

GEO 580

Advanced Applications of GIS in the Geosciences

This course is offered every Spring quarter on campus, and also every winter and spring via distance education.

Winter 2010, 4 credits

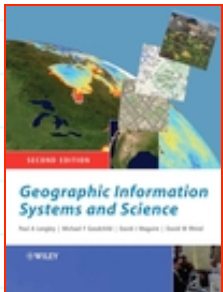
Instructor: [Dr. Dawn Wright](mailto:dawn-at-dusk.geo.orst.edu), dawn-at-dusk.geo.orst.edu, 541-737-1229

Office Hours: Spring term only, MW 1:50-2:50 p.m. in Wilkinson 114 or **by appointment**

Teaching Assistant: [Tracy Kugler](#)

Web Site: <http://dusk.geo.orst.edu/buffgis>

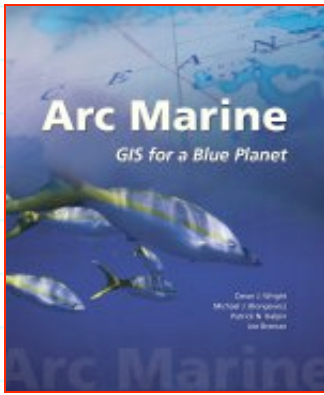
Prerequisite: GEO 465/565 or an *upper division/graduate*, intermediate level course in GIS



REQUIRED Text: *Geographic Information Systems and Science*
Longley, Goodchild, Maguire, and Rhind, 2005, **Second Edition**, John Wiley and Sons
ISBN: 0-470-87000-1



REQUIRED Text: *Modeling Our World*
Michael Zeiler, 1999, ESRI Press,
ISBN:1-879102-62-5



OPTIONAL Text: *Arc Marine: GIS for a Blue Planet*

Wright, Blongewicz, Halpin, and Breman, 2007, ESRI Press,
ISBN 978-1-58948-017-9



OPTIONAL Text: *Designing Geodatabases*

David Arctur and Michael Zeiler, 2004, ESRI Press,
ISBN:1-58948-021-X

OPTIONAL Text: *Map Analysis: Procedures and Applications in GIS Modeling*

Joseph K. Berry, 2001, BASIS Press

[Completely Online](http://www.innovativegis.com/basis/MapAnalysis/) (www.innovativegis.com/basis/MapAnalysis/)

Course Objectives: GEO 580 will take graduate students beyond the development of geographic mapping technology that simply answers the question, "Where is it?" to integrated *systems* and the foundational geographic information *science* that help us answer the question, "Why is it?" Designed as the "sequel" to the introductory course in GIS ([GEO 465/565](#)), GEO 580 will cover technical topics that we didn't have time to cover in GEO 465/565 while broadening the base of GIS theory established in that introductory course. Occasional discussion of the latest developments published in the GIS/geography literature and/or on the World Wide Web will reinforce this and foster an appreciation of GIS as an effective analytical tool for understanding complex processes. Each student will choose between: (1) a series or rigorous exercises in ArcGIS 9; or (2) completion and presentation of an 8-week long analytical project that will apply the concepts discussed in class.

Learning Outcomes - By the end of the course it is expected that students will be able to:

- Synthesize and integrate concepts of GIS theory and methodology, including data models, data structures, topology, and spatial analysis.
- More fully articulate the role of space as a source for explanation and understanding.
- Synthesize and integrate information from the GIS/GIScience literature.
- Demonstrate a conceptual and working knowledge of spatial analysis operations,

including interpolation, transformation, spatial statistics, and estimation of error and uncertainty.

- Design and implement a GIS analytical model; demonstrate basic understanding and use of a customized GIS data model
- Develop a strategy to implement an effective GIS, starting with a basic scientific or decision-support question in mind, knowing something about potential problems to avoid, and realizing that all GIS projects vary in their design, configuration and operation, as well as in the amount of time needed to gather, format, and input data.
- Employ teamwork skills in labs.
- Demonstrate advanced GIS software skills, particularly in ArcGIS 9.x, as well as intermediate to advanced scientific computing skills.
- Employ verbal/written communication and computer technology skills by way of poster presentations.

