

Disaster Sciences and Sustainable Communities

Introduction

Damage and economic impacts of natural and man-made disasters have been growing at exponential rates over the past few decades. The magnitude of these disasters and our global interconnectedness have grown to the point where a catastrophic disaster resulting from either natural or man-made hazards have regional, national, and even global economic consequences. Nowhere are these threats more daunting than in Louisiana, the Gulf Coast Region and the Caribbean Basin. Coastal areas, towns, and urban centers alike are struggling to balance the threat of natural and man-made disasters with social and economic development through informed planning, protection, mitigation, and recovery strategies.

Engineers and scientists currently apply various technological tools and models to assess the impacts of hurricanes, floods, earthquakes, chemical spills, or terrorist incidents. We try to deduce the causes of the disaster so as to facilitate recovery efforts. Unfortunately, this same level of engineering science and information technology is not brought to bear in the mitigation, planning, and immediate response phases of a disaster. This limitation increases the risks for our natural, social, and economic infrastructure, thereby compromising our economy, safety and quality of life in our state and region.

In order to plan and to build sustainable communities with a high quality of life, we must reverse this philosophy. Mitigation and long term planning must be our first priority. We must learn to effectively utilize available information technologies including environmental modeling, telecommunications systems, geographic information sciences (GIS), and advanced remote sensing. In addition we must address the root causes of this growth in catastrophic and incremental disasters through technologically enhanced education and research in the management of our natural and built environments.

Disaster Sciences and Sustainable Communities

Disaster Sciences and Sustainable Communities (DSSC) is a unique program that includes elements of education, basic and applied research, and community outreach activities. The overall goal of DSSC is to understand the nature and impact of disasters on the natural, built and human environments, and to train a new generation of professionals and scientists with disaster management expertise. Through a coordinated multi-disciplinary research and academic curricula, we intend to develop strategies that employ the latest advances in information technology such as remote sensing, GIS, modeling, advanced communications, and distance learning, to enhance disaster planning, mitigation, response, and recovery.

LSU's Disaster Science and Management (DSM) curricula and research program represents a comprehensive and coordinated approach to form the basis of educating the next generation of emergency managers, environmental scientists, planners, and engineers. The DSM curriculum was initiated in response to the Federal Emergency Management Agency (FEMA) call for expanded emergency management programs in colleges and universities in the United States. A minor in Disaster Science and Management is currently available to undergraduate students at Louisiana State University (LSU). The DSSC proposal is a coordinated approach drawing from diverse academic and research fields represented by a broad cross section of LSU Colleges, Schools, Institutes, Centers and Laboratories. We propose new courses in environmental modeling, application of remote sensing and GIS to disasters, GIS in risk analysis, and coastal hazards. Through this program, links between existing laboratories will be strengthened and a dedicated environmental modeling laboratory will be established.

The DSM undergraduate, graduate, and continuing education curriculum will prepare highly skilled, technology oriented professionals capable of understanding and implementing the cohesive nature of science and technology to help create and maintain sustainable communities. Our graduates will obtain the technical, scientific and planning skills to assume leadership positions in professions, agencies and organizations that impact our social, economic, and environmental welfare. Our faculty and students will use new GIS, remote sensing, and modeling labs to develop the information technology tools and knowledge

necessary to understand and investigate the natural and man-made hazards associated with living in Louisiana, the Gulf region, and the Caribbean Basin. These tools and new knowledge will prepare them to formulate comprehensive strategies to protect, conserve, and cost-effectively utilize the region's wealth of natural resources. The intrinsic interdisciplinary approach of this program ensures that students and faculty will be exposed to a range of information technology needs, tools and skills related to both the basic sciences and social sciences. This program will also develop a new conceptual framework for assessing natural and cultural resources, social needs and preferences, and economic opportunities and impacts.

The recent developments in information technologies such as peer-to-peer applications, high-speed Ethernet networks and streaming video imagery have facilitated the delivery of information to multiple users with high accuracy and reliability. One of the areas in which the fast and reliable delivery of information is critical occurs during or prior to a disaster. As technology becomes better integrated in the multidisciplinary research of disaster science and management, it becomes of the utmost importance to prepare future and present managers about this coupling of state-of-the-art research and cutting-edge technologies.

