

**The University of Mississippi  
Geoinformatics Center  
(UMGC)**

**Report of Activities  
2000 – 2002**



<http://umgc.olemiss.edu>

**Summary of Research Activities**  
**05/08/2000 to 09/30/2002**

**TITLE:** The University of Mississippi Geoinformatics Center (UMGC)

**PRINCIPAL INVESTIGATOR:** Gregory L. Easson, Associate Professor

**PI's INSTITUTION:** The University of Mississippi  
Office of Research  
125 Old Chemistry  
University, MS 38677

**GRANT NUMBER:** NAG13-00037

## **EXECUTIVE SUMMARY**

The overarching goal of the University of Mississippi Geoinformatics Center (UMGC) is to promote application of geospatial information technologies through technology education, research support, and infrastructure development. During the initial two-year phase of operation the UMGC has successfully met those goals and is uniquely positioned to continue operation and further expand the UMGC into additional academic programs.

At the end of the first funding cycle, the goals of the UMGC have been and are being met through research and educational activities in the original four participating programs; Biology, Computer and Information Science, Geology and Geological Engineering, and Sociology and Anthropology, with the School of Business joining the UMGC in early 2001. Each of these departments is supporting graduate students conducting research, has created combination teaching and research laboratories, and supported faculty during the summer months.

The UMGC is implementing its goals by:

- Expanding the RS/GIS research and teaching infrastructure across campus
- Developing new courses and expanding the offering of existing courses to more students from different disciplines
- Supporting graduate research for students in six academic disciplines
- Sponsoring a lecture series on geospatial information technology
- Summer salary support for faculty
- Conducting workshops in remote sensing, GIS and GPS for community college and high school teachers
- Training state and local government officials in GIS technologies

The success of the UMGC has increased the number of researchers actively investigating the application of Remote Sensing (RS), Geographic Information Systems (GIS), and Global Positioning Satellite (GPS) systems to different disciplines. The UMGC has supported more than 25 graduate students and faculty conducting geospatial information technology application research. This support research has resulted in more than 20 publications and presentations given at national and regional meetings. The expertise gained by the faculty and graduate students and the infrastructure developed as part of the UMGC has also resulted in submission of more than 10 proposals to federal, state and private agencies.

## **GOAL:**

The overarching goal of the University of Mississippi Geoinformatics Center (UMGC) is to promote the application and use of geospatial information technologies through education, research support, and infrastructure development.

## **INTRODUCTION:**

The University of Mississippi Geoinformatics Center (UMGC) began operation in May, 2000. At that time the UMGC began the task of increasing the capabilities of the University of Mississippi to conduct research in the application of the geospatial information technologies of Geographic Information Systems (GIS), Remote Sensing (RS) and Global Positioning Satellite (GPS) systems. The need to increase these capabilities is driven by the rapid expansion of the geospatial information technology industry in Mississippi.

All the major universities in Mississippi are engaged in activities related to the growth of the geospatial information technology industry. The UMGC is unique in that the primary focus of the center is the investigation of how different aspects of geospatial information technology can be applied to different disciplines and scenarios. Other centers on other campuses are focusing on commercial product development, workforce development, or web-enabled course development. The UMGC was designed to evaluate the uses of geospatial information technology and develop new uses in disciplines with limited experience in the use of the technologies.

The activities of the UMGC can be divided into three broad categories; **education, research, and outreach**. Educational opportunities include university course offerings, short courses, on-line training and workshops. Research activities are application oriented projects conducted by faculty and graduate students on the University of Mississippi campus. Outreach includes seminars and short courses conducted for the geospatial technology user community and includes short courses, workshops, and presentations given at civic organizations, high schools, and community colleges.

## **EDUCATION:**

Education in geospatial information technologies is conducted as part of university courses, all-day workshops, teacher training workshops, and seminars. Participants in the UMGC educational activities have included;

- university, community college, and high school faculty,
- college and high school students, and
- state and local government officials.

Class attendees come from backgrounds such as engineering, geology, computer science, marketing, biology, geography, nursing, sociology, and business. The majority of these classes have been conducted in the Geoinformatics Learning Laboratory (GLL).



Geoinformatics Learning Laboratory at The University of Mississippi  
Room 216 Old Chemistry Building

The Geoinformatics Learning Laboratory is the primary facility for geospatial information technologies education. This facility is equipped with 27 computer workstations that each include;

- CPU with Pentium 750 mhz processor and 512 mb of RAM,
- 21" high-resolution color monitor,
- CD-ROM drive,
- access to small and large format printers and plotters,
- connection to campus network and central data server, and
- ergonomic seating and desk.

