

(NATR 4365/7365)  
**GIS APPLICATIONS**  
Winter Semester of Even Year

**Instructor**

Prof. Hong S. He  
203M ABNR Building  
Email: HeH@missouri.edu  
Phone: 882-7717

**Lecture Hours / Location**

Tuesday 11:00–11:50 am 123 ABNR Building

**Instructed Lab Hours / Location**

Thursday 3:00–5:30 am 109 ABNR Building

**Office Hours**

Wednesday: 11:00–12:00 am 203 M ABNR Building

**1. Course Description**

Introduce logical thinking and techniques in applying GIS to practical problems. Cover general GIS functionalities, including database management, spatial and non-spatial query, terrain analysis, hydrological analysis, grid, and remote sensing image processing. Prerequisite: NATR4325/7325, GEOG4840, or consent of the instructor.

**2. Evaluation and grading**

**2.1 Components of Evaluation:**

Midterm Exam	15%
Class Projects (seven of them)	65%
Student Project	20%

*Students in NATR 7365 are required to*

- 1. Additional literature reading involving GIS applications*
- 2. Conduct in-depth GIS analysis for the final student project (See project description for details)*

**2.2 Grading policy:**

Grades of class projects are based on:

- 1) the academic merit of your answers to the questions
- 2) clarity of answers, NO BEATING AROUND THE BUSH
- 3) concise and logical presentation.

**2.3 Due date and time:**

Each of the assignments will have a due day clearly written underneath the title of the assignment. The due time is 6:00 p.m. on the due day. Any assignment that is turned after the due time on the due day is considered late.

#### **2.4 Penalty for late assignments**

The penalty of a late assignment is based on the number of days late (including weekends!). If an assignment is late less than 24 hours, it is considered 1 day late. If an assignment is late less than 48 hours but more than 24 hours, it is considered 2 days late, and so on. All assignments should be turned electronically to the designated hand-in place unless specified otherwise.

Late assignments are penalized 10% per day. Here is the formula for calculating the points of a late assignment:

$$\text{Points\_get} = \text{Points\_scored} - 0.1 * \text{num\_days\_late} * \text{Points\_scored}$$

The minimum value of Points\_get is 0. Assignments handed in after the instructor has returned the graded assignment to class (usually a week after the due date) will receive no points.

### **3. Prerequisites**

Consent of instructors required; NATR325 or GEOG347; basic understanding of GIS is expected.

### **4. Computer Environments and Software**

ArcGIS on PC platform will be used for the instructions and class projects.

### **5. MU Statement on Academic Dishonesty**

“Academic honesty is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor. From Provost Brady Deaton.”

### **6. Disability Statement**

If you need accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office.

Office location: 203M ABNR Building, Office hours : 11:00-12:00 am (w).

To request academic accommodations (for example, a notetaker), students must also register with Disability Services, AO38 Brady Commons, 882-4696. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. Another resource, MU's Adaptive Computing Technology Center, 884-2828, is available to provide computing assistance to students with disabilities. For more information about the rights of people with disabilities, please see [ada.missouri.edu](http://ada.missouri.edu) or call 884-7278.

## 7. Other Important Issues

Class attendance is accounted as part of classroom participation although classroom participation also includes asking questions and engaging in discussion. There may be a time that the class is full and there are people waiting to get into the class. Those of you who are registered for this class but later decide not to take the course, please let the instructor know as soon as possible so that he can add the people on the waiting list to the class list.

Only medical reasons may be taken as excuses for turning in an assignment late or missing a class. However, you must provide a written report from a medical doctor stating your inability to attend class and/or complete an assignment.

The instructor will certainly give you ample time for each assignment. There is no reason for him to be informed that the computer is down or the software is not working a day before the assignment is due. He will NOT take this as an excuse for a late assignment!

## 8. Intended Topics and Schedule

Week 01 Introductions

Introduction to NATR 4365/7365

What you expect to learn?

*Project 0 starts*

- *Get familiar with WEBCT (class website, discussion list assignment board), hand-in and handout directory and procedure (project 0 does not count to score)*
- *Get started with ArcGIS*

Week 02 Review of ArcGIS functionalities

Important Concepts and Data Types

coverage, shape, graphic, and table, ASCII

How does GIS work

How does desktop GIS work

Exploring ArcGIS Interface

Working with ArcGIS shape file/coverage, Geodatabase

What are the differences between shape, coverage, and graphics?

How to convert them from one to another?