The DSSC program will enable LSU to assume a leadership position nationally in education and research by engaging in activities that address Louisiana's critical resource management and human skills development needs. DSSC will expand and create an institutional framework for this collaborative interdisciplinary relationship between academic units, nonprofit foundations, governmental agencies, private sector partners, and communities. It also represents a strategy that can be immediately applied to the geopolitical region of the Gulf of Mexico and Caribbean region. Effective data collection and analysis yields information critical to resource conservation and protection efforts, and can serve as a basis for promoting information technology education. Access to computer-based information technology that present an accurate understanding of business and community assets and liabilities will enable disaster science and management professionals to make better-informed decisions about resource management, capital investment, and land development. In doing so, DSSC will support the informed management of natural and cultural heritage resources, and assist in promoting sustainable social and economic development.

The DSSC program complements two proposed IT Initiatives and incorporates their fundamental research into the DSSC research, teaching and outreach agenda. The proposed Geoinformatics initiative from the College of Engineering would enhance basic building blocks broadly used throughout the DSSC program, such as GPS and GIS technologies. The Rationale for Coastal Oceanography and Observing Systems in Louisiana would provide baseline oceanographic and meteorological data that would be used in DSSC modeling research.

Representative Project Types

- Modeling short and long-term environmental processes to promote an understanding of coastal dynamics, problems and potential solutions
- Support state and local emergency response operations
- Examine Louisiana's exposure to tropical storms, hurricanes, chemical spills, and terrorism
- Cataloging heritage resources, creating streetscape and landscape plans, designing tourism and recreational facilities to promote heritage and eco-tourism
- Utilize direct and remote sensing technologies to map community infrastructure and resources
- Expand the use of distance learning information technologies and service learning
- Build scalable software systems for information dissemination in emergencies
- Use GIS in social service agencies to clarify vulnerable populations

Resources

In order to accomplish the research, education and outreach agenda of the DSSC, funding will be requested to support faculty, staff, and graduate students as well as to enhance existing research and teaching laboratories. The new personnel resources will strengthen LSU's current research and academic DSM program and activities. The additional teaching and research labs will provide both students and faculty with the infrastructure required to apply the new information technologies to the study of complex economic, social and environmental problems and issues and support outreach and service learning activities.

Six new tenure track positions will be created in the DSSC program to support the undergraduate degree program, graduate concentration, and research programs. These positions will be shared across participating departments and colleges, as a fundamental means of sustaining the interdisciplinary nature of the program. They include a remote sensing position for natural systems in the Department of Oceanography and Coastal Sciences (DOCS), a remote sensing / GIS position for engineered systems (in Civil and Environmental Engineering), a risk analysis/hazards assessment position in the Department of Environmental Studies (DES), a landscape modeler (in DOCS), an emergency manager (in DES), and a planner position shared by Architecture, Landscape Architecture, and Geography.

Conclusion

Economic Development: The DSSC proposal addresses critical economic growth needs by producing graduates skilled in the application of information technology tools. Training and education activities are aimed at creating a skilled workforce for new enterprises and jobs. For existing companies, the research and education activities capitalize on existing resources at LSU to support the competitiveness of Louisiana's businesses, agencies, organizations and communities.

Organizations need employees who understand hazards and have knowledge and skills in environmental modeling, remote sensing and image processing, geographic information sciences, and communication technology. Louisiana organizations will benefit by having employees who understand natural and man-made hazards and who have the capacity to develop innovative approaches to address them. The bottom line is that organizations that understand risks and hazards are in a position to develop innovative strategies to be more competitive locally, regionally, nationally, and internationally.

Innovative Interdisciplinary Research and Teaching: The DSSC utilizes a unique interdisciplinary technology intensive framework drawing on current LSU academic and research resources from eighteen colleges, schools, divisions, centers, institutes and labs. This structure is founded on the basic and applied sciences and is capable of responding to an evolving education and research agenda on a state, regional or national level. The interdepartmental approach extends beyond the campus by creating partnerships with professional associations, businesses, non-profit organizations, and governmental agencies and utilizes the Internet and distance learning technologies to take learning beyond the campus.

Irreplaceable natural and cultural assets in Louisiana and the region are increasingly threatened with degradation and destruction, often through ill-informed or conflicting hazard management practices. Viable opportunities for effective protection and management of these resources remain poorly understood and unexploited, and the benefits of using advance information technologies and spatial data management systems to address these challenges are generally not available to many businesses, agencies and communities due to lack of appropriate professional expertise. The DSSC is a multi-disciplinary approach to that will create a skilled and educated workforce that understands the application of information technologies to the complex problems of disasters.