Courses offered by the UMGC during the initial phase of operation include university courses, short courses and workshops. The university courses offered in conjunction with the UMGC include:

- Introduction to Geographic Information Systems – (GE470/GEOL500) Senior and graduate level course that introduces the fundamental concepts of GIS and its application.

- Introduction to Remote Sensing – (GE510) Senior and graduate level course that presents the basic concepts of remote sensing, image processing and image analysis.
- Spatial Analysis – (GE511) Advanced GIS course that concentrates on analysis of 3-dimensional data, spatial patterns, and network analysis
- Geometrics – (GEOL614) GIS Decision support systems, focusing on different applications, such as local government issues, city planning, environmental analysis and other applications.
- Advanced Remote Sensing – (ENGR620) Advanced applications of remote sensing and use of more advanced sensor data, including hyperspectral.
- Radar Remote Sensing – (ENGR691) Theory and application of active remote sensing system, focusing on RadarSAT and IFSAR
- Landscape Ecology -- (BISC677) Current theory and application of landscape context of ecological problems, scale dependence and processes.

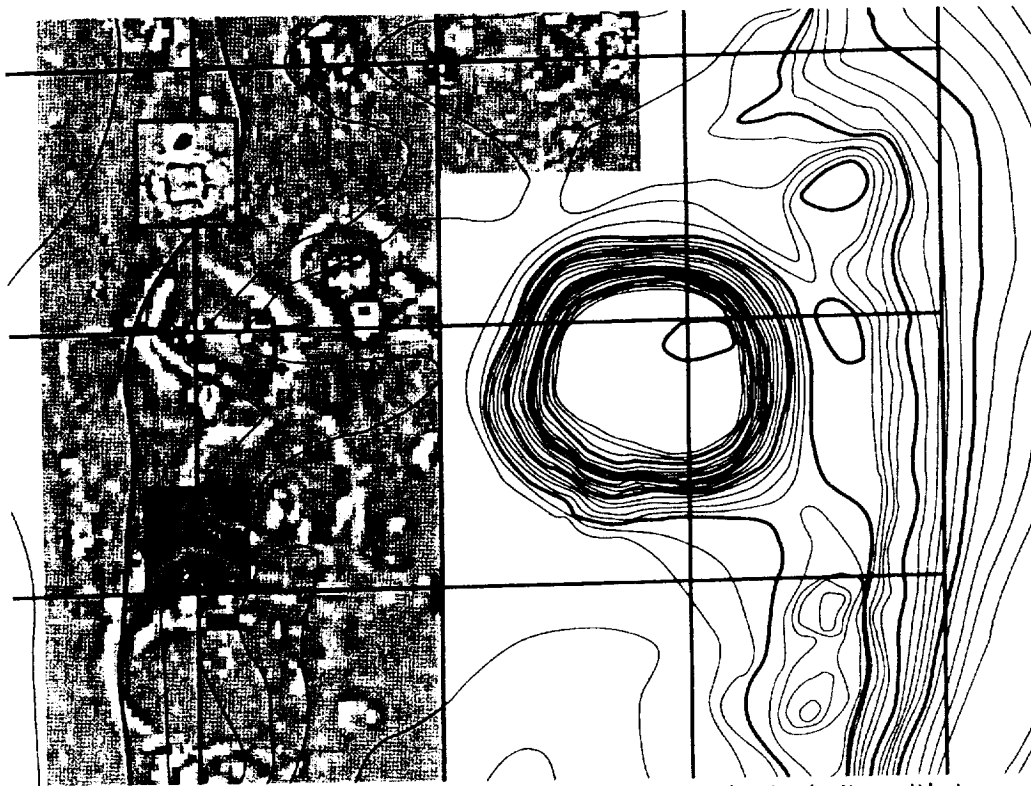
Short courses taught by UMGC staff are offered on a regular schedule and when requested. Greg Easson, Director of UMGC, is a member of ESRI Authorized Training Program (ATP) and is an authorized trainer in ArcView. Short courses are both technology specific and theoretical. Contract trainers are also used to teach additional courses. Short courses offered include:

- Introduction to ArcView – 2-day course developed by ESRI Incorporated that introduces the basic concepts and operation of ArcView. This course has been taught 10 times to approximately 200 students
- Integration of GPS and ArcView – One-day course that presents the theory of GPS and provides hands-on experience in using a GPS unit and downloading the data into ArcView to create spatial themes.
- Introduction to Remote Sensing – 2-day course that introduces the concepts of remote sensing and the operation of ERDAS Imagine software

In addition to the short courses offered on campus, Dr. Jay Johnson of the Department of Sociology and Anthropology has taught a summer course in the use of remote sensing techniques for archaeological site characterization. This is one of the only such courses offered in the United States. The course is taught in the field at the Hollywood Archaeological site in Tunica County, Mississippi. The format of the course is field work in the morning, during the cooler portion of the day, and lectures by visiting professors in the afternoon.