ArcGIS extensions

*Project 0 due*

*Project 1 starts*

- *Working with ArcGIS shapes/coverage (a fire bureau example)*

Week 03 Review of ArcGIS Functionalities

Topology

Single Theme GIS Analysis

Multiple Themes GIS Analysis (Theme on Theme, no new feature data created)

Multiple Themes GIS Analysis (Geoprocessing, new feature data created)

Multiple Themes GIS Analysis (Spatial Analysis to be taught in this class)

Working with Tables

Database and database management

Join and relate

Spatial and non-spatial joins

*Project 1 due*

*Project 2 starts*

- *Analyzing the task of a park management district*

Week 04 Systematic approaches in GIS applications, analyzing a case

Conceptualizing the problem

- 1) Identify involving variables (data layers)
- 2) Determine the forms of the involving variables
- 3) Pre-GIS processing

Identifying GIS techniques

GIS and Spatial Analysis

Post GIS processing

Results Analysis

Discussions

Focusing on solving problems not specific techniques

Spatial queries of multiple layers

*Project 2 continues*

Week 05 Working with hierarchical Forest Inventory and Analysis (FIA) Data

1. Introduction
2. FIA Sampling and Estimation Procedures
3. Accuracy and standards
4. Other topics of this lecture

How to work with database with hierarchical structure

*Project 2 due*

*Project 3 starts*

- *mapping and analyzing statewide species distribution using FIA*

Week 06 Continue on Forest Inventory and Analysis (FIA) Data

1. Limitations of FIA data
2. Relevant Scales of Using FIA Data
3. General Methods in using FIA Data
4. Other Types of Point Vegetation Data

*Project 3 continues*

Week 07 Working with hierarchical Soil Geographic Databases

Introduction to soil geographic databases (STATSGO)

Hierarchical structure

Spatial analysis

1. STATSGO interpretive maps
2. Structure of STATSGO databases
3. STATSGO data analysis

*Project 3 due*

*Project 4 starts*

- *working with STATSGO, mapping and analyzing statewide soil properties*

Week 08 Continue on STATSGO Data

1. Limitations of STATSGO data
2. Relevant Scales of Using STATSGO Data
3. General Analyses Using STATSGO Data
4. Other Polygon Data

*Project 4 continues*

Week 09 Introduction to Census Bureau's TIGER data

Census block, block group, and tract

Population, income, race, housing, etc.

Linking census block/blockgroup/track with attributes

Analysis

*Project 4 due*

*Project 5 starts*

- *Analysis census data for a county*

Week 10 GIS Applications by examples

Discussion on the Final Project

Continue on census database

*Project 5 continues*

Week 11 Working ArcGIS Grid—Spatial Analysis Extension

1. Introduction
2. Working with grid themes
3. Analyze grid themes
4. Analyzing Terrain
5. Surface creation
6. Surface analysis
7. Surface visualization

*Project 5 due*

*Project 6 starts*

*Working with grids and terrain analysis*

Week 12 Working ArcGIS Grid--Map algebra

1. Introduction to map algebra.
2. Raster Calculator

3. syntax and functions in Raster Calculator
4. Map algebra operators
  - Map calculator
  - Using Avenue script
  - Map calculator expression syntax and rules

*Project 6 continues*

*Discussion on independent project*

Week 13 Working ArcGIS Grid—Map Algebra

1. local functions
  - a. reclass, resample
2. focal and block functions
  - a. focalstats and blockstats
3. global functions
  - a. cell grouping, regionGroup
  - b. slice
4. Zonal function
5. analyzing mask, grid clip

Flow direction, sinks  
 Stream networks  
 Stream link and order  
 Watersheds

*Project 6 due*

*Project 7 starts*

*Georeferencing of Grids and hydrological analysis*

Week 14 Hydrological analysis

- 1 Introduction
- 2 Flow direction
- 3 Identifying sinks/peaks
- 4 Flow accumulation
- 5 Stream Networks
- 6 Stream link
- 7 Stream Order

Questions regarding the independent student project

*Project 7 due on*

Week 15 Beyond the class

*Class overview*

What is next?

New generation of GIS software

Future directions of GIS

*Apply for a GIS related position*

Week 16

Presentations of independent projects

Independent project due

## **7.Course Materials**

There is no text for this course but some references are listed below.

### **7.1 Tool Books**

Minami, M. , 2000. Using ArcMap. ESRI, Redlands, CA, USA.

Vienneau, A., 2000. Using ArcCatalog. ESRI, Redlands, CA, USA.

Booth, B. and Mitchell, A. 2000. Getting Started with ArcGIS. ESRI, Redlands, CA, USA.

McCoy, J. and Johnson, K. 2001. Using ArcGIS' Spatial Analyst. ESRI, Redlands, CA, USA.

### **7.2 Other GIS Books**

Burrough, P.A. and Rachael A. McDonnell, 1998. Principles of Geographic Information Systems. New York: Oxford University Press, 333 p.

Chang Kang-tsung 2002. Introduction to Geographic Information Systems. McGraw-Hill Higher Education. Boston, MA, USA.

Clarke, Keith C., 1997. Getting Started with Geographic Information Systems. Upper Saddle River, New Jersey: Prentice Hall, 353p.

DeMers, M.N., 2000. Fundamentals of Geographic Information Systems. New York: John Wiley & Sons, 498 p.

Heit, Michael, H. Dennison Parker, and Art Shortreid (eds.), 1996. GIS Applications in Natural Resources 2, GIS World, Inc., Fort Collins, Colorado, 540p.

Ripple, William J. (ed.). 1994. The GIS Applications Book: Examples in Natural Resources: A Compendium, American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland.