GIS in Land Resource Management (SOS5__)
3 Credits; Fall 2002

INSTRUCTOR: Sabine Grunwald, Soil and Water Science Department, 2171 McCarty Hall, PO Box 110290, Gainesville, FL 32611-0290
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COURSE OBJECTIVES: To provide students with the basic concepts of, and experience in using, the ArcGIS geographic information system (GIS) as applied to land resource management issues.

COURSE FORMAT: Lectures and Labs (2 hours lectures and 2 hours labs each week)

FREQUENCY TAUGHT: Fall term yearly

CLASS ATTENDANCE: Required

GRADING:

Mid-term exam	15%
Final Exam	20%
Assignments	40%
Project	15%
Presentation	10%

There will be no make-up labs and exams. Please, notify the instructor if you cannot attend the lab one week prior to the lab session. Late submission of assignments will result in reduced credit (10%).

ASSIGNMENTS/ EXAMS/PROJECTS/ LECTURES/LABS: Students will be introduced to GIS-based concepts and modeling techniques used in managing land resources.
The course has two separate and equally important components: lecture and lab (hands-on GIS experience - GIS Computer Lab, McCarty Hall B). While each component of the course supports the other, they require different study habits to be effective. The lecture component requires that students read provided course material and be prepared to discuss issues in class. The lab (hands-on experience) complements lectures (theoretical background). The lab component requires the solving of traditional and topical GISystem problems. Assignments will be given to students, which have to be submitted for grading. Students will learn to import/export, manipulate, analyze, and interpret resource data utilizing ArcGIS software. These lab problems will require faculty/student interaction in order to fully understand the significance of the concepts presented in each lab. The importance of class participation and faculty/student interaction cannot be

	stressed enough. Each student will select a special project topic and present results in class (oral or poster presentation).
RECOMMENDED TEXTBOOK	Morain S. (ed.) 1999. GIS Solutions in Natural Resource Management. OnWord Press, Santa Fe, NM.
INFORMATION:	Relevant information is provided by instructor on a course web page
PREREQUISITES:	Basic computer literacy (Windows 2000 file management system); students are expected to have a basic theoretical understanding of GIS; or consent of instructor. No other courses are required.
OFFICE HOURS INSTRUCTOR:	Thursday 2:00 - 3:30 p.m. and Friday 9:00 – 10:00 a.m.

REFERENCE BOOKS

Burrough P.A. and R.A. McDonnell. 1998. Principles of Geographical Information Systems. Spatial Information Systems and Geostatistics, Oxford University Press Inc., New York.

Ffolliott P.F., L.A. Bojorquez-Tapia, and M. Hernandez-Narvaz. 2001. Natural Resources Management Practices. Iowa State University Press, Ames, Iowa.

McCloy K.R. 1995. Resource Management Information Systems. Taylor and Francis Ltd. Bristol, PA.

ACADEMIC HONESTY: As a results of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work and understand that my failure to comply with this commitment may results in disciplinary action up to and including expulsion from the University". *We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.*

UF COUNSELING SERVICES: Resources are available on-campus for students having personal problems or lacking clear career and academic goals which interfere with their academic performance. These resources include: 1) University Counseling Center – 301 Peabody Hall, 392-1575, personal and career counseling; 2) Student Mental Health, Student health Care Center, 392-1171, personal counseling, 3) Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161, sexual assault counseling, and 4) Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

SOFTWARE USE: All faculty, staff, and students of the University of Florida are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead

to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

STUDENTS WITH DISABILITIES: Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Student Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

COURSE OUTLINE

1. Principles of Geographic Information Systems (GIS)
   - What is a GIS?
   - Components of a GIS
   - Conceptual models of real world geographic phenomena
     (i) Entity view
     (ii) Field view
   - Geographical entities
     (i) Points
     (ii) Lines
     (iii) Polygons
     (iv) Pixels
     (v) Voxels
     (vi) Polyhedrons
   - Geo-referenced entities – topology- attributes - metadata
2. The role of GIS in resource management
   - GIS functions:
     (i) Management of natural resource data / Natural Resource Management Information Systems (NRMIS)
     (ii) Geo-data modeling to analyze and interpret resource data
   - Paradigm shifts from:
     (i) The non-spatial to the spatial domain
     (ii) Data capture towards geo-data analyses
     (iii) Production of goods and services towards holistic ecosystem management
3. The 3 M's of land resource management
   - Multiple functions of soil-landscapes
   - Multiple interests / users
   - Multiple scales
4. Sustainability concept
   - Discussion of sustainable management goals:
     (i) Environmental health (stewardship of natural resources)
     (ii) Economic profitability
     (iii) Social equity (concerned with quality of life)
   - Impacts on natural resources
   - Linking people with pixels / human-environment interactions investigated within the geographic domain
   - Sustainable GIS modeling integrating natural resource data and socioeconomic, demographic, political, and cultural attributes
5. Soil-landscape characterization utilizing natural resource geo-data
   - Data themes recognized by the Federal Geographic Data Committee (FGDC) as most often required for attribution in resource applications implementing the National Spatial Data Infrastructure (NSDI)
   - Review spatial and spectral data domains
   - Data sources and data quality
   - Map errors:
     (i) User errors

(ii) Measurement/data errors
(iii) Processing errors

- Local, regional, state, national, and global scales
- Horizontal and vertical integration of data themes
- Standardized metadata protocols

6. Indicators of land resource conditions and their incorporation into GIS-based resource applications
   - Use of indicators to:
     (i) Index the current / past condition of a landscape
     (ii) Detect changes over time
   - Indicators characterize:
     (i) Class composition
     (ii) Patterns
     (iii) Scale
   - Spatial pattern analysis: Pattern metrics quantify landscape structure, which is a prerequisite to studying landscape function, change, and spatially explicit processes
   - Factors affecting the quantification of environmental heterogeneity:
     (i) Scale
     (ii) Grain size
     (iii) Extent of study area
   - Pattern elements:
     (i) Patches
     (ii) Corridors
     (iii) The underlying matrix
   - Indices used to quantify spatial patterns:
     (i) Dominance and diversity indices
     (ii) Connectivity indices
     (iii) Fragmentation indices
     (iv) Shape metrics
7. GIS modeling techniques
   - Role of GIS-based models in land resource management
   - Model components:
     (i) State variables
     (ii) External variables (forcing functions)
     (iii) Mathematical expressions to describe the relationship between external and state variables as well as interrelationships among state variables
   - Good models vs. bad models
   - Geo-modeling steps:
     (i) Definition of goals
     (ii) GIS-based resource inventory
     (iii) Model development (selection) / specification of algorithms
     (iv) Model implementation
     (v) Parameterization of the model
     (vi) Sensitivity analysis
     (vii) Verification
     (viii) Validation

(ix) Accuracy assessment
(x) Interpretation of results
(xi) Visualization of results

- Types of models relevant to natural resource management:
  (i) Descriptive vs. explanatory models
  (ii) Static ("snapshot") vs. dynamic (time-dependent) models
  (iii) Deterministic (mechanistic) vs. stochastic models
  (iv) Spatially explicit (distributed) vs. lumped models
  (v) Decision support systems
  (vi) Predictive models (scenarios calculations)
- Error propagation in numerical modeling. Factors:
  (i) Quality of the data
  (ii) Quality of the model
  (iii) The way data and model interact