1999; Kusky, 2004, 2008a-h; El-Baz et al., 1998, 1999a,b, 2000, 2002, Ghulam et al., 2007a,b, 2008a,b,c). One of the research emphasis areas in the Environmental Sciences and GIS track will build on this experience, data collections, and rapid increase in computing power to derive innovative methods of assessing water resources and use, benefiting society in the most fundamental of ways.

St. Louis sits at and near the junction of four of the nation's largest river systems, the Mississippi, Missouri, Illinois and Ohio. Being at this critical location provides students a natural field laboratory to investigate relationships between different Earth Systems associated with rivers, and SLU maintains several biological and ecological field stations in the region. Courses in the IAS program include many hands-on field experiences, and include local field investigations for research. Students in the program may choose to investigate the causes of regional variations and relationships in aquatic biodiversity, conservation, and link these studies with environmental influences on the rivers, modeling their data in a GIS. Rivers and streams of North America's Central Highlands physiographic province adjoining the St. Louis area harbor one of the most diverse aquatic biotas in the world; these aquatic ecosystems have been ranked internationally as among the most diverse and imperiled ecosystems in the world (Lydeard and Mayden 1995; Knouft, 2006; Knouft et al., 2006). The diversity within this region is related to the varied geological history of the landscape, so it is necessary to understand the geology to model the biology. Although the river systems in the highlands or gulf coast drainages have never been glaciated and were only partially inundated by the Cretaceous sea (thus minimizing extinctions of species and communities), their component biotas have been strongly impacted by the geological processes acting on the landscape as a whole. Thus, studies of the environmental influences on fish ecology need to integrate biological, geological, climate, and genetic data, and the best way to do this is using a Geographic Information System that integrates GIS and genetic data.

The Missouri River traverses over 2,300 miles and drains one-sixth of the United States. During the past two centuries, the Missouri River, along with its adjacent wetlands and floodplains, has been significantly modified in various attempts to promote transportation, agriculture, and development. These modifications have included draining wetlands for cultivation, straightening stream channels to facilitate navigation, stabilizing banks to prevent erosion, and constructing agricultural levees, dams, reservoirs, and flood control levees to control water flow and exclude flood waters from the floodplain. These modifications have resulted in a loss of wetlands. Historically, the Missouri River floodplain below Sioux City, Iowa covered 1.9 million acres. Due to the modifications identified above, approximately 168,000 acres of natural channel, 354,000 acres of meander belt habitat, and 50% of the Missouri River's surface have been lost. In addition, shallow-water habitat has been reduced by up to 90% in some areas while sandbars, islands, oxbows, and backwaters have been virtually eliminated. Forested floodplains along the Missouri River have decreased from 76% in the 19th century to 13% in 1972 and cultivated lands have increased from 18% to 83%. By the late 1970's, the lower Missouri River had been totally channelized and its natural floodplain ecosystems almost completely converted to agricultural or other uses. Today, the Lower Missouri River is flanked by levees and other flood control structures for most of its length. These changes have dramatically altered the river flow dynamics, the ecology of the entire river and floodplain system, and the economic development of the region. Most of these changes have gone undocumented and unplanned, and as part of the Environmental Sciences and GIS PhD track we are studying this system through different Ph.D. dissertations, making an impact locally, nationally, and globally in understanding the effects of urbanization on river-floodplain systems.

Remote sensing and GIS are powerful tools for monitoring change in ecological and geological systems. For instance, satellite image change detection techniques can be used to monitor deforestation (Kusky et al., 2004, 2008), or vegetation changes and urban expansion, through successive satellite imaging and a GIS, or linking these ecological changes with ground based measurements of changes in the biota. Other techniques can monitor ground water and surface soil moisture (Ghulam et al., 2007, 2008). Using these types of techniques for different integrated global projects forms the core of the IAS training and education, exposing the students to state-of-the art technology, research, ideas, and scientists who are attempting to make a difference in the environment of the world. For instance, one project we are co-investigating with the St. Louis Zoo is helping to track changes in endangered lemur populations in Madagascar using a GIS and satellite image database, together with data on the health of the lemur populations (see MFG, 2008). There are many research projects like this that IAS students can become involved with, being mentored from University faculty and professional (Ph.D.) biologists and ecologists from the zoo and affiliates, chemists, and other scientists from government and industry labs.