Appendices

- A. Participating Colleges, Schools, Centers, Institutes and Laboratories
- B. Undergraduate Curriculum in Disaster Science and Management: Draft
- C. Interdepartmental Graduate Studies Concentration in Disaster Science and Management
- D. Year One Budget and Annual Budget Summaries

Appendix A
Disaster Science and Sustainable Communities
Participating Colleges, Schools, Centers, Institutes and Laboratories

- Department of Civil and Environmental Engineering, College of Engineering
- School of Architecture, College of Art and Design
- School of Landscape Architecture, College of Art and Design
- Department of Geography, College of Arts and Sciences
- Department of Environmental Studies, School of the Coastal and the Environment
- Department of Oceanography And Coastal Sciences, School of the Coastal and the Environment
- Department of Sociology, College of Arts and Sciences
- School of Social Work
- LSU Hurricane Center
- Southern Regional Climate Center
- Coastal Studies Institute Earth Scan Laboratory
- Louisiana Water Resources Research Institute
- Coastal Morphodynamics Laboratory
- CADGIS (Computer Aided Design Geographic Information System Laboratory)
- Office of Community Design and Development
- Natural Systems Modeling Laboratory
- Division of Continuing Education
- LSU Agricultural Center

Appendix B

UNDERGRADUATE CURRICULUM IN DISASTER SCIENCE AND MANAGEMENT: DRAFT

TOTAL SEM. HRS. 130

Approved Electives: A list of approved DSM Core Courses is available from the Department of Environmental Studies. Students may select twelve hours from the list. A list of approved DSM Electives is also available from the Department of Environmental Studies. Students may select 15 hours from this list.

Students with interest in the engineering and the physical science aspects of the hazards, disasters, remote sensing, and modeling are recommended to take the mathematics sequence of MATH 1550, 1552, and 2065 as well as Physics 2001 and 2002.

FRESHMAN YEAR	SEM. HRS.
Biology for Science Majors I & II (1201, 1208 and 1402)	(8 hours)
Or	
General Biology (1001 and 1002) and Lab (1005)	(8 hours)
Or	
Introduction to Physics (2001 and 2002)	(6 hours)
Or	
Social Science Elective	(6 hours)
General Chemistry (1201, 1202), & Lab (1212)	8
Or 8 hours of Biology or Physics from the list above)	
English Composition 1000/ 1001, 1002	6
Introduction to Oceanography (1005)	3
College Algebra (1021), Plane Trigonometry (1022) or	
Analytic Geometry and Calculus I & II (1550, 1552)	6
Introduction to GIS and Hazards (DSM 1000)	3
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	34 *

* Students who select Physics 2001 and 2002 will have an additional 2 hours of electives.

SOPHOMORE YEAR	SEM. HRS
Hazards and the Environment (DSM 2000)	3
Fundamentals of Emergency Management (DSM 2010)	3
Physical Geography: The Atmosphere (GEOG 2050)	3
Physical Geography: Land & Water Surfaces, Plant & Animal Realms (GEOG 2051)	3
Public Speaking (SPCM 2060)	3
General Education Humanities elective	6

Because of Louisiana's location in the Gulf of Mexico Basin, students are encouraged to consider taking Spanish to meet the Humanities requirement)

Social Science Elective	6
Electives or ROTC	6
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	33

JUNIOR YEAR **SEM. HRS**

Disaster Science and Management Core Courses **	6
Introduction to Statistical Analysis (EXST 2201)	4
Disaster Science and Management Electives **	9
Hazards Seminar (DSM 3910)	1
Technology and Emergency Management (DSM 3200)	3
Calculus with Application to Technology (MATH 1441 or Elementary Differential Equations (MATH 2065)	3
Or	
Social Science Elective	3
Electives or ROTC	4
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	33

** The DSM Core Courses and Elective Courses are listed on the following pages

SENIOR YEAR **SEM. HRS**

Disaster Science and Management Core Courses	6
Disaster Science and Management Electives	6
Geographic Information Systems (GEOG 4047)	3
Introduction to Management (MGT 3200)	3
General Education Arts course	3
Disaster Science and Management Internship (DSM 3900)	3
Electives or ROTC	6
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	30

DSM Core Courses (12 Hours)

Disaster Science and Engineering

- Hurricane Engineering (CE 4445) or Hurricanes and the Built Environment (for Non-engineers) (CE 4745) (3 hours)
- Weather Analysis and Satellite Meteorology (OCS 4021)
- Coastal Hazards (OCS 4---) *CLASS TO BE ADDED*
- Introduction to Environmental Modeling OCS 4--- *CLASS TO BE ADDED*
- Environmental Remote Sensing (GEOG 4045) (3 hours)

