Syllabus, ESPM 5295
GIS for Problem Solving in Environmental Science and Management, 4 cr.

Pre-requisite: FR3131/5131, Intro to GIS, or similar class, or instructor consent
Time and Place: 10:40-12:35 MF 35 Skok and sometimes 210 Green Hall
Instructor: Paul Bolstad, Forest Resources, 624-9711, pbolstad@umn.edu
TA: Andy Jenks, jenk0088@umn.edu
Catalog Description: Spatial data inventory and analysis in environmental planning. Students may gain experience with common spatial data collection and database development methods, such as GPS, digital photo, and DEM data, as well as spatial analysis. Professional-quality analysis and written reports are required.

Objectives: Develop GIS project planning, implementation, and reporting skills through extensive spatial data collection and analysis. Master primary spatial data development and analysis skills, including GPS data collection, vector and raster data entry and editing, tiling, edge-matching, tilt and terrain correction in scanned airphotos, DEM and derivative surface generation, database development, cartographic model development, spatial analysis including multi-layer overlay, metadata development, and cartographic products.

General Problem Area:
This year's class will focus on two problems in the community of Marine-on-St. Croix, in northern Washington County. Students will develop data layers and analyses for the community trail system, and impervious surface and opportunities for mitigation. Data development includes identifying the trail alignment, converting various written and map descriptions to digital versions, and assembling an integrated digital database for other factors that affect trail use and expansion, including digital elevation data, current land ownership, building and infrastructure development and location, and existing regional, state, and county trails. Analysis includes the identification of areas susceptible to overuse or degradation due to physical constraints (e.g., steepness, soils), or social constraints (parking, noise, improper use by motorized vehicles, impervious surface and building mapping, wetlands and other sensitive areas, and mitigation zones. Target delivered products include a database to support improved trail management, recommendations for trail expansion and connections to regional trails, impervious surfaces, potential runoff and mitigation zones, and digital and hardcopy maps to enhance trail use.

ESPM5295 students will have three primary activities, one each for data collection, analysis, and results synthesis/recommendations.

Data and resources for this course are found at www.paulbolstad.net/courses/5295/5295.html

There will be three main phases of this course: 1) Skills development and methods assessment, 2) data development, and 3) analysis and reporting. Each phase will involve groupwork on sub-projects. Group membership will be reshuffled for each phase.

Skills/methods projects will include three Major Activies (performed on or near the St. Paul Campus):
1) Control point development and documentation
2) Image accuracy assessment and reporting,
3) Sub-canopy point and line digitizing accuracy and reporting.

Data development groups will focus on:
A) trail alignment and attribute collection from existing documents and GPS, for trails both within Marine on St. Croix, and for the surrounding regional trail system, cadastral data organization and verification, and elevation data organization,

B) Roads data collection and digitizing (entire study area) and impervious surface and main culverts (in drainageways) on main roads (within Marine on St. Croix), and wetlands from existing digital sources (entire study area), and verification and field updating of large (> 0.3 acre) depressional wetlands in Marine on St. Croix.

Analysis/reporting groups will be organized around:
X) Analyze and report on at least two alternative alignments (routes) for extension/connection of a regional trail from Pine Point Park to William O'Brien Park, through Marine on St. Croix, develop a walking tour of historic sites within Marine on St. Croix that connects to one of these regional trail alignments, and produce high-quality digital and hardcopy maps of historic route,

Y) analysis and report on impervious surface threats, and mitigation strategies, for the Marine on St. Croix area, including zones of highest risk of increased runoff if developed, most sensitive near-stream and near-river areas, wetlands vulnerable to siltation with up-watershed development, and locations for runoff mitigation structures.

A consensus on the general data model and integration should be agreed to by all groups prior to or shortly after the initiation of field data collection.

Attendance: Required at all class sessions when materials are presented or due. For other class sessions you may work on your project, meet with your group, and to organize and ask questions of the instructor during this period.

Dates for lectures and instructions are noted near the back of the syllabus.