Grading: For students doing option (1), the midterm will be worth 30%, the final 30%, the labs 40%, (including the required ArcGIS data model exercise). For students doing option (2), the midterm will be worth 30%, the project 50%, and Labs 1-3 plus the data model exercise 20% (no final exam).

Lecture/Discussion Topics to Include:

- Conceptual models of geographic data
- Objects and fields
- Structure of ArcGIS 9: ArcMap, ArcCatalog, ArcToolbox, ArcInfo Workstation
- The coverage model: classic ArcInfo
- Shapefiles, topology, the geodatabase
- UML, primitive modeling elements
- Applications using ArcGIS data models
- Finding data: metadata, clearinghouses, geolibraries
- Alternative data structures
- Spatial analysis: reasoning, measurement, transformations, interpolation
- Accuracy, uncertainty - towards an "honest" GIS

Week 10 - Poster Presentations of Projects **Final Exam - Week of March 15 via Blackboard**

Library Info: As you know, we have a wonderful library on campus! See the Reference Services page at osulibrary.orst.edu/reference.

You can access most of the library's databases at osulibrary.orst.edu/research.html from outside of the library or off campus.

To obtain materials not in our collection, Interlibrary Loan forms for books and journal articles can be found at osulibrary.orst.edu/ill.

There is a single GIS workstation in the library, running ArcGIS 9.x and several other related applications. Contact the Map Library for access and use policies.

Student conduct is governed by the university's policies, as explained in the Office of

Student Conduct: Information and Regulations at oregonstate.edu/studentconduct/.

[[home](#) | [lectures](#) | [projects](#) | [labs](#) | [resources](#) | [surf](#) | [email prof.](#)]

Last update: January 17, 2010

<http://dusk.geo.orst.edu/buffgis/580desc.html>

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GEO 580
OSU Campus Section
Schedule, Notes, & Assignments
Spring 2010

Week	Date	Topic	Work on Lab	Turn in Lab	Optional Longley	Optional Zeiler
1	Mar 29	1 - Introduction PPT file (405 Kb)			1-3	2 and 3
	Mar 31	2 - Representation PPT file Al Gore's Digital Earth Speech!			1-3	2 and 3
2	Apr 5	3 - Data Modeling PPT file ArcGIS Desktop Help Online from OSU ESRI site ESRI Resources Site ESRI Mapping Center ESRI Support	1 Intro		8	4, 5, 12
	Apr 7	4 - UML, Object Modeling Elements PPT file ESRI Data Model Site ESRI Demos Project Option Choice Due by FRIDAY, Apr. 9th!!	1		8	4, 5, 12
	Apr	5 - UML cont. PPT file Demo 1 Demo	2 Data			

3	Apr 12	2	Models-Data Structures	1	4, 8	1, 6
		Required Data Model Exercise				
	Apr 14	6 - Object Orientation PPT file	2		4, 8	1, 6
		7 - GIS Analysis Models PPT file (9.8 Mb)	3			
4	Apr 19	IJGIS paper Annals paper Comp & Geosci paper	Analysis Models	2	11, 16	8
	Apr 21	8 - Concepts of Data Sharing PPT file (3.8 Mb) Google Earth - Crisis in Darfur KMZ	3		11, 16	8
		9 - Rory Plaire, SharpMap, Corvallis Notes				
5	Apr 26	EXTRA: Open source web map analysis demo from Aaron Racicot	3		11	
	Apr 28	MIDTERM EXAM				
		10 - Spatial Analysis: Intro and Interpolation PPT file (2.4 Mb) ESRI Pandemic Movie	4			
6	May 3		Interpolation	3	14, 15	
		11 - Spatial Analysis cont.: Density				

	May 5	Estimation, Spatial Stats PPT file (2.9 Mb) OSU Fragstats site UMass Fragstats site Landscape connectivity article (Theobald)	4			14, 15	
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7	May 10	12 - Guest Lecture PPT file (21.4 Mb)	4			14, 15	
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	May 12	13 - Spatial Analysis cont: Terrain Analysis PPT file (8.6 Mb)	4			14, 15	
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		14 - Spatial Analysis cont.: Routing, Optimization PPT file (788 Kb)					
8	May 17	Georgia Tech Traveling Salesman Problems Old Fire/Grand Prix Wildfire Evacuation (San Bernadino) Cedar/Paradise Wildfire Evacuation (San Diego)	5 Network Analysis	4		14, 15	8 (for Lab 5), 9, 10