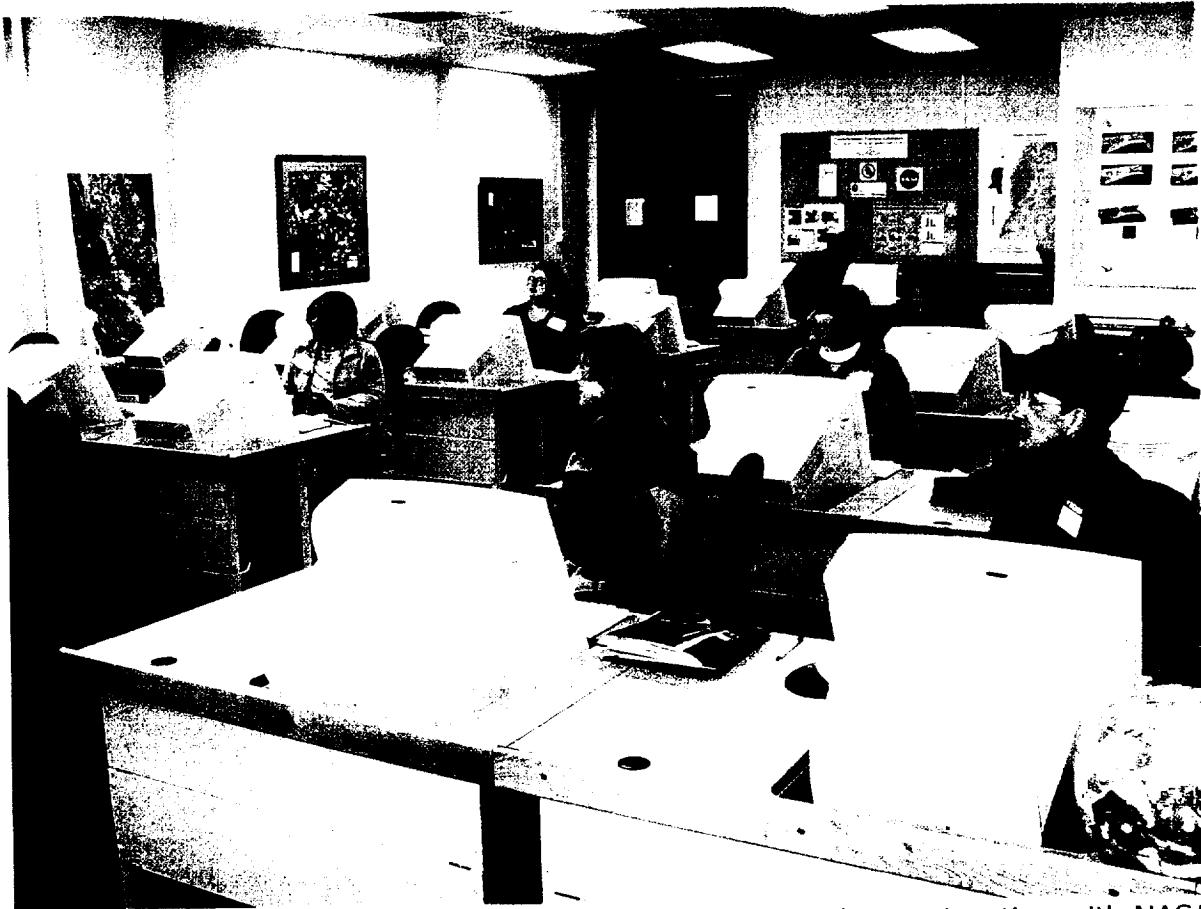


Gravity surveying at the Hollywood Archaeological site.



Results of gravity survey of the Hollywood Archaeological site with topographic contours.

Workshops are similar to short courses, but have been used as the primary forum for introducing high school students and teachers and community college teachers to geospatial information technologies. The focus of these workshops has been to provide material and support so that the teachers can incorporate GIS, GPS, and remote sensing into their courses. Workshops have been offered as part of NASA Space Grant Teacher Training, NASA's GLOBE program, and when needed.



Remote sensing workshop for high school teachers, offered in conjunction with NASA Space Grant Teacher Training Workshop in January, 2002.