Research Emphasis 2) Natural Hazards & GIS, Sustainable Development, and Society.

The Earth is a naturally dynamic world, with volcanic eruptions spewing lava and ash, earthquakes uplifting mountains, shaking the surface and forming tsunami that move across ocean basins at hundred of miles per hour and rise in huge waves on distant shores. Mountains may suddenly collapse burying entire villages in landslides (Liu and Kusky, 2008), and slopes are gradually creeping downhill moving everything built on them. Storms sweep coastlines and remove millions of tons of sand from one place and deposit it in another in single days. Large parts of the globe are turning into desert, and glaciers that once advanced are rapidly retreating. Sea level is beginning to rise faster than previously imagined, and global warming is causing increased severity of storms with increased flood and wind damage. Advances in science and engineering in recent decades have dramatically changed the way people view natural hazards. In the past society viewed destructive natural phenomena including earthquakes, volcanic eruptions, floods, landslides and tsunami as unavoidable and unpredictable. Society's attention to basic scientific research has changed that view dramatically, and we are now able to make general predictions of when, where, and how severe such destructive natural events may be, reducing their consequences significantly. We are therefore able to plan evacuations, strengthen buildings, and make detailed plans of what needs to be done in natural disasters to such a degree that the costs of these natural geological hazards have been greatly reduced. The next generation of scientists needs to be trained to understand these natural risks, how to mitigate and plan for decreasing the impact of the risks and how to manage disasters, and how to educate the public about risks of living in certain areas. This can only be done in interdisciplinary programs such as the IAS PhD track in Environmental Sciences and GIS.

This greater scientific understanding has also come with increased governmental responsibility. In the past, society placed little blame on government for the consequences of natural disasters. Now, few disasters go without blame being placed on public officials, scientists, engineers, or planners. Our extensive warning systems, building codes, and understanding have certainly prevented the loss of thousands of lives, yet they also give us a false sense of security. When an earthquake or other disaster strikes, we expect our homes to be safe, yet they are only built to be safe to a certain level of shaking. When a natural geological hazard exceeds the expected level, a natural disaster with great destruction may result, and we blame the government for not anticipating the event. What can be done? Planning and construction efforts are only designed to meet certain levels of force for earthquakes and other hazards, and planning for the rare stronger events would be exorbitantly expensive. Recent international environmental summits have recommended that nations increase international cooperation and monitoring of geological hazards and climate change. Many of the possible PhD projects in the IAS Environmental Sciences and GIS PhD track link faculty expertise in geologic hazards, climate change, and planning for disaster aversion and relief. Our group of geologists, atmospheric scientists, urban planners, law and policy experts, and public health scientists offers a unique group for the IAS students to learn the scientific and social aspects of trying to prevent natural Earth processes from becoming disasters, how to deal with hazards and disasters as scientific experts advising public officials, and what to do when hazardous Earth processes affect communities.

Earth's climate changes on many different time scales, ranging from tens of millions of years to decadal and even shorter time scale variations. In the last 2.5 billion years, several periods of glaciation have been identified, separated by periods of mild climate similar to that of today. Other periods are marked by global hot house type conditions, when the Earth had a very hot and wet climate, approaching that of Venus. These dramatic climate changes are caused by a number of different factors that exert their influence on different time scales. One variable is the amount of incoming solar radiation, which changes in response to several astronomical effects such as orbital tilt, eccentricity and wobble. Changes in the incoming solar radiation in response to changes in orbital variations produce cyclical variations known as

