Course Number	URBDP 404/504
Term and Date	Autumn, 2015
Lecture with 504	Monday 3:30-4:20 pm (Gould 114)
Lab (undergrad section)	Wednesday 3:30 - 5:20 pm (Gould 114)

Instructor Contact Information

Matt Patterson	maspatte@uw.edu
Office Hours:	TBD

TA Contact Information

Peng Chen	chenp5@uw.edu

COURSE DESCRIPTION

URBDP 404 is a lecture and lab-based course designed to provide students with introductory practical knowledge of Geographical Information Systems and Science for current and future coursework in urban planning. At the end of this course, all students should be functional in basic GIS skills in the ArcGIS software package, to the point where they can find necessary spatial data, manage this information on a desktop system, run simple spatial analyses, and present output in maps and data files. The format of this course will be flexible enough to meet specific needs of the students in the course, but there will be an overview provided of all of the major functions of ArcGIS.

Please note that this course is an *introduction* only. The material will focus on what you need to start using GIS for general planning applications, and will provide just enough background with the nuts and bolts of GIS to allow you to do basic tasks. If you are interested in more in-depth instruction on specific topics and tools (remote sensing, Python programming, web applications, etc.), there are some excellent courses taught in the Departments of Urban Planning, Geography, Forest Resources, and others that would be strong follow-ups to this course.

Student Learning Objectives

- Understand basic concepts and theories of geographic information systems and science, including: spatial reasoning and thinking, spatial data, basic spatial analysis techniques

- Be able to use GIS to create and manage data, perform spatial analysis, communicate spatial analysis process and results through effective writing, creation of maps, and inclusion of descriptive statistics (primarily using ArcGIS software)
  1.

- Be aware of issues related to data quality and availability
  2.

Reading Materials

The main text for the course is GIS Fundamentals, 4th Edition, by Paul Bolstad.

Students are responsible for completing readings, preferably before lectures. We will be using a number of textbooks and other sources in this class. Non-Bolstad readings will be available as a pdf online via the Canvas website. * Not all readings will be required for the undergraduate section. Required readings will be noted on the Canvas Website.

Course Schedule

		Topic	Readings
Week 0	Lab Sessions	Introduction to course Running GIS on your laptop.	
Week 1	Lecture	Overview of GIS	Longley Ch 1-2, What is ArcGIS?
Lab Sessions		*GIS Software: ArcMap, ArcCatalog*	Assignment 1
Week 2	Lecture	Data Models: types, structures, formats	Bolstad: Chapter 2
Lab Sessions		*Exploring Data Models, Data Management*	Assignment 2
Week 3	Lecture	Coordinate Systems, Projections, Datum	Longley: Chapter 5 or Bolstad: Chapter 3
Lab Sessions		*Coordinate Systems: Alaska*	Assignment 3
Week 4	Lecture	Tables and Queries	Bolstad: Chapter 8
Lab Sessions		Exploring tables, joins, and queries	Assignment 4
Week 5	Lecture	Spatial Analysis: Vectors	Bolstad: Chapter 9
Lab Sessions		*Vector Analysis*	Assignment 5
Week 6	Lecture	Spatial Analysis: Rasters	Bolstad: Chapter 10
Lab Sessions		*Raster Analysis*	Assignment 6
Week 7	Lecture	Model building	TBD
Lab Sessions		*Conceptual Models, Model Builder*	Assignment 7
Week 8	Lecture	Geovisualization:	Brewer: Chapter 1

Lab Sessions		*Making maps, Writing Reports, Documenting Data (Data Dictionary)*	Assignment 8 3.
Week 9	Lecture	Data Quality: finding, data, metadata, error, precision, accuracy	Bolstad: Chapter 14
Lab Sessions		*Creating spatial data: digitizing, scanning, field data*	Assignment 9
Week 10	Lecture	Course Review	
Lab Sessions			
Finals Week:	Final exam		

Policies

Student Assessment

- *Assignments*: 70% of grade. There will be 9 assignments in total (one each week of class) Each assignment is worth 10-15 points. You will have one week to work on the assignment from the date it is assigned. All assignments should be turned in via the Canvas course website. Late submissions are strongly discouraged. Assignments that are turned in within a week past the due date will be deducted 10% of their value per day of lateness; submissions turned in later than one week past due date will not be accepted, except under extreme circumstances. You are encouraged to work on and discuss assignments in groups, but everyone must submit their own original work for credit, including original text, maps, etc. No group submissions are permitted. (The graduate (504) section will have an additional synthetic assignment which is not required for undergraduates)

- *Final Exam*: 28% of grade. There will be a cumulative final exam covering lecture material, readings, and skills from the lab sessions.