### **RESEARCH**

Research in each of the disciplines participating in the UMGC is focused on the application of remote sensing and GIS techniques as tools to answer questions posed by federal, state and local government agencies, individual researchers, and the user community. Examples of research topics investigated during the initial phase of operation are listed below for each major area of excellence at the University of Mississippi. These research topics have addressed research questions raised by a wide variety of agencies, including, National Science Foundation, U.S. Environmental Protection Agency, NASA, Mississippi Emergency Management, the Lake Arrowhead



Water Association, City of Oxford, Mississippi, DeSoto County Planning Department, and others. The research support provided by the UMGC includes:

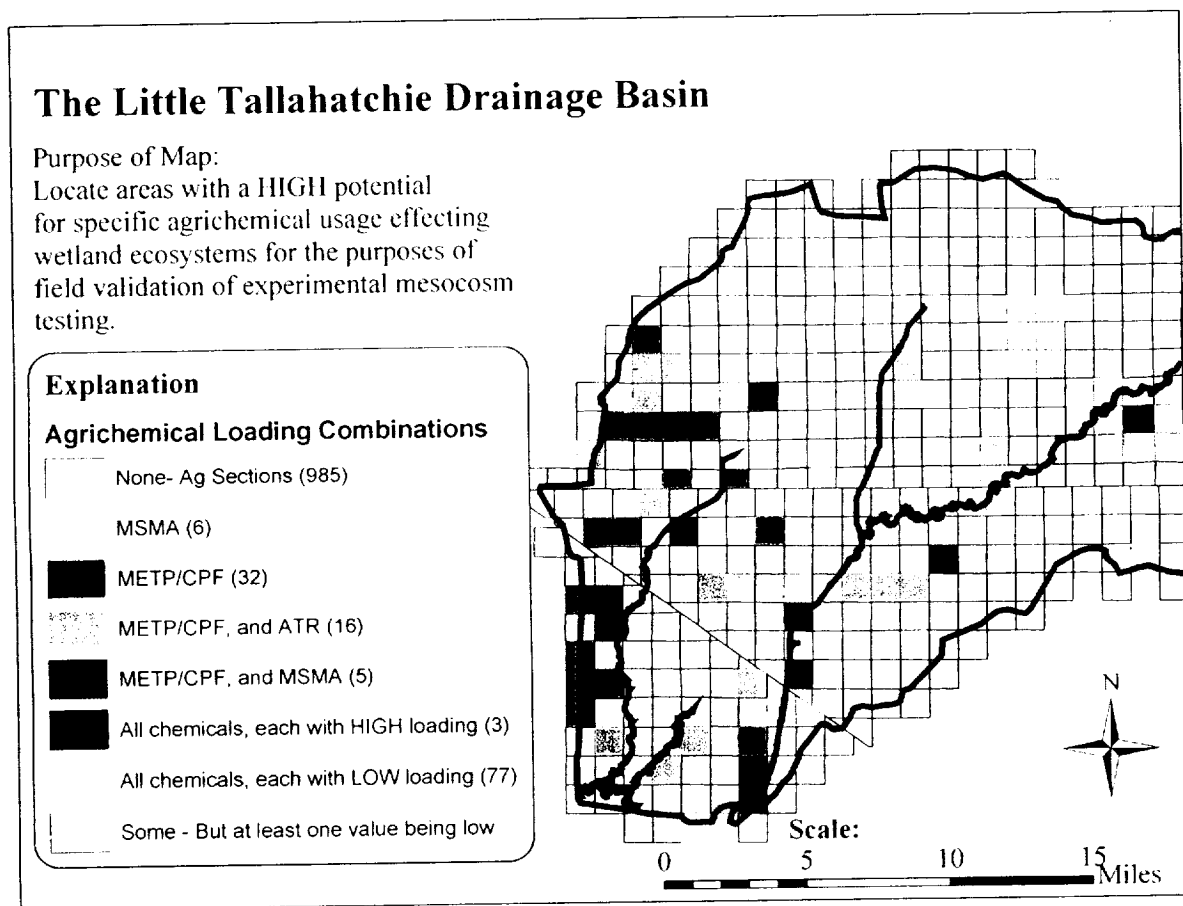
- financial support for graduate students and faculty,
- application support,
- computer acquisition,
- imagery data purchase,
- central database development and maintenance, and
- travel support to present results of research.

**Biology Department:**

**Dr. Stephen Threlkeld, Professor, Department of Biology**

Analysis of estuarine research institutions and research sites using GIS; implications for online and print distribution of the research journal ESTUARIES

Effects of interacting stressors in agricultural ecosystems: mesocosm and field evaluation of multi-level indicators of wetland responses.



Distribution of agricultural practices for modeling wetland ecosystem response to multiple stressors.

Dr. Marjorie Holland, Associate Professor, Department of Biology  
Dr. Lawrence R. Shaffer, Center for Water and Wetland Resources  
Effectiveness of silvicultural Best Management Practices protecting aquatic habitat in timber management areas.

