WELCOME
To GEOG 350 / 550
Introduction to
Geographic Information Science
Second Lecture
1. Systems, Science, and Study
Outline

- What is geographic information?
- Definition of data, information, knowledge and wisdom
- Kinds of decisions that use geographic information
- What is geographic information science?
- How do scientists use GIS?
Geographic – Earth’s surface and near-surface

Spatial – any space (including geographic) e.g. medical imaging

Geospatial – synonymous with geographic
GI is Special

- Multidimensional
- Voluminous
- Requires projection to flat surface
- Unique analysis methods
- Analyses require data integration
- Data updates are expensive and time consuming
- Map displays require fast data retrieval
<table>
<thead>
<tr>
<th>Decision-making Support Infrastructure</th>
<th>Ease of sharing</th>
</tr>
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<tbody>
<tr>
<td>Wisdom</td>
<td>Impossible</td>
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<tr>
<td>Knowledge</td>
<td>Difficult</td>
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<tr>
<td>Evidence</td>
<td>Difficult</td>
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<tr>
<td>Information</td>
<td>Easy</td>
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<tr>
<td>Data</td>
<td>Easy</td>
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Information on the World

- How it looks – Form
- How it works – Process
- Knowledge about process more valuable than form, because can be used to predict
- GIS combine
  - General scientific knowledge in software
  - Specific information in databases
Forms of General Knowledge

- Classifications - e.g. what is a wetland? (established rules)
- Rule sets - e.g. how can wetlands be used, how wilderness defined
- Laws - e.g. Newton Laws of Motion predict the way in which all matter (e.g. planets) behave
- Geography laws are of much lower precision, e.g. spatial interaction models
Problem Solving

Components and stages

- Objective or goal - often maximize or minimize (cost, distance)
- Tangible (well defined scale) vs intangible - e.g. quality of life, environmental impact
- Multiple objectives - e.g. cost and environmental impact
  - Multi-criteria decision-making techniques
Geographic Information Systems

- Software product
- Data sets / databases
- Community of people working with geographic information and tools
- Activity of advanced science and problem solving
Brief History of GIS

- **1960 – 70s Innovation**
  - First GIS – Canada Land Inventory
  - DIME US Bureau of Census
  - Harvard Laboratory for Computer Graphics
  - Major vendors started (e.g. ESRI, Intergraph)
  - Landsat satellite launched
  - Key academic conferences (e.g. AutoCarto)
Brief History of GIS

- **1980s Commercialization**
  - Commercial GIS software (e.g. ArcInfo)
  - First GIS textbooks
  - First global data sets
  - Clinton Executive Order

- **2000s Exploitation**
  - Internet becomes major deliver vehicle
  - More than 1 million active users
A Brief History of GIS

- GIS’s origins lie in thematic cartography
- Many planners used the method of map overlay using manual techniques
- Manual map overlay as a method was first described comprehensively by Jacqueline Tyrwhitt in a 1950 planning textbook
- Ian McHarg used blacked out transparent overlays for site selection in *Design with Nature*
Tyrwhitt: Town & Country Planning
A Brief History of GIS (cont.)

- The 1960s saw many new forms of geographic data and mapping software
- Computer cartography developed the first basic GIS concepts during the late 1950s and 1960s
- Linked software modules, rather than stand-alone programs, preceded GISs
- Early influential data sets were the World Data Bank and the GBF/DIME files
- Early systems were CGIS, MLMIS, GRID and LUNR
- The Harvard University ODYSSEY system was influential due to its topological arc-node (vector) data structure
A Brief History of GIS (cont.)

- GIS was significantly altered by (1) the PC and (2) the workstation.
- During the 1980s, new GIS software could better exploit more advanced hardware.
- User Interface developments led to GIS's vastly improved ease of use during the 1990s.
- During the 1980s, new GIS software could better exploit more advanced hardware.
- During 1990 – 2000 Rapid advances in storage and processing power – multidimensional, visualization.
Sources of Information on GIS

- The amount of information available about GIS can be overwhelming.
- Sources of GIS information include journals and magazines, books, professional societies, the World Wide Web, and conferences.
- GIS has Web Home pages, network conference groups, professional organizations, and user groups.
- Most colleges and universities now offer GIS classes in geography departments.
First Internet Mapping Site

Xerox PARC Map Viewer: world 0.00N 0.00E (1.0X)

Select a point on the map to zoom in (by 2), or select an option below. Please read About the Map Viewer, FAQ and Details. To find a U.S. location by name, see the Geographic Name Server.