	May 19	15 - "Alternative" Data Structures PPT file (14.2 Mb) Hanan Samet Data Structure Demos Dynamic Segmentation tutorial ESRI Knowledge Base - DynSeq in ArcGIS	5			14, 15	8 (for Lab 5), 9, 10
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16 - "Honest"

GIS, Error,
Uncertainty |

[PPT file](#)

[Berry Shadow Maps](#)

[Example](#)

[Error Simulation](#)

[Example](#)

[U. of Laval Data](#)

[Quality /Ethics Site](#)

[Uncertainty](#)

[research article](#)

(pdf)

[2002 UCGIS White](#)

[Paper](#) (pdf)

9

May
24

6
Terrains

5
(May
26)

6

9, 10 (for
Lab 6)

May
26

Wrapup, Review
for Final | [PPT](#)

[file](#)

[Student Poster](#)
[Presentations](#)

Free Pizza

6

6

9, 10 (for
Lab 6)

10

May
31

**MEMORIAL
DAY HOLIDAY**

6

Jun 2

[Student Poster](#)
[Presentations](#)

Free Pizza

11

Jun 7

**FINAL EXAM,
6:00-8:00 p.m.**

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Last update: June 15, 2009

<http://dusk.geo.orst.edu/buffgis/580lec.html>

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GEO 580

Project Descriptions

Required Project - 2 options to choose from

- **Option 1:** Series of lab exercises in ArcGIS 9 (These already include all necessary data.)
 - All labs must be completed by the end of Dead Week (take final exam)
- **Option 2:** Apply course concepts to your own project (including planned thesis or dissertation). And then during Dead Week, present to the class a poster or web site based on the project, while also turning in an accompanying 10-20 page paper (no final exam). **Students wishing to pursue this option MUST still complete the required Arc Marine data model exercise and Labs 1, 2, and 3. In addition, they MUST submit a project proposal with:**
 1. Your name, department and email address
 2. Your previous PROJECT experience with GIS (project in a previous GIS course?, previous GIS project experience during an internship or job?)
 3. The question or problem that you would like to address during your analytical project.
 - This is critical! You must use GIS to answer a question. Note that making a map may only be a small part of this. **Simply collecting data, putting it into GIS, and making a map, misses the point of this project option!!!** The data should be used in such a way as to create new information and this new information should answer a question or result in a management decision. Think about not only answering the question "where is..." but also "where WILL there be...", "how many...", "how much..."
 4. The tentative or expected analysis steps that you will take in order to answer the question or solve the problem.
 5. If not already mentioned above, state where and how you hope to obtain your data, if you don't already have it in hand.

[Here](#) is an example of an excellent option 2 proposal

(http://dusk.geo.orst.edu/buffgis/opt2_proposal_model.pdf)

Please select your option by the end of

the Add-Drop Period for the quarter (Friday, January 15 for Winter 2010)

In order to fulfill project **Option 2** you should take the knowledge and skills derived from class discussions and readings (perhaps also from the ArcGIS labs), and expand upon these in your project. The project must either incorporate **actual** GIS analyses or a **discussion** of planned GIS analyses.