- *Class participation*: 2% of grade.

Course meetings

Important policies to follow during lectures and labs:

- **No non-course computer work is permitted during lecture**. Typing during a lecture can be very distracting to other students, and you are probably not getting much out of the session if you're working on a separate assignment or writing

- emails anyway. Students are encouraged to take notes by hand during lectures. Research shows greater retention of material in students who make handwritten notes.

- **Turn your cell phone *off*. Period. Never answer calls or texts in class.** If you have a situation where you absolutely cannot miss a phone call (medical emergencies, job interviews, etc), put your phone on vibrate, and please discuss it with the instructor and/or TA to let them know that you may answer a call and leave during class.

- **Keep talking to a bare minimum.** During lab sessions it is acceptable to ask your neighbor a brief question, or to provide assistance if you see someone struggling and know how to help. Excessive general chatting, and conversation can be very distracting.

Course Feedback

I would like to encourage you to share your feedback about the course (lectures, labs, assignments, etc) with me on an on-going basis. At the end of the year you will fill out a course evaluation form - these comments will help improve the class for next year's cohort of students; but I am interested in working with you today to improve the class for you and your classmates! I am continually working to present concepts and skills as clearly as possible, and hearing from you about what works and what doesn't work as well is invaluable.

I look forward to continually improving this course with you!

Course Resources

The entire syllabus is posted on the course website, along with links to GIS resources on the web and other information that may be useful to you. A version of the lecture and lab slides will be posted prior to sessions on the Schedule page. While we will always do our best to clearly communicate any changes in schedule, office hours, or assigment due dates, **students are responsible for checking the website for any changes to the schedule of events in the course.**

Readings are identified on the Schedule page.

There are a number of books in the library that can be useful for further information about GIS and cartography, and there are also booklets available from ESRI that can provide you with more information about the different functions in ArcGIS. Note that

updates to ArcGIS are coming out all the time, and features in the current version may be a little different than those in previous versions. Please look at the resources page for a full list. Other sources can also be recommended for specific needs.

Software Access

All Digital Commons computers will have full versions of ESRI ArcGIS, with all available extensions.

Free copies of a 1-year student version of ArcGIS software will also be available. On the upside, this is a free version of a software package costing thousands of dollars, and this software can be very useful for future coursework. The downside is that the student version has limited functionality; there may be some functions that you need that are not available in this software package, and it does tend to run slower. If you are working on anything time dependent for this or any other course, you should test the capabilities of the limited version.
Note that this software is Windows Only! If you own a Mac, you must use Bootcamp, a virtual machine, or a remote desktop service to run ArcGIS.

Center for Studies in Demography and Ecology GIS services: you can access ArcGIS on their terminal servers. Read more here: http://csde.washington.edu/services/gis/. This works reasonably well, but is not without problems, and is somewhat complex for the uninitiated.

Resources

This page may be added to during the quarter.

PDF authoring tools

Adobe PDFs provide a very convenient way to exchange documents between computers. Department computers should have the means to convert Word files to PDFs, either with a dedicated option in the program or through a printer driver in the "print" menu.

There are also tools that you can install on your own personal computers to create PDF output:

CutePDF: Windows; also requires that you install Ghostscript, which you can find here for Windows 32-bit.

PDFCreator: Windows; install 0.9.6 to keep a rather annoying Yahoo toolbar from

being put into your web browser.

Libre Office: Windows, Mac, Linux; an open source office suite comparable to Microsoft Office, capable of producing pdfs from most file types. The default office suite of your instructor. **Open Office** is a fork of the same project, and comparable.

Data

GIS data relevant to planning applications can be found in a number of different places. You'll need to pay for some of it, but others (usually from government authorities or the university) you can get for free.