Dr. Dagmar Frisch, Postdoctoral Associate, Department of Biology  
Floodplain connectivity and life history attributes of aquatic floodplain organisms.

Dr. Lidija Halda-Alija, Assistant Professor, Department of Biology  
The effect of soil types on wetland plants and the diversity of wetland plants rhizobacteria in Mississippi.

Dr. Gail Stratton, Instructor, Department of Biology  
Phylogeography: Biogeography of the North American wolf spider

Dr. Carol Britson, Postdoctoral Research Associate, Department of Biology  
Status survey of the alligator snapping turtle in the Little Tallahatchie River Basin

Dr. Lucile M. McCook, Department of Biology, Curator of the Pullen Herbarium  
Study of Threatened, Endangered and Sensitive Plant Species and Their Habitats in Holly Springs National Forest.

Michael Hodson, Department of Biology, Graduate Student  
The effects of patch connectivity on dispersal guild composition of small wetlands.

Robert Moye, Department of Biology, Graduate Student  
Landscape and omnivore effects on ichthyofaunal community structure of the Little Tallahatchie River Basin.

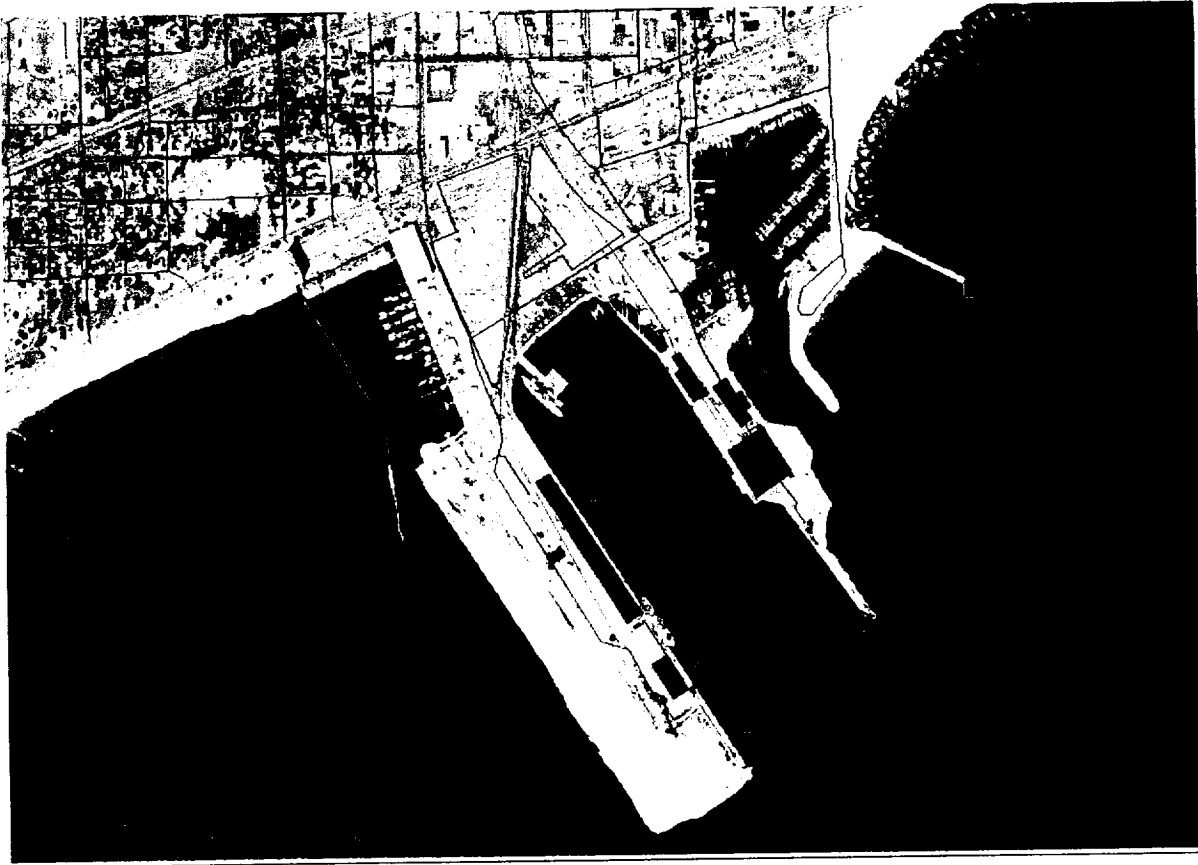
### **Computer and Information Science Department:**

Luis Paris, Computer and Information Science, Graduate Student  
File compression algorithms for transfer of imagery