Email Addresses: All students shoujld give their email address to the instructor. Email will be used for contacting students and groups throughout the semester.

Computer Software: We will be using primarily ArcGIS for spatial data analysis in this course. We'll also use ERDAS Imagine, Trimble Pathfinder Office software, and various other utility programs. We may use web authoring software, if the project develops in this direction, and subgroups may use specific ArcGIS add-ons, e.g., ArcHydro or TauDEM.

Books: No books are required for this course. The textbook, "GIS Fundamentals, 3rd Edition" will be a reference, there are five copies on reserve in the Forestry Library, Skok Hall, under the FR 3131/5131 courses. Costs for transportation to the field sites, and maps and reproduction of the report may be incurred, but should be small, and are considered as part of the course costs. Certain other reference materials may be discussed in class.

Course Grade: Your grade depends on class participation, ability to use your knowledge to accomplish a task, and writing/editing ability. Students will work alone and in changing groups.

- 15% on participation, individual worksheets and homeworks,
- 30% on the quality of work, participation, and output for groups 1 through 3.
- 5% on photo resection
- 30% the quality of your data collection for groups A and B.
- 15% on work in groups X and Y, and combined final presentations and data.
- 5% on faculty, self, and peer evaluation.

Miscellaneous Exercises

You will be responsible for individual work, in addition to the group work. This will include:

- A copy of the NGS control sheet for high-order control points in the study area
- A photo resection exercise
- A GPS exercise
- Group-specific data, reports, and other output.

Schedule and Important Dates, **ESPM5295**

Week	Activity	Deadlines: Items to be Turned In
Sept. 7	**Friday, Sept. 11th:** Course mechanics, data types and sources. Review ranking criteria and requirements. Description of lab facilities. Visit control points. **Read:** espm4294-5295-Digitizing-tips.pdf, Helpful hints…doc, geodatabases_topology2.doc, and av9edit_topology.doc.	Nothing to turn in. Each student must sign up for Groups (One of 1, 2, or 3, and one A or B, and one of X or Z), You must also visit the NGS website, and print data sheet for on-campus control points.
Sept. 14	**Monday:** Arc/GIS introduction/review, Introduction of Geodatabases, topology. GPS review, field demonstration, practice. **Read** Trimble_Pathfinder_OfficeVer3.1…, Trimble_receivers_3.pdf" **Friday:** MA1, GPS field data collection.	**Monday**: Turn in NGS control point identification sheet. **Friday:** Groups 1 through 3 should turn in an outline of the steps and timetable for collecting and analyzing required data, group member assignments (list who does what).
Sept. 21	Review of image registration. Work on MA1 projects	**Friday:** Groups 1, 2, and 3 reports due. **Sunday, Sept. 27, 1 pm:** Class visit to Marine on St Croix Field sites
Sept. 28	Familiarization with study area data collection, digitizing, project work. Data development for groups/activities A and B should begin in earnest.	Project work
Oct. 4	Continue data development, editing, attributing.	**Monday:** Each of groups A and B, should turn in an outline of the steps and timetable for collecting and analyzing required data, group member assignments (list who does what). **Saturday, Oct. 10:** Class visit, Marine, 9 a.m.
Oct. 11	Continue data development, editing, attributing.	Project work
Oct. 18	Continue data development.	Project work
Oct. 25	Continue data development.	Project work
Nov. 2	Beginning data analysis	**Monday**: Groups A and B deliver data layer to class server, and on CD, and hardcopy map (scalebar, north arrow, and legend). **Friday**: Each of groups X and Y should turn in an outline of the steps and timetable for collecting and analyzing required data, group member assignments (list who does what). Begin group XY analyses.
Nov. 9	Data analysis	
Nov. 16	Data analysis, metadata development, report writing	
Nov. 23	Analysis, editing, writing	**Monday**: Draft report due.
Nov. 30	Analysis, writing, editing.	
Dec. 7	Work on final report	**Friday**: Presentation of analyses due.
Dec. 14	Finish written report	**Monday**: Written report of sensitivity analysis due