Milankovitch Cycles. Another variable is the amount of heat retained by the atmosphere and ocean, or the balance between the incoming and outgoing heat. A third variable is the distribution of landmasses on the planet, since shifting continents influence the patterns of ocean circulation and heat distribution. Shorter term climate variations include those that operate on periods of thousands of years, and shorter, less regular decadal scale variations. Both of these relatively short-period variations are of most concern to humans, and considerable effort is being extended to understand their causes, and to estimate the consequences of the current climate changes the planet is experiencing. Great research efforts are being expended to understand the climate history of the last million years, and to help predict the future. Understanding past climates is in the realm of the environmental geologist.

It is clear that human activities are changing the global climate, primarily through the introduction of greenhouse gases such as CO_2 into the atmosphere, while cutting down tropical rain forests that act as sinks for the CO_2 and put oxygen back into the atmosphere. The time scale of observation of these human, also called anthropogenic, changes is short but the effect is clear, with a nearly one degree change in global temperature measured for the past few decades. The increase in temperature will lead to more water vapor in the atmosphere, and since water vapor is also a greenhouse gas, this will lead to a further increase in temperature. Many computer-based climate models are attempting to predict how much global temperatures will rise as a consequence of our anthropogenic influences, and what effects this temperature rise will have on melting of the ice sheets (which could be catastrophic), sea level rise (perhaps tens of meters or more), and runaway greenhouse temperature rise (which is possible).

Climate change is starting to impact river systems in the mid-west (e.g., Pan et al., 2006). These changes will severely impact the way people live along river basins, shorelines, and elsewhere. We must understand and plan for these geologic changes, and the next generation of students must be taught how to lead society to cope with these changes. We are able to integrate measurements of soil moisture/water content with models of heavy rainfall to make forecasts of floods and hydrologic conditions. Research at St. Louis University (Pan et al., 2006) has shown that with global warming, some regions known as warming holes will actually become wetter and slightly colder than at present. In the USA, the central plains centered on the Missouri River Basin represent a warming hole, formed by the interaction between the convergence of water vapor leading to increased rainfall, accumulation of water in thick soils, and evaporation enhancing cooling. For our concerns, the increased precipitation is most significant, in that a 21% increase in precipitation for the Missouri / Mississippi River basins is predicted in this region, along with an alarming 51% increase in the amount of water flowing through our rivers. River flood stages will be higher, floods will be more frequent and potentially devastating. The geologic consequences of these climate changes are not appreciated, and desperately need to be understood by the people who live in the region, developers, insurance underwriters, urban planners, politicians, and the federal government. The IAS PhD track in Environmental Sciences and GIS offers the best way to train a new generation of scientists about these hazards, and how to become leaders and agents of change to successfully lead society through the dramatic changes that are anticipated in coming decades.

Application and Admissions Procedure

Students from a variety of backgrounds are eligible to enter the IAS Track in Environmental Sciences and GIS, though we expect that most will possess a Master's degree that already includes exposure to basic geology or related environmental science coursework and a typical science core. The IAS PhD students in Environmental Sciences and GIS will require a well-rounded science education before entering the program, with students admitted through the graduate school using the formal guidelines in the IAS Handbook for PhD Studies (http://www.slu.edu/ias/). Typical students will have completed 2 calculus, 1 statistics, 2 physics, 2 chemistry, and 2 geology before entering the program. Based on our previous experience, we suggest that these requirements be guidelines, and that students from diverse backgrounds be given opportunities to make up for deficiencies in their background if they are deemed to be strong candidates for the program for other reasons by the admissions committee. The students will then enroll in Ph.D. courses in environmental geology, ecology, biology, environmental policy, disaster planning, plus advanced GIS and remote sensing courses, as shown below**.** At this stage, IAS students are assessed as to their potential to complete the Ph.D., and are either asked to leave the program with a M.Sc. and GIS certificate, or granted permission to continue toward Ph.D. candidacy. Students will design their own specific research project with their faculty mentors, and participating in the additional integrated interdisciplinary seminars and experience courses. We have developed several new courses in advanced methods and technologies in remote sensing and GIS that form part of the core of the IAS program. The structure of the IAS Ph.D. program in Environmental Sciences and GIS brings together a broad group of faculty, industry scientists, students, returning professional students, international collaborators and exchange students.