Planning and Mitigation

- Building Sustainable Communities (LA 4277) (3 hours)
- Environmental Hazards Analysis (ENVS 4262) (3 hours)
- Regulation and Environmental Hazards (ENVS 4264) (3 hours)
- Environmental Economics (ECON 4320) (3 hours)

Social Dimensions

- Crisis Intervention (SW 4050) (3 hours)
- Social Dimensions of Disasters (SW 4---) *CLASS TO BE ADDED*
- Environmental Historical Geography (GEOG 4---) *CLASS TO BE ADDED*

* After meeting the DSM Core Course Requirement of 12 hours, a student may take classes from this list to meet any or all of the 15 hour DSM Elective Course requirement.

DSM Elective Courses (15 hours)

Natural Hazards

- Applied Ecology (IES 4010)
- Physical Oceanography (OCS 4170)
- Coastal Zone Management (OCS 4465)
- Coastal Morphodynamics (OCS 4024)
- Geographical Hydrology GEOG 4018
- Meteorology (GEOG 4013)

Chemical and Biological Hazards

- Quantitative Risk Assessment (EMS 4020)
- Environmental Toxicology (ENVS 4477)
- Environmental Pollution Transport Processes (OCS 4040)
- Introduction to Nuclear Science (NS 2051)
- Climatology (GEOG 4014)

The Human Environment

- Methods of Sociological Research (SOCL 2211) (3 hours)
- Introduction to Sociology (SOCL 2001) Satisfies an LSU Social Science Requirement
- Human Ecology (SOCL 4711)
 - Perspectives in Contemporary Social Welfare (SW 3000)
 - Psychology of Adjustment (PSYC 2004) SATISFIES AN LSU SOCIAL SCIENCE REQUIREMENT
 - Counseling (PSY 3083)

The Community

- Public Policy Making (POL 2070)
- Seminar on Coastal Zone Management (OCS 4465)
- Economic Principles and Problems (ECON 2010) SATISFIES AN LSU SOCIAL SCIENCE REQUIREMENT)

Practicum / Research (Limit of 6 hours in this category)

- Directed Readings in Disaster Science and Management (DSM 4996) (1 - 6 hours)
- Research in Disaster Science and Management (DSM 4900) (3 Hours)

Appendix C

Interdepartmental Graduate Studies Concentration in Disaster Science and Management

Louisiana State University offers graduate programs in several departments with an Interdepartmental Studies Concentration in Disaster Science and Management. The masters and doctorate graduate programs involve a course of study and research in fields within the Departments of Civil and Environmental Engineering, Environmental Studies, Geography, Oceanography and Coastal Sciences, and Sociology as well as the Schools of Architecture, Landscape Architecture, and Social Work.

The concentration in disaster science and management is designed for students who wish to extend their graduate studies to include a core of courses in the science and engineering of natural or man-made hazards, planning for and mitigation of disasters, and the social dimensions of disasters. In addition the program includes a thesis or dissertation research that has an orientation to hazards or disasters. This multi-disciplinary approach is designed to prepare individuals for careers in a wide range of disciplines in business and industry, government, the not-for-profit sector, and academia that require a broad understanding of disasters and hazards.

The Interdepartmental Studies Concentration in Disaster Science and Management provides students with:

- A broad understanding of the nature and impact of disasters on the natural, built and human environments;
- A basis for establishing strategies to effectively plan for disasters, mitigate the adverse effects of disasters, respond to disasters, and recover from disasters.

This program of study is based on a coordinated approach to training of graduate students from diverse academic and fields of research and study. Each graduate student's program of study can be tailored to his/her interests within the sponsoring department or school. Every student receives a broad-based foundation through coursework, seminars, and research studies.

DEGREE OPTIONS

Upon successful completion of the requirements for a masters or doctoral degree with one of the participating academic units, the student will receive a degree in one of the disciplines listed below with a recognized concentration in Disaster Science and Management.

- Department of Civil and Environmental Engineering (CE): College of Engineering – M.S. or Ph.D. in C.E.; M.S. or Ph.D. in E.S.
- School of Architecture (ARCH), College of Design: M.Arch.
- School of Landscape Architecture (LA), College of Design: M.L.A.
- Department of Geography (GEOG), College of Arts and Sciences: M.A., M.S. and Ph.D.
- Department of Environmental Studies (IES), School of the Coastal and the Environment: M.S.
- Department of Oceanography And Coastal Sciences (OCS), School of the Coastal and the Environment: M.S. and Ph.D.
- Department of Sociology (SOC): M.A., Ph.D.
- School of Social Work (SW): M.S.W., Ph.D.

Institutes and Centers

The following institutes and centers with faculty participating in the interdepartmental concentration include:

- LSU Hurricane Center
- Southern Regional Climate Center
- Earth Scan Laboratory
- Louisiana Water Resources Research Institute
- Coastal Morphodynamics Laboratory
- CADGIS (Computer Aided Design Geographic Information System Laboratory)
- Natural Systems Modeling Laboratory
- LSU Agricultural Center

ADMISSIONS

Application for admission into the concentration must be directed to one of the departments listed above. A student must first be accepted by the Graduate School of LSU and one of the participating departments. After acceptance into one of these departments and selection of a research adviser, the student should contact the DSM coordinator in the department to apply for admission to the Interdepartmental Studies Concentration in Disaster Science and Management. General admission requires:

- Bachelor's degree or higher
- Completion of (with a minimum grade-point average of 3.0) sufficient credits in engineering, social/behavioral, and physical sciences to indicate probable success in the sponsoring academic program. If a student does not have the necessary background for a specific graduate program they may be admitted on a provisional basis to take up to nine hours of classes.
- Recommendation by one of the participating faculty members of the Interdepartmental Studies Concentration in Disaster Science and Management
- Identification of a thesis, project, or dissertation research topic involving disasters or natural or man-made hazards.

FINANCIAL SUPPORT

A limited number of graduate assistantships are available from participating department, institutes and centers. Financial support is from contracts and grants with faculty associated with the Disaster Science and Management concentration.

REQUIREMENTS FOR THE DEGREE

To earn the masters or doctoral degree with a concentration in disaster science and management, a student must satisfy the degree requirements in one of the participating departments and those of the Interdepartmental Studies Concentration in Disaster Science and Management. Where course requirements overlap, a student will receive credit toward both sets of requirements. For non-thesis masters programs, the student would satisfy the requirements of the participating department.

CURRICULUM

Core Courses (7 hours required)

- Advanced Geographic Information Systems (GIS) (GEOG 7973 - 3 hours)
- Crisis Intervention (SW 4050) (3 hours)
- Environmental Seminar (ENVS 7995) (1 hour)

Electives (6 hours)

Disaster Science and Engineering

- Hurricane Engineering (CE 4445) or Hurricanes and the Built Environment (for Non-engineers) (CE 4745) (3 hours)
- Weather Analysis and Satellite Meteorology (OCS 4021)
- Physical Oceanography (OCS 4170)
- Spatial Modeling of Environmental Data (ENVS 7045)
- Quantitative Risk Assessment (EMS 4020)
- Environmental Toxicology (ENVS 4477)
- Environmental Remote Sensing (GEOG 4045)

Planning and Mitigation

- Building Sustainable Communities (LA 4277) (3 hours)
- Environmental Hazards Analysis (ENVS 4262) (3 hours)
- Environmental Law and Regulation (ENVS 7043) (3 hours) or Land Use Law and Regulation (ENVS 7045)
- Environmental Economics (ECON 4320) (3 hours)
- Seminar on Coastal Zone Management (OCS 4465) (3 hours)

Social Dimensions

- Human Ecology (SOCL 4711) (3 hours)

For Further Information Contact:

John C. Pine, Professor – Research
Department of Environmental Studies
Louisiana State University
Baton Rouge, LA 70803-5705

Telephone (225) 578-1075
Email: jpine@lsu.edu

FAX (225) 578-4286

Or Members of the Disaster Science and Management Coordinating Committee

Craig E. Colton (Department of Geography)
Scott L. Feld (Department of Sociology)
Marc L. Levitan (Department of Civil and Environmental Engineering)
C. Barrett Kennedy (School of Architecture)
John C. Pine (Department of Environmental Studies)
Julie A. Schroeder (School of Social Work)
Bruce G. Sharky (School of Landscape Architecture)
Nan G. Walker (Department of Oceanography And Coastal Sciences)

For applications to the Graduate School at LSU contact:

**Graduate Admissions
Graduate School
114 David Boyd Hall
Baton Rouge, LA 70803**

Telephone: (225) 578-1641

Further information about the concentration and about departmental graduate programs can be found by accessing the Louisiana State University web site at:

<http://www.lsu.edu>

Applications may be submitted electronically by using the on line application process at:

<http://gradlsu.gs.lsu.edu/admiss.htm>

Departments may review the candidate's application after completing the on-line application form.

Appendix D

Budget