

GIS and Forest Engineering Applications

FE 357

Lecture and laboratory

3 credits

Instructor:

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Syllabus

COURSE DESCRIPTION

An introduction to the appropriate use and potential applications of geographic information systems (GIS) and related technologies (GPS and remote sensing) in forest management and operations planning and problem solving. Students are presented with lectures and exercises that cover a wide range of GIS and GIS-related topics and issues including spatial database creation, structure, analysis, and modeling.

Class meetings include a lectures and hands-on GIS exercises in a computer lab. Students are required to complete weekly lab assignments and a final project.

LEARNING OBJECTIVES

Students who successfully complete this course should have:

The ability to design and successfully complete a spatial analysis.

An understanding of GIS fundamentals and theory and an ability to apply these concepts to solve problems.

The ability to create thematic maps.

Familiarity with advanced GIS operations and the ability to use these techniques.

The ability to work with data of different structures and to use these data to solve problems.

The ability to import data of different cartographic projections and to use these data to solve problems.

The ability to communicate with others in writing and orally regarding GIS applications.

COURSE MATERIALS

1. Materials including lecture and lab notes are made available at the course WWW site:
<http://www.cof.orst.edu/cof/teach/fe357/>

These materials are provided for your convenience. Please print them out prior to class and bring them with you to lecture and lab.

2. Students must purchase a copy of (available at the OSU bookstore):

Wing, M.G. and P. Bettinger. 2008. Geographic information systems: Applications in natural resource management. Oxford University Press, Oxford. 272 pp.

GRADING

- Weekly exercises and labs 50%, 100 points possible
- Final project 25%, 50 points possible
- Exams (3) 25%, 50 points possible
 - Midterm (20 pts)
 - Final (20 pts)
 - Lab exam (10 pts)

Weekly exercises and labs are due at the beginning of your lab period, one week after they are assigned. All submitted assignments should include assignment number, problem number, class number (FE 357), and your name(s). *Late work will not be accepted and all work must be type written.*

Letter grades will be based on the following table.

Letter grade	% of total points
A	92.5-100
A-	90.0-92.5
B+	87.5-90.0
B	82.5-87.5
B-	80.0-82.5
C+	77.5-80.0
C	72.5-77.5
C-	70.0-72.5
D	60.0-69.9
F	< 60.0

FINAL PROJECT GUIDELINES

The project report is due on December 4th by 5 PM (Friday before finals week) and is worth 50 points. I encourage you to work in teams of two but the guidelines and requirements will be identical for all projects. I would also encourage you to design your own project topic and you may use your own data. If you have trouble developing a

project topic and/or finding data, I will help you. Your project should result in a spatial analysis that addresses a forestry or engineering topic. If you have questions about the suitability of a project, please check with me.

REPORT GUIDELINES

Prepare a three to five page typed (double spaced) report with a cover page containing the paper title, class number (FE 357), date, and author names. Include a minimum of two 8.5 x 11 inch maps in addition to your report. One of the maps should be show the location of your study area. The other map(s) should show your project results.

REQUIRED PAPER SECTIONS

Please organize your paper to include the following sections:

INTRODUCTION

This explains the relevance of the topic and provides a brief background. This section should conclude with 1-3 paragraphs describing what you are intending to do and why it's important.

METHODS

Describe what tools (software) you used to accomplish your project. What were the key steps in answering questions related to your project? Where did your data come from? What is the quality of your data (you should include discussion of the data scale or resolution)?

RESULTS

Describe what you discovered. This may include problems and/or successes with the methods you used. Were there any unexpected or unanticipated results?

CONCLUSION

This should contain a brief summary of the importance of your results. *Also address why GIS was (or was not) an appropriate tool for your project. Could what you did be more easily accomplished through other software?*

WEEKLY SCHEDULE

Week 1

What is a GIS?

How does a typical GIS work?

- Traditional GIS feature model
- Location, topology, and attribute data
- Coordinate systems
- Data types

GIS application Examples

LAB 1: Basic GIS operations with ArcGIS
 Calculating stream lengths and watershed areas

Week 2

Data structures

- Typical database structures
- Raster v. vector structures

- Other spatial database structures
- The need for multiple structures

Map scale and resolution

A close look at a USGS Quadrangle map

Map accuracy standards

Data sources

- Free/Low Cost
 - USGS- Nationwide
 - OGDC- Statewide
- Commercial Venders
 - EOSAT- National/International
 - ESRI- National/International

Cartographic principles

- What is a map?
- Typical elements
- Communication strategies

LAB 2: Cartographic operations with ArcMap
Creating maps of watershed analysis results

Week 3

Inputting data into GIS databases

- Global Positioning Systems (GPS)
 - Principles and practice
- Digital Total Stations
- Laser Range Finders
- Image Acquisition and Processing
- Digitizing
- Scanning

Selecting landscape features in a GIS database

Clip and erase processes

LAB 3: Working with attribute data and clipping spatial data
Determining land use and ownership patterns associated with streams

Week 4

Acquiring, creating, and editing GIS databases
Examining spatial database errors

Buffering landscape features
Various buffering techniques

LAB 4: ArcGIS proximity operations
Buffering streams based on land use
Analyzing nesting locations and geology within stream buffers

Week 5

Combining (dissolving) and splitting landscape features
Merging GIS databases

Overlay processes
Union, intersect, identity
Basic GIS overlay operations

LAB 5: Overlay and proximity operations
Using an orthophoto to update a forest inventory
Calculating timber volumes

Week 6

Projections
Presenting an elliptical globe on a flat plane
Projections
Coordinates
Datums
Spheroids
Geoids

Recognizing the need for a common projection in Oregon
Projection Examples

LAB 6: Using ArcGIS projection tools
Converting data to Oregon's recommended Lambert projection
Determining stand size, stand types, road length, and stream length

MIDTERM EXAM (during Tuesday lecture period)

Week 7

Joining and linking spatial and non-spatial databases

Raster GIS database analysis

Types of raster databases

- Digital elevation models (DEMs)
- Orthophotoquads (DOQs)
- Digital Raster Graphs (DRGs)
- Satellite Imagery
- Digital camera applications
- What can ArcGIS accommodate and how

Integrating imagery with GIS tools

- The need for imagery in GIS applications

Interaction of raster and vector databases

- LAB 7: The geodatabase
Database modeling with the Spatial Analyst extension
Calculating elevation and slope values for forested roads, streams, and stands

Week 8

Updating GIS databases

Synthesis of techniques applied to advanced GIS topics

- LAB 8: Raster data applications
Viewshed analysis
Watershed delineation

Week 9

Contemporary Issues in GIS

- Trends in technology
- Institutional challenges and opportunities
- Certification and licensing

Concluding session

- What does the future hold for GIS tools and applications?
- Preparing yourself for a career involving Geographic Information Science
- Career Opportunities
- Career Considerations

No labs due to Thanksgiving Holiday

Week 10

No lecture meeting- use this time to work on your final project

Lab exam (During your lab time)

Project report due on Friday