Curriculum

PhD students enrolled in the Environmental Sciences and GIS track in the IAS Program experience a diverse and intensive learning environment, being guided initially through a core program of environmental science, geology, biology, math, engineering, education, policy, and ethics courses equivalent to a non-thesis Master's degree program. Following the initial two years each student will spend another two years completing a research dissertation in Environmental Sciences and GIS. Use of the technologies learned in the initial two years will form an integral part of the advanced research, and students will be paired with mentors both from the university sector, and the industry or government sectors to ensure a diversity of perspectives.

Suggested Course Sequence for IAS Interdisciplinary PhD Track in Environmental Sciences and GIS

We illustrate here the Interdisciplinary Environmental Sciences and GIS track. The courses listed here either exist in the different departments in the college that are affiliated with the center, or as IAS courses (IAS 551, 552). Students admitted to the track are required to have completed the following courses, or to have a plan to complete them within the first 2 years of study:

Prerequisites: students are assumed to have an environmental science related discipline, and most will have at least 2 geology courses, introductory GIS, statistics, 2 chemistry, 2 physics, and 2 calculus. IAS students are permitted to transfer up to 9 credits from their MS studies, using the appropriate CAS petitions and approvals.

The track in Environmental Sciences and GIS requires 48-54 hours of EAS and interdisciplinary coursework, and 12 hours of dissertation. The sequence satisfies the following program requirements:

- Participating Departmental Core Courses: 24 credit hours *(GIS is listed in IAS for another 6 credits in major field, for total of 24)
- Related Science courses: 6-12 credit hours
- Interdisciplinary Courses: 19-26 Total credit hours (*includes 6 credits of GIS)
  - Interdisciplinary seminar: (5-7 credit hours)
  - Current Topics in Interdisciplinary Research: (5-7 credit hours)
  - Interdisciplinary Research: (4-7 credit hours)
- Dissertation credits. 12 credit hours

Committee and Comprehensive Exam Structure

The dissertation committee for each student will consist of a primary research mentor, a secondary research mentor from a different department than the student's core department, and 2-3 other members of the Graduate Faculty. This committee will be responsible for developing and administering the written and oral comprehensive examinations. The intent of these exams, which are graduate school requirements, is to determine if the student is prepared to continue his or her PhD studies. The exams will take a modular format, based on the student's area of specialization. The written exam will be taken no earlier than the end of the fourth semester of coursework studies, and will be followed by an oral exam. The student must pass the Oral Defense of the Dissertation Research, administered by the dissertation committee, following the requirements of the graduate school.

The dissertation committee will be responsible for the oversight of the student's research development. The members of this committee will assist the student in the development of a PhD Dissertation Research Proposal prior to the beginning of their 5th semester. The secondary mentor will perform a unique function for students in the interdisciplinary program. The secondary mentor will be a member of a different discipline than the primary mentor, yet they will be directly involved in the development of the students research, and its eventual presentation and publication. Many of the environmental projects in the world today require the input of multidisciplinary and interdisciplinary science, and we believe that the structure of the program we are proposing will build the interdisciplinary skills that the students require to succeed in the international arena.

Environmental Sciences and GIS Track – Earth and Atmospheric Science Courses

IAS Students are permitted to take up to 10 credit hours at the 400 level

EAS 450 Scientific Communication	2	Total Credits
EAS 435 Ground Water Hydrology	3	
EAS 425 Surface Water Hydrology	3	
EAS 519 Seminar in Geosciences	3	
EAS 591 Journal Club	1	
EAS 517 Divergent/Convergent Margins	3	
EAS 518 Transform/Plate Interiors	3	
IAS 551 Remote Sensing of Environment and Resources	3	
IAS 552 GIS and Geospatial Methods for IAS	3	24

Courses from Other Disciplines: *Two to four courses from pre-approved lists from affiliated departments should be taken in the research emphasis area, outside the research specialization of the PhD candidate. A sample of these courses includes:*

BIO 468 Landscape Ecology and Management	3	
BIO 593 GIS in Biology	3	
BIO 548 Conservation Biology	3	
BIO 550 Problems in Ecology	3	
CHEM 521 Environmental Chemistry	3	
PPS 536 Science, Technology, & Public Policy	3	
PPS 543 Environmental Planning & Risk Management	3	
BSDP 566 Disaster Planning	3	
EOH 597 Environmental Occupational Health	3	
EAS 534 Physical Meteorology	3	6-12

<u>Interdisciplinary Courses in the Integrated Applied Science Program Core</u>

Interdisciplinary Seminar	5-7	
Interdisciplinary Research Discussion	5-7	
Interdisciplinary Research	3-6	
Research (Dissertation)	12 Credits	35-42

Faculty Resources: Participating Faculty Members

The following faculty members are currently associated with the Center for Environmental Sciences, and work together on the Environmental Sciences and GIS PhD track advising. All are members of the graduate faculty.

<u>P.I.</u> *Timothy Kusky*, Director, Center for Environmental Sciences, P.C. Reinert Chair of Natural Sciences, Department of Earth and Atmospheric Sciences, St. Louis University

<u>Co-Investigators and Collaborators:</u>
Bill Dannevik, Chair, Department of Earth and Atmospheric Sciences, St. Louis University
Rick Mayden, Chair, W.S. Barnickel Chair of Natural Sciences, Dept. of Biology, St. Louis University
Jason Knouft, Geospatial Biology, Department of Biology, St. Louis University
Steve Buckner, Chair, Dept. of Chemistry, St. Louis University
Paul Jelliss, Integrated Applied Sciences PhD Program Director, Dept. of Chemistry, St. Louis University
Wynne Moskop, Chair, Department of Political Sciences, St. Louis University
Bob Cropf, Chair, College of Public Policy, St. Louis University
Dave Sterling, Prof. of Public Health, School of Public Health St. Louis University
Doug Williams, Prof. of Environmental Law, School of Law, St. Louis University
Gregory Yablonski, Prof. of Green Engineering, Parks College of Engineering, St. Louis University

Administration

The IAS Program is managed by Dr. Paul Jelliss, from the Department of Chemistry. Dr. Jelliss is also affiliated with the CES, and the Environmental Sciences and GIS track will be handled logistically (space) in the Center for Environmental Science at SLU. The Center houses research, staff, research and teaching labs. The Center is an interdisciplinary research structure focusing on issues of critical importance in environmental science, including the geological, biological, chemical, and atmospheric sciences. Projects are linked by their interdisciplinary theme and use of common remote sensing and GIS technologies as one of the major tools to answer fundamental scientific questions. Major areas of emphasis include water resources and ecology, natural hazards and disasters, environmental science and policy, and the use of emerging technologies and visualization systems to study the Earth.

The Center for Environmental Science has a simple organization structure. It is run by the Center Director (T. Kusky), from the Department of Earth and Atmospheric Sciences (Chair, Bill Dannevik), and overseen by the Dean and Associate Provost for Research (D. Brennan, and Ray Tait). Faculty with research and teaching interests in environmental sciences from several departments are affiliated with the center, including faculty from the Departments of Earth and Atmospheric Sciences, Biology, Chemistry, Engineering, and Public Policy. Grant finances will be run from the Office of Grants and Contracts and the Graduate School. The Center has one full-time staff position, including a Geospatial Analyst who specializes in drought and water resources (Dr. Wulamu), and several temporary staff including a Research Scientist specializing in Natural Hazards (Dr. Wang).