WAGDA (University of Washington). The Washington State Geospatial Data Archive (WAGDA) is, simply put, the most useful repository of data for anyone doing GIS work in the central Puget Sound region. Run by the UW Libraries, this contains all sorts of different data sources useful for mapping applications. This should be your first stop for any GIS data for classes. The new version of WAGDA is somewhat more complex to connect to and acquire data from, unfortunately.

Map Library (University of Washington). In the basement of the Suzallo / Allen library, there is a map section of the library. In addition to hardcopy maps, they have a number of datasets on CD/DVD. While WAGDA is great for up-to-date GIS data, historical data may require a trip down there.

County databases. In addition to the files available on WAGDA, local counties have some up-to-date data relevant to GIS analysis available online. Some that you may find useful:

King County: The Department of Assessments in the County routinely publishes "extracts" of their databases, which include property and sales data (but NOT any GIS files). The link is here. The King County GIS Center publishes CDs/DVDs quarterly with the necessary GIS files, but they charge for this service. Unless you absolutely need the most up-to-date version, WAGDA usually gets these files every year. (The old-version WAGDA files for King County are here.)

Kitsap County: Pretty much the best deal around! This page has both land/building data and the GIS files, and these are updated *daily*. Link is here.

Pierce County: Getting data from Pierce County directly will cost money, as you need to order the data from the relevant county offices. Use WAGDA whenever possible (link),

as the university arranges to obtain this data on a regular basis. If you REALLY need

more up-to-date data, the GIS Center is here, and property data can be requested here.

San Juan County: GIS files are available here.

Skagit County: GIS files are here.

Snohomish County: There's good news and bad news with respect to Snohomish GIS data. The good news is that all of the necessary files that you might need are available online, on their FTP site. The bad news? Some of the extracts are only updated yearly, which is not the best if you need up-to-date information.

If you have any questions about using these data sets, let me know. The formats can be tricky sometimes.

LIDAR data (Puget Sound LIDAR Consortium). LIDAR (LIght Distance And Ranging) is a technique that allows topographical measurements to be taken of a region at an incredibly high resolution. It also allows surface elevations to be measured even through forest canopy, and can be very useful in geologic studies of a region. May be too detailed for some applications, DEM may work better when you only need low-resolution elevation data.

WA State Department of Ecology and WA State Department of Natural Resources. These data sets are useful for research related to environmental monitoring, such as the location of management areas and potential pollutant sources.

Natural Earth Data. Natural Earth is a public domain map dataset available at 1:10m, 1:50m, and 1:110 million scales. Featuring tightly integrated vector and raster data, with Natural Earth you can make a variety of visually pleasing, well-crafted maps with cartography or GIS software. This is useful for making political maps, and other maps where you need to represent large areas.

Software

There are a lot of software packages out there that you can use with GIS data. Some of the most popular that are in use right now include:

ArcGIS (ESRI). Truly the dominant player in the GIS software market. ESRI has one-third the global market share and 80% of the users of GIS worldwide. Products include desktop- and server-based GIS software, web-based services, mobile systems -- pretty

much anything that you want to do with GIS can be done with an ESRI product. The downside is that the desktop software is only available for Windows.

Google Maps/Google Earth (Google). Mostly useful as a quick and easy geocoding method, but Google Maps and Google Earth can read and write KML files, and some individuals and institutions have been using "pro" and enterprise systems for practical applications traditionally performed by desktop GIS systems.

QGIS (QGIS Development Team). One of the most popular examples of an open source GIS platform, QGIS is developed and maintained by a community of developers and provided to users for free. The functionality of QGIS is roughly equivalent to that of a closed-source software package like ArcGIS and there may be some data compatibility issues (specifically, dealing with file geodatabases can be a hassle), but it can be more flexible than ArcGIS for certain specific tasks. QGIS builds on GRASS, SAGA, and other open source GIS software. If you're an independent consultant that needs a GIS desktop package or simply wish to avoid closed-source software, this may be a very attractive alternative. QGIS is also cross-platform, unlike ArcGIS, so it is an attractive option if you prefer Mac OS or Linux over Windows.

GRASS GIS (US Army Corps of Engineers / Open Source Geospatial Foundation). Geographic Resources Analysis Support System, or GRASS, is another popular open source GIS package, originally developed for land management and environmental planning by the military and primarily intended for dealing with raster data. GRASS can be used with its own interface, or QGIS can be used as a front-end. It is also cross-platform.

Python (Python Software Foundation). Python is a programming language, and not GIS software per se. However, both ArcGIS and QGIS use Python internally, and ship with numerous Python libraries. There are software packages that use Python to interact with the internal libraries of these GIS platforms, and others that can read GIS data and produce output. See mapnik, for example. This is a relatively easy programming language to learn, and can be very useful for the advanced GIS user.

Websites, forums, listservers, blogs, and RSS feeds

Aside from fixed webpages, there is a lot of information that you can get from discussion boards, blogs and email listservers. Discussion forums and listservers can be an invaluable resource if you're looking for answers to a problem: odds are that someone

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had the same problem somewhere at some point in the past, and got an answer on a discussion forum. Blogs and news sites are also great resources to learn about new projects and software.

StackExchange: GIS. Chances are that searching for answers to problems you run into with ArcGIS will take you to StackExchange. It is probably the largest Question and Answer site for programmers on the internet, at the moment. It is a tremendous resource.

ESRI Support Center. If you ever have any problems with ArcGIS software, this site is a remarkable resource. It includes current software patches for ESRI products, as well as articles, documentation, white papers, and other sources of information. The forums can also be a very good resource for particular questions.

Center for Studies in Demography and Ecology GIS Services. You can access ArcGIS on their terminal servers.

UW-GIS-L. This is the email list used for discussing issues with GIS at UW **If you use GIS at UW, you should sign up for this list.** Given that there are a number of academic units at the university using GIS, it tends to get a lot of activity. You can often find a number of useful hints and university- and region-specific advice in the archives.

Google Lat Long Blog. Obviously Google specific, but still very fascinating for the GIS user. Definitely a must if you use Google Maps, Google Earth, SketchUp, etc. professionally.

Slashgeo. Slashdot for GIS geeks (and only computer geeks generally will know what /. is), managed by a Canadian organization. Aggregates news about new software releases, tricks, applications of GIS, and opinion pieces.

All Points Blog. The blog for *Directions Magazine*. It has a general geospatial focus, and aggregates news about industry developments, new software, and projects that rely on GIS.

Planet Geospatial. Much more tech-heavy, also aggregating from other feeds, but potentially useful.

Cool projects and miscellaneous

Earth. A tremendously cool and hypnotic piece of data visualization, drawing on publicly available weather data. Initially showed only global winds at various heights in the atmosphere, but since extended to include a slew of climate data. Also a neat tool for

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fiddling with projections, and understanding how they distort the representation of data.

Areography and extraterrestrial GIS. "Areography" is the study of the geography of Mars, and there are projects that apply GIS to other planets. The USGS Planetary GIS Web Server (Planetary Interactive G.I.S.-on-the-Web Analyzable Database, or PIGWAD) is one such project, and UW Earth and Space Sciences has done some work in this area as

well with the "Mars Orbiter Laser Altimeter". In a related note, your ArcGIS system actually has projection information for all the planets and major moons in the solar system in the Geographic Coordinate Systems > Solar System folder. (You know... if the situation ever comes up.)

Ogle Earth. Not a blog that is updated too often, but it does outline some interesting geopolitical issues with Google Earth. Look, for example, at an interesting post about how Google fell afoul of a border dispute between China and India, and another about hunting for Iranian nuclear facilities in Googe Earth. Worth a read.

Computer Graphics and Visualization Lab. (Purdue University) Fascinating project that uses the geometric information in geographical/GIS information to understand the configuration of urban patterns, and then expand upon those patterns in simulations. Some examples from Seattle are on the site.

Books

As software is constantly being updated, many of the resources available may be out of date. Online resources, including PDFs on the ESRI website, are most likely up-to-date, but if you pick up a book in the library, keep in mind that there are subtle differences between different versions of the software.

Some books that might be of interest for GIS applications in planning:

Juliana Maantay and John Ziegler, *GIS for the Urban Environment*. (Amazon)

Tim Ormsby et al., *Getting to Know ArcGIS Desktop: Basics of ArcView, ArcEditor, and ArcInfo*.(Amazon)

Anita Graser, *Learning QGIS 2.0* A resource for learning QGIS. (Packt Publishing)