Watershed Sciences 4930 & 6920
GEOGRAPHIC INFORMATION SYSTEMS

WEEK ONE – Lecture 2
GIS Review & Intro to WebGIS

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TODAY’S PLAN...

I. Housekeeping
II. Review of GIS
III. Alternatives to ArcGIS
IV. WebGIS
V. Summary
HOUSEKEEPING: HOMEWORK:

Introduction

Lab 01 - ArcGIS Refresher & Intro to WebGIS
- You’ll make a very basic map in ArcGIS just to get you used to working in ArcGIS again ;)
- You will create a website that will be the repository for ALL of your lab assignments
- You will publish your map to your website...

Everything you need:
http://gis.joewheaton.org/assignments/labs/lab01
HOUSEKEEPING: OTHER QUESTIONS??

• Post other questions to our Class Forum at http://forum.bluezone.usu.edu/gis

WHAT DID BOLSTAD HAVE TO SAY?

You Read Chapter One of Bolstad: “An Introduction to GIS”

I. Introduction
   I. What is GIS?
   II. GIS in Action

II. GIS Components

III. GIS in Organizations
   I. Structure of Book
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GIS—WHAT IS IT?

Bolstad (2009) says:

• “A GIS is a tool for making and using spatial information. Among the many different definitions of GIS, we choose:
  - A GIS is a computer-based system to aid in the collection, maintenance, storage, analysis, output and distribution of spatial data and information.”

• GIS--what’s in the S?
  - Systems: the technology
  - Science: the concepts and theory
  - Studies: the societal context
MATCH VERBS FROM DEFINITION TO OUR LEARNING OUTCOMES & SYLLABUS

A GIS is a computer-based system to aid in the collection, maintenance, storage, analysis, output, and distribution of spatial data and information.”

Primary Learning Outcomes

1. Understand the fundamental theory of Geographic Information Science behind Geographic Information Systems (GIS), and in so doing build an awareness of what GIS can and cannot be used for.
2. Become proficient in the use of GIS tools to conduct spatial analyses and build maps that are fit-for-purpose and effectively convey the information they are intended to
3. Build confidence in teaching yourself how to undertake new analyses (unfamiliar to you) using GIS, troubleshooting problems in GIS, and seeking help from the GIS community to solve your problems.
4. Use GIS analyses to address applied problems and/or research questions.
5. Become effective in building maps that can be shared with non-GIS users (e.g. PDF maps and interactive webGIS maps).

EXAMPLES OF APPLIED GIS

- **Urban Planning, Management & Policy**
  - Zoning, subdivision planning
  - Land acquisition
  - Economic development
  - Code enforcement
  - Housing renovation programs
  - Emergency response
  - Crime analysis
  - Tax assessment
- **Environmental Sciences**
  - Monitoring environmental risk
  - Modeling stormwater runoff
  - Management of watersheds, floodplains, wetlands, forests, aquifers
  - Environmental Impact Analysis
  - Hazardous or toxic facility siting
  - Groundwater modeling and contamination tracking
- **Political Science**
  - Redistricting
  - Analysis of election results
- **Civil Engineering/Utility**
  - Locating underground facilities
  - Designing alignment for freeways, transit
  - Coordination of infrastructure maintenance
- **Business**
  - Demographic Analysis
  - Market Penetration/Share Analysis
  - Site Selection
- **Education Administration**
  - Attendance Area Maintenance
  - Enrollment Projections
  - School Bus Routing
- **Real Estate**
  - Neighborhood land prices
  - Traffic Impact Analysis
  - Determination of Highest and Best Use
- **Health Care**
  - Epidemiology
  - Needs Analysis
  - Service Inventory
WANT A LITTLE MORE...

Additional Resources

Examples of Applications of GIS
- ESRI Publishes a number of useful publications, which help give you an idea of the scope of applications of GIS (you can subscribe to them for free or view them online).
  - ESRI News - The main hub of all these publications (including podcasts)
  - ArcUser
  - ArcUser & ArcUser Online
  - ArcWatch
  - Environmental Observer

Careers in GIS
- If you think you might want a career in GIS, I encourage you to subscribe to or check out the following
  - ESRI’s University Career Connections
  - GIS Job Clearinghouse
  - See [here] for more career links

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DESPITE WHAT IMPRESSION ESRI GIVES

- They are not the ONLY game in town
- There are lots of commercial and open source alternatives
- If you have interest in these, you may consider WILD 6900 -

SOFTWARE FOR GIS:

**Full GIS**
- ESRI, Inc.
- MapInfo
- MapWindow
- LandSerf
- Saga GIS
- Quantum GIS
- Intergraph
- Bentley Systems (MicroStation)
- Autodesk (AutoCAD MAP)

**Vector GIS**
- Smallworld Systems
- Manifold
- Maptitude

**Raster GIS**
- ERDAS/Imagine
  - long established leader in remote sensing
  - acquired by Leica Geosystems in 2001
- ER MAPPER
  - aggressive newcomer originating in Australia
- ENVI,
  - relative newcomer, radar specialization
  - acquired by Kodak in 2000
- PCI--Geomatica
  - long-term Canadian player
- CARIS
  - newer Canadian entry
- GRASS (Rutgers Univ.)
- IDRISI (Clark Univ.)
  - pioneering, university-developed package
- Free! Open-source GIS
- Developed both here at USU and up at ISU
- Like lots... Extendible, Simple

**LandSerf**

LandSerf is a freely available Geographical Information System (GIS) for the visualization and analysis of surfaces. Applications include visualization of landscapes; geomorphological analysis; gaming development; GIS file conversion; map output; archaeological mapping and analysis; surface modelling and many others. It runs on any platform that supports the Java Run-time Environment (Windows, MacOSX, Unix, Linux etc.).

**Features:**
- Handles multiple surface models - raster digital elevation models (DEMs), vector Triangulated Irregular Networks (TINs), contours and metric surface networks (MSNs).
- Interactive 3D viewing and 'flythrough' of surfaces on platforms that support OpenGL.
- A range of powerful and interactive visualisation techniques including lighting/shade models, multiple image blending and dynamic graphical query.
- Raster and vector transformation including image rectification and map projection.
- Multi-scale surface processing based on quadratic regression.
- Fractal and polynomial surface generation for modelling and simulation.
- Multi-scale parameter and feature extraction (slope, aspect, curvature etc.).
- Import and export of common raster and vector formats.
- Integration with Garmin GPS receivers.

- [http://www.soi.city.ac.uk/~jwo/landserf/](http://www.soi.city.ac.uk/~jwo/landserf/)
SOME MORE REFERENCES...

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Web GIS QUESTIONS

- What is it?
- What’s out there?
- What’s it used for?
- How does it differ from desktop GIS?
- How is it deployed?
- How could you deploy it?

WHAT IS IT?

- Return to our definition of GIS.... Just implemented and delivered over the web
  - Typically simpler user interface then desktop GIS
  - Typically more complicated backbone...
  - Often free for users

“A GIS is a computer-based system to aid in the collection, maintenance, storage, analysis, output and distribution of spatial data and information.”
WHAT’S OUT THERE?

- The common map/directions sites
  - Google Maps
  - Bing Maps (Live)
  - Mapquest
- Data viewers
- Data distribution centers
- Personal data repositories
- Project sites...
- Commercial Sites
- Web mapping services (WMS)

RANGE FROM SIMPLE....

- Soil Web via Gmaps

http://casoilresource.lawr.ucdavis.edu/soilweb_gmap/
TO COMPLEX...

MAPQUEST

• One of the first... lost its marketshare
BING.COM/ MAPS (FORMERLY LIVE MAPS -> Microsoft)

• Microsoft had to do something... to fight back Google

BING.COM – COOL FEATURES

• Built in 3D Viewer: Virtual Earth (w/ plugin; analogous to Google Earth)
• Birds Eye View
WHAT’S IT USED FOR?

• Just directions?
• A better question is: what is it not used for?

Examples of WebGIS at Work
Backed by ESRI ArcGIS Server:
  • Renewable Energy Atlas of Vermont - See article from ESRI Observer
Backed by ESRI's ArcGIS Online
  • Browse a plethora of public maps at ArcGIS Online's Gallery
  • Oregon Watershed Enhancement Board Investment Tracker
Backed by GoogleMaps
  • OpenTopography Portal
  • Housing Maps.com
  • 10 Great Journeys in a Car
  • 2010 Tour de France Route - with interactive profiles
  • 2008 Tour de France - Street View (see video)
Backed by Bing Maps
  • Gas Prices
  • 2010 Tour de France Route - Different features like Bird's Eye view
  • Photosynth

Web GIS QUESTIONS

• What is it?
• What's out there?
• What's it used for?
• **How does it differ from desktop GIS?**
• How is it deployed?
• How could you deploy it?
HOW DOES IT DIFFER FROM DESKTOP GIS?

• You can answer this...
• What of the ArcGIS family of products is WebGIS?

ArcGIS EXPLORER ONLINE

• Improved dramatically...
WHAT IS A WEB MAP?

A web map is an interactive display of geographic information that you can use to answer questions. For example, you may find a street map that highlights a new bike path or a map showing the age distribution of populations across parts of Southern California. A web map can be an effective metaphor for modeling and exploring geographic information as a series of data layers. For example, you might be able to explore datasets that show the age distribution of populations in Southern California and the age distribution of populations in the United States and for contexts, the map has a topographic basemap that includes cities, roads, and bedding overlaid in land cover and shaded relief imagery.
Web GIS QUESTIONS

• What is it?
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• **How is it deployed?**
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HOW IS IT DEPLOYED

• What platforms is WebGIS consumed in?
  - Web applications (i.e. browsers)
  - Web services (i.e. desktop GIS)
  - Mobile applications (i.e. your smart phone)
• What software does a user need to use it?
• How is it deployed at the back end?
  - WMS Web Map Services (for user interactivity)
    • Allows creation of web maps that can call up data from multiple servers and sources
  - GIS server(s) for hosting GIS data
  - Other services for doing heavy lifting (number crunching)
YOU SHOULD BE AWARE OF ARCGIS SERVER

What is a service?
A service is a representation of a GIS resource that a server is making available to other computers on a network. This network can be a local one, such as your company's computer system, or it can be a broader network, such as the Internet. The computers on the network that access your service are called clients. When you use ArcGIS Server to publish a service, you are giving clients access to a GIS resource. In many cases, clients can do the same things with the service that they could if a copy of the resource were on their own computer.

Using ArcGIS Server
As you use ArcGIS Server, you will follow a workflow of three steps to make your geographic information available through the server:
- Author the GIS resource using ArcGIS Desktop.
- Publish the resource as a service using ArcGIS Server.
- Use the service through a client application.


OPEN TOPOGRAPHY... SYSTEM ARCHITECTURE
SOME OTHER CARTOONS...

The arrows and components can vary, but on the outside... there is always the client... blind to the details of the blackbox behind their browser:

WEB GIS QUESTIONS

• What is it?
• What's out there?
• What's it used for?
• How does it differ from desktop GIS?
• How is it deployed?
  • How could you deploy it?
HOW COULD YOU DEPLOY IT?

WebGIS is something most of you have used whether you realize it or not. For example, you have probably used maps like the Google Map below many times.

View Example Map.

This is a simple example of WebGIS. Most people already intuitively know how to navigate around Google Maps. You probably don’t really need instructions on how to zoom in on our campus or to know that if you click on the school you will get a pop-up window that you can see the street map of campus. You probably already know.

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YOUR QUIZ FOR TUESDAY

• Find an example of a good map and a bad map and explain why in terms of the 6 C’s
• Post these two examples as URL’s or images and your justification to the class forum at:
  - GIS Questions & Discussions -> Week 02 -> Quiz 1
  - Post before Tuesday’s Lecture
  - Feel free to comment on others...
  - Also SUBMIT your links to CANVAS under Quiz 1 So I can give you credit

• PURPOSE:
  - Develop a critical eye about other’s maps, so that you can make your own maps better
  - Familiarize you with grading criteria

READING FOR TUESDAY

• Read Chapter Three of Bolstad: “Map Projections & Coordinate Systems” (pp. 69-122)
  - Skim 70-72 (History)
  - Read pp. 72-119 in detail
NEXT LECTURE

On Tuesday:
• Projections & Coordinate Systems