Theodore Roman, Computer and Information Science, Graduate Student  
Web-Based Theme Management for ArcImS

**Dr. Pamela Lawhead, Associate Professor, Computer and Information Science**  
Virtual Private Networks and automatic backing File storage

Multi-lingual interactive information for the Port of Gulfport, Mississippi



## **GEOLOGY AND GEOLOGICAL ENGINEERING DEPARTMENT:**

### **Greg Easson, Associate Professor, Geology and Geological Engineering**

Remote analysis of damage from the January 26, 2001 earthquake in southwestern India

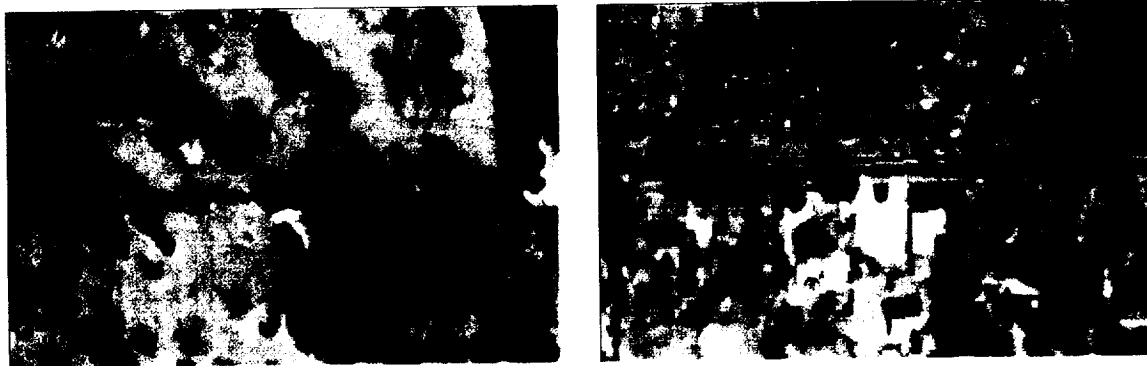
Elizabeth Johnson, Geology and Geological Engineering, Graduate Student,  
Geospatial analysis of contaminant plumes in the Snake River Plain Aquifer,

Erika Cohen, Geology and Geological Engineering, Graduate Student  
Analysis of Change in the Mississippi Gulf Coast from 1848 to Present through an  
GIS and Remote Sensing Analysis

Lance Yarbrough, Geology and Geological Engineering, Graduate Student  
Characterization of the Coral Reef Complex offshore Belize, Central America

Alan Barck, Geology and Geological Engineering, Graduate Student  
Identification of Potential Tectonic Features in Northwest Mississippi Utilizing  
Landsat Imagery

Dale Bowman, Geology and Geological Engineering, Graduate Student  
Reclassification of Shadows in High-Resolution Remotely Sensed Imagery



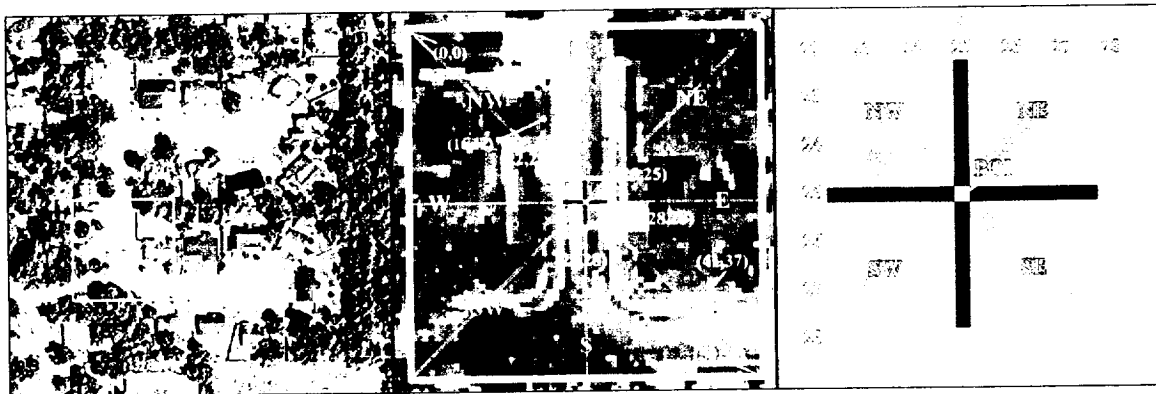
Examples of shadows masking land cover.

Stephen Ingram, Geology and Geological Engineering, Graduate Student  
Integration of Remote Sensing and GIS to Map Lithologic Variations in Heavily Vegetated Terrains.