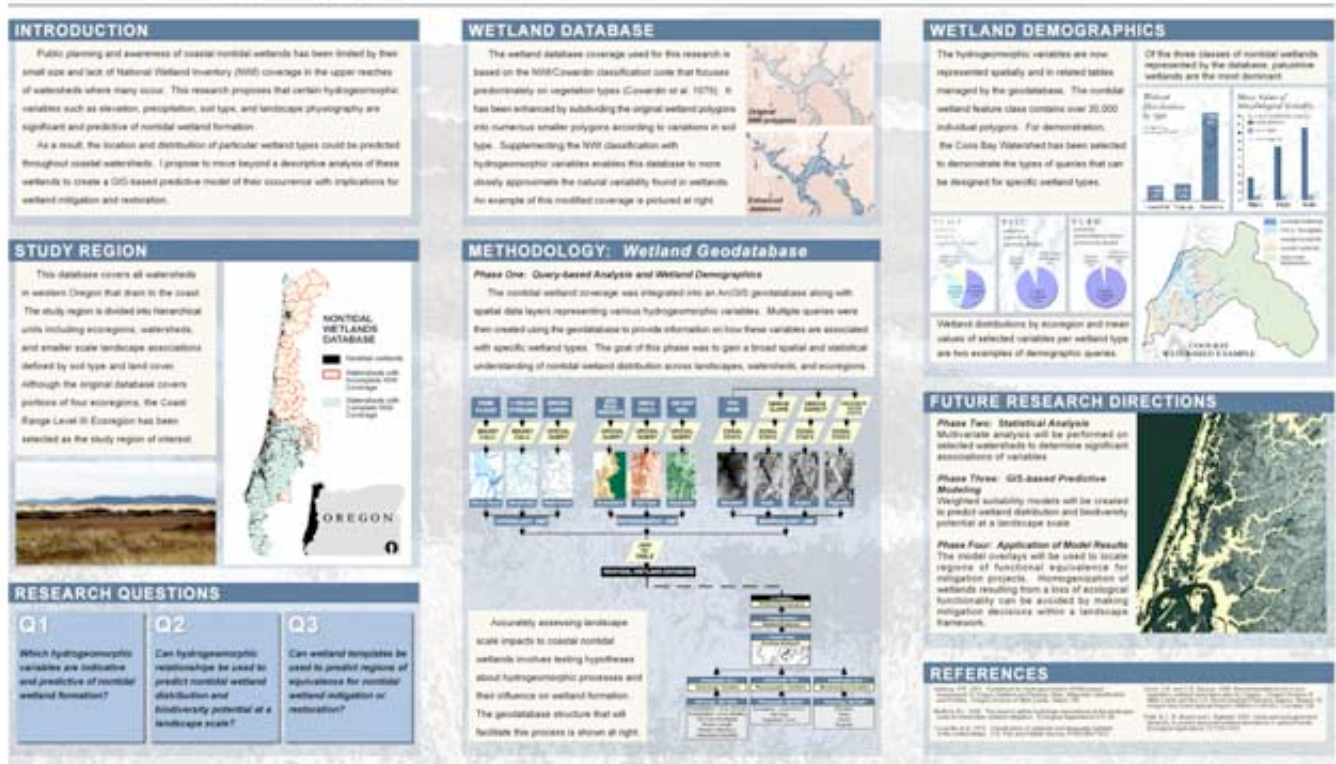
Your Option 2 project for GEO 580 MUST involve FOUR deliverables:

1. ...the use of advanced features in ArcGIS, ArcView, or any other **GIS package** that you might be working with. And you must use a full-fledged, professional grade GIS, not an image processing package, not Adobe Creative Suite, not Matlab, etc.!
2. ...creating a poster presentation or web site. This will involve **succinctly** describing the analyses you performed, capturing some of the important graphics, and preparing an attractive presentation within a limited space.

Here is an example of an excellent poster.

PREDICTING THE DISTRIBUTION & BIODIVERSITY POTENTIAL OF NONTIDAL WETLANDS IN THE OREGON COAST RANGE ECOREGION

JENNIFER LARSEN | GEO 580 | Dept. of Geography | Oregon State University | 02 June 2004



(Click on image for full size)

This is just one example of how you might organize your material: **be innovative!** **Every poster or web site must include an Introduction,**

Methods, and Discussion/Results, along with your name and department and the words "GEO 580, Advanced GIS". The Methods section of your poster or web site will need to be particularly succinct. Perhaps all you will need for that section is a flow chart.

[Here is a great page on how to make a good poster](http://www.aspb.org/education/poster.cfm)
(www.aspb.org/education/poster.cfm)

[And some tips on making great posters in PowerPoint](http://www.wfubmc.edu/biomed/tipsheets/ppt_poster.html)
(www.wfubmc.edu/biomed/tipsheets/ppt_poster.html) or
(meeting.apsnet.org/callpapers/Powerpoint_posters.cfm)

For on-campus students, since we have access to an excellent 36" plotter, you will probably find it much easier to create the entire poster as one document in PowerPoint, Freehand, or some other package, and send your poster document to that plotter.