Options:

- Zoom In: (2), (5), (10), (25); Zoom Out: (1/2), (1/5), (1/10), (1/25)
- Features: Default, All, borders, rivers
- Display: color, Projection: elliptical, rectangular, sinusoidal, Narrow, Square
- Change Database to USA only (more detail)
- Hide Map Image, Retrieve Map Image Only, No Zoom on Select,
- Place mark at (0.00N 0.00E), Reset All Options

Requested region is 360.00 deg. wide by 180.00 deg. (12420.00 miles) high.
Geographic Information System

- An organized collection of
  - Hardware
  - Software
  - Network
  - Data
  - People
  - Procedures
Major GIS-Only Journals

- International Journal of Geographical Information Systems
- Geographical Systems
- Transactions in GIS
- Geospatial solutions
- Geoworld
Specialty Journals

- GIS Law
- GrassClippings
- GIS Asia/Pacific
- GIS World Report/CANADA
- GIS Europe
- Mapping Awareness
Regular GIS Papers

- Annals of the Association of American Geographers
- Cartographica
- Cartography and GIS
- Computers, Environment, and Urban Systems
- Computers and Geosciences
- IEEE Transactions on Computer Graphics and Applications
- Photogrammetric Engineering and Remote Sensing
Occasional GIS papers

- Cartographic Perspectives
- Journal of Cartography
- Geocarto International
- IEEE Geosciences
- International Journal of Remote Sensing
- Landscape Ecology
- Remote Sensing Review
- Mapping Science and Remote Science
- Infoworld
Popular Distribution Magazines

- Geospatial solutions
- GIS Law
- Geoworld
- GPS World
- Mapping awareness/Mapping awareness and GIS in Europe/Asia/Africa
Proceedings of Conferences

- AUTOCARTO International Symposium on Automated Cartography
- Proceedings of International Symposium on Spatial Data Handling, IGU Commission on GIS.
- GIS / LIS (Retired 1998)
- International Advanced Study Symposium on Topological Data Structures for Geographic Information Systems
- SSD Advances in spatial databases
Professional Organizations

- ACSM: American Congress on Surveying and Mapping.
Welcome to GIS-L,

- the world’s leading discussion list for geographic information systems.

Index

- How do I subscribe to GIS-L?
- How do I subscribe to the DIGEST version of GIS-L?
- How do I post to GIS-L?
- How do I get listserv HELP if I need it?
- How do I get access to the GIS-L Archives and Digests?

Links
Geographic Information Systems

Geographic information systems (GIS) technology can be used for scientific investigations, resource management, and development planning. For example, a GIS might allow emergency planners to easily calculate emergency response times in the event of a natural disaster, or a GIS might be used to find wetlands that need protection from pollution.

- **USGS node of the National Geospatial Data Clearinghouse** – a component of the National Spatial Data Infrastructure (NSDI).
- **Manual of Federal Geographic Data Products**
- **Other Useful GIS Links**

**What is a GIS?**

In the strictest sense, a GIS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e., data identified according to their locations. Practitioners also regard the total GIS as including operating personnel and the data that go into the system.
WWW Resources: Textbook Pages

- Geographic Information Systems and Science
- http://www.wiley.co.uk/gis/Home.html
- http://www.wiley.co.uk/gis/powerpoint.html
WWW Resources: Textbook Web Pages

Chapter 1: Introduction

Study Guide

SQUAWK! “Who needs a GIS?”
SQUAWK! “Who needs a GIS?”
Chapter 10: The Future of GIS

GIS Resources

For further information, check out the following sites:

- California Teale Data Center GIS data library
  The GIS Solutions Group maintains a data library of over 35 types of geography. Library coverages are in ARC/INFO format and are convertible to other file formats as required.

- Cartography Resources on the Web
  Resources on Cartography, Mapping and GIS maintained by Jeremy Crampton

- CIA World Databank

- CIESIN

- Digital Elevation Data Catalogue
  This catalogue includes details of elevation and bathymetric data, together with a section on available software for the display and manipulation of these data, maintained by
GIS daily internet news/jobs

- http://www.geoplace.com
- http://www.giscafe.com
- http://www.gis.com
- http://www.geographynetwork.com
- http://www.census.gov/geo/www/faq-index.html
- http://www.geo.ed.ac.uk/home/giswww.html
- http://www.lib.berkeley.edu/EART/abbrev.html
GISystems, GIScience and GIStudies

- **GISystems**
  - Emphasis on technology and tools

- **GIScience**
  - Fundamental issues raised by the use of GIS and related technologies (e.g.)
    - Spatial analysis
    - Map projections
    - Accuracy
    - Scientific visualization

- **GIStudies**
  - Systematic study of the use of geographic information
Social Implications of GIS

- Favors generalization, possibly at expense of minorities and individuals
- Use is not always neutral and can be applied to military and industrial surveillance
- Tendency to be technological rather than human need focused
- Maintains and extends the status quo of societal power structures
- Absence of GIS in critical research
Summary

- GIS is a science based on extensive technology application
- Unique perspective for examining patterns and processes on the Earth’s surface
- From origins in 1960s now a +$7bn industry
- Widely studied in schools and universities as part of many discipline curricula
END

QUESTIONS?