SYLLABUS SOILS 450 ENVIRONMENTAL GEOGRAPHIC INFORMATION SYSTEMS (3)
Fall 2008

COURSE DESCRIPTION:
The overall goal of this course is to educate and prepare students in introductory uses of geographic information systems and digital environmental spatial databases to characterize landscapes for environmental assessment and management.

Lectures will introduce students to the basics of geographic information science as well as discuss the availability of and access to digital data products distributed by various governmental agencies like the Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS), and Pennsylvania Department of Environmental Protection (DEP) at varying scales. Each of these products will be examined critically to familiarize the students with techniques commonly employed for the construction of digital environmental databases and to provide guidance with respect to their applications.

In the laboratory portion of the course, emphasis is placed on the development of practical and problem-solving skills using ArcGIS desktop software with an emphasis on vector data manipulation. By the end of the course, the student will have acquired valuable technical expertise, which is commonly sought by employers in natural resource management fields.

INSTRUCTOR:

Dr. Rick L. Day
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By appointment

TEACHING ASSISTANT:

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Do not use ANGEL alone as a means to communicate. Send all E-correspondence directly to email accounts.

CLASS SCHEDULE:

Lecture: Tuesday & Thursday 10:10 a.m. - 11:00 a.m. in Room 11 ASI Building
Lab: Monday 1:25 p.m. - 4:25 p.m. in Room 109 ASI Building

PREREQUISITES:

Soils 101 (Introductory Soils) or equivalent

BOOKS:

GIS Fundamentals, 2005. Paul Bolstad. Second Edition, 543 pp. (optional)

ESRI Online Virtual Campus – series of online tutorials on ArcGIS and GIS fundamentals. (optional)

GRADING:

Midterm 1 & 2	30% total (15% each)
Final Exam	15%
Assignments (8-12)	55%
Extra Credit	TBD -

Note: The course may be revised to include a group/individual project that would be completed during the last third of the semester and replace one of the exams or some of the assignment grade.

SOFTWARE:

ESRI ArcGIS v 9.2

TOPICS:

Introduction
- ✶ Course Introduction
- ✶ Introduction to GIS: Examples, Definitions and Components
- ✶ Lab Introduction
- ✶ Introduction to ArcView & Introduction to Getting to Know ArcView

Data Types & Data Models
- ✶ Spatial Data vs. Attribute Data
- ✶ Raster Data Model vs. Vector Data Model
- ✶ Data Compression Techniques
- ✶ Quadtrees

Basic GIS Functions
- ✶ Definitions
- ✶ Data Entry

Map Scale & Map Projections
- ✶ Scale and Accuracy
- ✶ Basic Map Projections (conformal, equal-area, equi-distant and true-direction)
- ✶ Map Surfaces (tangential, secantial, planar, conic, cylincrical)
- ✶ Coordinate systems (lat/long, UTM, State Plane)

Tabular Data Management
- ✶ Data Editing
- ✶ Joining and Linking

Digital Data
- ✶ Digital Raster Graphics
- ✶ National Wetlands Inventory
- ✶ Digital Elevation Models
- ✶ PASDA
- ✶ Floodplains
- ✶ Wetlands
- ✶ Census
- ✶ Orthophotos
- ✶ National Land Cover
- ✶ Soils
- ✶ National Resource Inventory
- ✶ GPS
- ✶ LIDAR

SSURGO Soil Database
- Introduction
- Attribute Data Management
- Map Units (consociation, complex, association and undifferentiated soil group)
- Database Structure (tables: mapunit, component, layer, etc.)
- Connecting Tables
- Data Aggregation: Spatial (horizontal): dominant soil, area-weighted average
- Data Aggregation: Spatial (vertical): single layer, min/max value ('limiting layer'), depth-weighted total, depth-weighted average

STATSGO Soil Database
- Introduction & Specs
- STATSGO Compilation
- Database Structure (tables: mapunit, component, layer, etc.)
- Problems & Benefits

National Resource Inventory (NRI)
- Introduction
- Sample Design
- NRI Data & Data Collection
- Expansion Factor
- Imputation

Basic Spatial Analysis
- Spatial Selection operations
- Proximity Analysis (buffers, distance)
- Overlays (clip, intersect, unions)
- Spatial Joins

Building Models using Model Builder
- Example of Model Builder

WebGIS Applications
- AgMap
- FarmMap
- CentreMap
- NRCS Web Soil Survey

Terrain Analysis
- Slope and Aspect
- Curvature
- Shaded Relief

Airphotos and Orthophotos
- NHAP & NAPP
- Sources of Error and Error Correction (exterior orientation, space resection, collinearity equations)
- Creating Orthophotos

Global Positioning Systems (GPS)
- GPS Specs
- Triangulation
- Sources of Error
- Differential Correction
- WAAS

Gridded Data & Terrain Analysis (2 lecture)
- ✶ Calculating Slope & Aspect (maximum drop, 4-neighbor & 8-neighbor method)
- ✶ USGS DEMs

Remote Sensing (1.5 lectures)
- ✶ Introduction
- ✶ Classification
- ✶ Various satellites (optical vs. radar)

LABS:

- ✶ Introduction to ArcView & Introduction to Getting to Know ArcView
- ✶ ArcView Basics
- ✶ Working with Spatial Data (Map Projections and Scale)
- ✶ Querying Data
- ✶ Managing Tabular Data
- ✶ Presenting Information
- ✶ Analyzing Spatial Relationships
- ✶ SSURGO Soil Database & STATSGO Soil Database
- ✶ Calculating area-weighted averages, depth-weighted averages, depth-weighted totals, etc.
- ✶ NRI Data
- ✶ Creating and Editing Themes
- ✶ Digitizing
- ✶ Geoprocessing (Buffer, Clip, Dissolve, Union and Intersect)
- ✶ Model Builder Application
- ✶ Global Positioning Systems: Mission Planning, Differential Correction and Exporting GPS files

Academic Integrity

All students are expected to conform to high standards of academic integrity. Academic integrity, as defined by the University Faculty Senate Policy 49-20, is the pursuit of scholarly activity free from fraud and deception and is an educational objective of Penn State. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating of information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students.