Please remember that you can also do your project as a web site instead of a paper poster.

Need help with web page creation? Have no fear, click [here!](http://dusk.geo.orst.edu/gis/page_help.html)
(http://dusk.geo.orst.edu/gis/page_help.html)

At some point, you should consider developing your own home page, if you haven't done so already, that includes links to your resume/CV and your GEO 580 project. Home page design and creation is not only TONS of fun, but potential employers or major professors may be favorably impressed with a well-designed page that demonstrates your skills and talents.

3. ...preparing a 10-20 page discussion of your project. *A Master's or Doctoral thesis **proposal** is acceptable only if you have never prepared one before, and only if it will have a significant GIS analytical component, to be developed while in GEO 580 (for Geosciences students, this means that you cannot just turn in your previous GEO 518 paper!).* Your paper should discuss:
 - Why you selected the topic you did and what your main question or hypothesis is. Can the results be quantified? If so, how and by what measures? An indication that you have read the appropriate literature and carefully thought out your analyses must be clearly evident in your paper. You should also take the knowledge and skills derived from class lectures and associated readings (perhaps also from the ArcGIS exercises), and expand upon these in your project.
 - How you collected your data (already available? what formats, projections, precisions/accuracies. Did you obtain or create applicable metadata?
 - How you processed your data (conversion to GIS format? importing? projecting or reprojecting?)
 - Steps taken in your GIS analysis (or planned steps). **This MUST include a flow chart of the GIS analysis steps!** An ArcGIS ModelBuilder diagram is an excellent example of a flow chart that should be included. This is essentially your GIS analysis model.

- A general discussion of your findings and a summary or conclusion. What is the answer to your question or your final decision and why? What future steps need to be taken? Where do you need to go from here.

Please include a title page, abstract, full list of references, and appropriate figures and/or tables. **Please turn this paper in to me right after you give your oral presentation in class (i.e., have it done and ready to turn in before class that evening that you are presenting). You can also save a tree and email it to me right before class as an MS-Word attachment, which is actually preferred because then I can use MS-Word Track Changes to directly insert comments and return to you..**

4. Presenting your poster or your web site to the class during Dead Week. Distance education students will "present" their projects to the class using the Discussion Board in Blackboard (logistical details on this forthcoming).

There are a large number of **databases** available on the Internet that you might use for your project. A good place to start is the campus GIS web page listing data sets available on campus. For instance, check out www.geo.oregonstate.edu/ucgis/datasoft.html. Another interesting place is the [Manifold Free Data](http://www.manifold.net/download/download_set.html) page (www.manifold.net/download/download_set.html). Other useful sites for data can be found on the [GEO 456/565 site](http://dusk.geo.orst.edu/gis/projects.html#data) (dusk.geo.orst.edu/gis/projects.html#data).

Evaluation scale used for Option 2 projects (100 points possible):

Poster or Web Site Completed with Required Components - 20 points

Presentation - 20 points

Paper

Sections - intro/methods/result/disc/concl/future - 15 points

Required Length - 5 points

Used *advanced* GIS analysis technique/approach? - 20 points

Diagram/flow chart of the GIS analysis itself? - 10 points

Turned in on time? - 10 points

Past Projects

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Last update: June 15, 2009

<http://dusk.geo.orst.edu/buffgis/project.html>

GEO 580

ArcGIS 9 Labs

[Lab Notebook Guidelines](#)

Lab 1

[**Brushing up on ArcGIS 9**](#)

Lab 2

[**GIS Data Models and Data Structures**](#)

Lab 3

[**GIS Analysis Models**](#)

[Lab 3 data](#) (20.5 Mb zip)

Lab 4

[**Geostatistics/Spatial Interpolation**](#)

[Lab 4 data](#) (150 Kb zip)

Lab 5

[**Network Analysis**](#)

Lab 6

[**Surface/Terrain Analysis**](#)