Igor Jaramillo, Geology and Geological Engineering, Graduate Student  
Landslide inventory in northwestern Mississippi

Lance Yarbrough, Geology and Geological Engineering, Graduate Student  
Development of Three-dimensional Models of the Campus of The University of Mississippi

Patrick Jackson, Geology and Geological Engineering, Graduate Student  
Building Extraction Utilizing Neuro-Fuzzy Pattern Recognition



This series of enlargements indicates the area of interest for the Filters. Left is a sample region with the input window delineated. The center image is an enlargement of the input window, and the right-hand image is an enlargement of the Minimum Size Filter window.

## **SOCIOLOGY AND ANTHROPOLOGY DEPARTMENT**

### **Jay Johnson, Professor, Sociology and Anthropology**

Bryan Haley, Sociology and Anthropology, Graduate Student  
Detection of subsurface archeological features with high-resolution airborne remote sensing

Matthew Reynolds, Sociology and Anthropology, Graduate Student  
Magnetometry and airborne remote sensing in cultural resource management

Allan Lemon, Sociology and Anthropology, Graduate Student  
Resistivity and airborne remote sensing in cultural resource management

John Peukert, Sociology and Anthropology, Graduate Student  
Ground penetrating radar and airborne remote sensing in cultural resource management

## **BUSINESS AND MARKETING**

### **Hugh Sloan, Associate Professor, School of Business**

Utilization of High-Resolution Digital Imagery in Marketing Science:  
Advancements in Market, Trade Area, and Spending Power Analysis

### **OUTREACH:**

Outreach activities are the presentation of research results at professional society meetings and those events designed to raise public awareness of the capabilities of geospatial information technologies.

In addition to class room courses and short courses, the UMGC sponsors a bi-weekly lecture series. This lecture series brings researchers from across the country to campus. These lecturers present their research in a forum to students, faculty, and interested citizens.

The following researchers have given lectures as part of this series;

- Tom Sever, NASA
- Fred Limp, University of Arkansas
- Duane Marble, The Ohio State University
- Kenneth L. Kvamme, University of Arkansas
- Elizabeth Wentz, Arizona State University
- Luoheng Han, University of Alabama
- Brett Thomassie, Earthwatch Incorporated
- Anne Hershey, University of North Carolina – Greensboro

- Cathy Grace, Mississippi Mineral Resource Institute
- Joanne Gabrynowicz, Director, National Remote Sensing and Space Law Center
- John Grahm, U.S. Air Force, Retired
- John Jensen, University of South Carolina
- Paul L. Freeman, The Nature Conservancy
- Laurie Richardson, Florida International University
- Jessica Neuner, ESRI Incorporated

#### Presentations and Publications:

Bowman, Dale O. and Greg Easson, 2002, Reclassification of Shadows in High-Resolution Remotely Sensed Imagery, accepted for presentation at the American Society of Photogrammetry and Remote Sensing Annual meeting, April 22-26, 2002, Washington, DC.

Easson, Greg, and Julie M. Sappington, 2002, The Validation and Verification of the STAR-3i Digital Elevation Model of Long Beach, Mississippi, accepted for presentation at the American Society of Photogrammetry and Remote Sensing Annual meeting, April 22-26, 2002, Washington, DC.

Ingram, Stephen L., Greg Easson, Khaled Hasan, 2002, Application Of Remote Sensing For Mapping Surface Geology In Heavily Vegetated Cover In North Mississippi, accepted for presentation at the American Society of Photogrammetry and Remote Sensing Annual meeting, April 22-26, 2002, Washington, DC

Jackson, Patrick, Greg Easson, Dawn Wilkins, 2002, Building Extraction using Neuro-Fuzzy Pattern Recognition, accepted for presentation at the American Society of Photogrammetry and Remote Sensing Annual meeting, April 22-26, 2002, Washington, DC

Lemmon, A., B. Haley, J. Peukert, and M. Reynolds, 2002, Remote Sensing Research in the Confederate Cemetery at Ole Miss. Thirty-fifth Annual Meeting of the Society for Historical Archaeology, Mobile, AL.

Cohen, Erika C., Greg Easson, Stephen L. Ingram, Hal Robinson, and Julie Sappington, 2001, Investigation of Earthquake Phenomena Related to the Republic Day Earthquake in India, Association of Engineering Geologists Annual Meeting, St. Louis, Missouri Sept. 29 – Oct. 7, 2001, Program with Abstracts, p. 57.

Easson, Gregory L. and Harold Robinson, 2001, Assembling DEM Files for Watershed Analysis, ArcUser, July – September 2001, Volume 4, Number 3, p.26-28.

Haley, Bryan, 2001, Airborne Remote Sensing at the Hollywood Site. Fifty-eighth Annual Meeting of the Southeastern Archaeological Conference, Chattanooga, TN.

Henderson, Jennifer F., Greg Easson, Gary Gaston, 2001, Assessing Coral Reef from Space, Association of Engineering Geologists Annual Meeting, St. Louis, Missouri Sept. 29 – Oct. 7, 2001, Program with Abstracts, p. 63.

Johnson, Jay, 2001, So You Wanna be in Pictures; An Overview of Remote Sensing Research at the Hollywood Site. Fifty-eighth Annual Meeting of the Southeastern Archaeological Conference, Chattanooga, TN.

Johnson, Jay and Richard Stallings, 2001 Seeing Beneath the Surface, presented at the 65<sup>th</sup> Annual Meeting of the Society for American Archaeology, Philadelphia, PA

Lemmon, Allan, 2001, Passive Resistance at Hollywood. Fifty-eighth Annual Meeting of the Southeastern Archaeological Conference, Chattanooga, TN.

Peacock, Evan and Matthew Reynolds, 2001, Remote Sensing at Lyons Bluff, A Mississippian Mound and Village Site in Oktibbeha County, Mississippi. Fifty-eighth Annual Meeting of the Southeastern Archaeological Conference, Chattanooga, TN.

Peukert, John, 2001, Beaming into Hollywood. Fifty-eighth Annual Meeting of the Southeastern Archaeological Conference, Chattanooga, TN.

Reynolds, Matthew, 2001, Magnetic Gradient Surveying and Ground Truth at the Hollywood Site. Fifty-eighth Annual Meeting of the Southeastern Archaeological Conference, Chattanooga, TN.

Robinson, Harold, Greg Easson, Stephen Threlkeld, 2001, Using, Mapping, and Modeling Detailed Farm Service Agency Agriculture Data, Proceedings of the 21<sup>st</sup> Annual ESRI International User Conference, <http://www.esri.com/library/userconf/proc01/professional/papers/pap746/p746.htm>

Yarbrough, Lance D., Greg Easson, Robert Holt, 2001, Geologic and Hydrologic Analysis with Geographic Information Systems, Association of Engineering Geologists Annual Meeting, Program with Abstracts, p.80.

Threlkeld, S., D. Chiavelli, and R. Willey. 2000, Spatial and temporal constraints on development of epibiont communities on crustacean zooplankton. Presented at Aquatic Habitats as Ecological Islands, University of Plymouth, United Kingdom, Sept. 5-7, 2000.

Threlkeld, S., 2000, Preliminary report on GIS analysis of full, student and institutional subscriptions to ESTUARIES. Estuarine Research Federation, Governing Board meeting, St. Pete Beach, FL, October 26-27, 2000

Other less formal presentations include posters presented at Sigma Xi scientific symposiums at The University of Mississippi. Five posters associated with the research

or educational activities of the UMGC were presented in this forum in April, 2001. The results of projects were also presented to project participants in meetings and research forums. General information presentations about the functions of the UMGC were also given at the Oxford Lions and Rotary clubs.

### Public Outreach

One of the key components of the UMGC is to complete part of the mandate of NASA's State and Local Initiative. As part of this, key UMGC personnel have conducted workshops and meetings with officials from county and local government about the potential uses of geospatial information technology. In addition to local government, UMGC is assisting the Oxford High School TechPrep program as well as individual teachers at Lafayette High School in developing new and creative ways to incorporate geospatial information technology into the classroom.

### **FINANCIAL:**

A key goal of the UMGC was to make the University of Mississippi and the participating researchers more competitive in securing grants and funding from other agencies. During the first 20 months of operation of the University of Mississippi Geoinformatics Center, the majority of the funding has been used to provide support for graduate research, through research assistantships, equipment purchase, and faculty summer support. These resources, expertise and infrastructure, have been used as justification in submitted proposals and to support research funded from sources other than NASA.

During the initial phase of UMGC grant applications have been submitted to the following agencies. These grant applications and funded projects will use or are using the capabilities created as part of the UMGC.

- National Science Foundation;
  - Collection improvement and computerization of the Pullen Herbarium (funded for 3 years)
  - Integrated Graduate Education Research and Training
  - The effects of nitrogen availability on indole-3-acetic acid (IAA) production by nitrogen-fixing wetland rhizobacteria (funded)
- NASA; State and Local Initiative
- U.S. Environmental Protection Agency; Effects of interacting stressors in agricultural ecosystem wetlands (funded for 4 years)
- Mississippi Wildlife Heritage Fund; Status survey of the Alligator snapping turtle in the Little Tallahatchie River Basin (funded for 1 ½ years)
- Mississippi Space Commerce Initiative (MSCI) graduate student scholarships; total of 6 funded projects.