Welcome to REM402
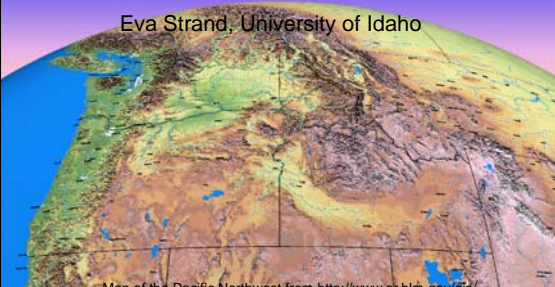## Applied Spatial Analysis in Natural Resources

Eva Strand, University of Idaho

Map of the Pacific Northwest from http://www.or.blm.gov/gis

Where and When?

➢Lectures Monday & Wednesday 9:30 – 10:20 am in TLC 248. No class on Labor Day September 6

➢Hands on labs Friday 8:30 – 10:20 or 10:30 – 12:20 in CNR room 26 (GIS lab)

➢ Class ends by October 30 (2 credits), but you have until Nov 15 to turn in the Final Project

➢ Access course material via Blackboard

➢ Reading: Karl Chang, *Introduction to Geographic Information Systems*, 3rd Edition (McGrawHill, 2005).

➢Teaching assistant Nick Fordes

➢Office hours Monday and Wednesday 1:30 – 2:30 pm CNR room 25A

REM402 goals

➢Understanding of how GIS works and can be used in natural resource applications

➢To quickly become comfortable using GIS as an analysis tool applied to natural resource management or research

➢ Refine the ability to independently assemble a GIS database and complete complex spatial analyses

Course overview

- Week 1: Review of GIS concepts
- Week 2: Accessing GIS data on the Internet
          Map projections
- Week 3: GPS/GIS Integration + Digitizing
- Week 4: Wildlife application - Resource selection
- Week 5: Raster data and Spatial Analyst
- Week 6: Raster modeling
- Week 7: GIS Applications in Natural Resources
- Week 8-10: Independent work on Final Project

Final project

The final project gives the student an opportunity to apply gained knowledge to a GIS analysis project of your choice.

You can use your own data, data from the Internet, data that we have used in the class or data for projects provided by the instructor.

Grading criteria are provided.

Grading and Evaluation

Lab exercises: 50%
Quiz 1 & 2:   20%
Final project: 30%

Five steps in GIS awareness

1) Excitement: GIS is supposed to be an important tool – I want to learn how to use it!

2) Frustration: I basically understand the concepts of GIS but I don't know what tools to use to make it do the analysis

3) Technical competence: GIS can solve most problems and I am a great GIS analyst!

4) Doubt: Polygons don't exist, the world is not made up of raster pixels, scales don't match – why use this tool

5) Professional competence: I am a competent GIS analyst and I have an understanding of what the limitations and errors in my analyses are.

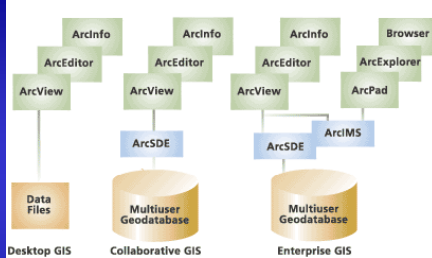### What level are you at?

❖ Support - Knowledge Base
❖ Software
❖ Books
❖ Education and Training
❖ Virtual Campus
❖ Geography Network – Online Data
❖ Conferences and Events

http://www.esri.com

ArcGIS is designed as a scalable system that can be customized from an individual desktop to a globally distributed network of people.

What is ArcGIS 9.3?

ArcView, ArcEditor and ArcInfo 9.3 are designed with the same Windows user interface and include Visual Basic for Applications for customization.

ArcView, ArcEditor & ArcInfo consist of three desktop applications:

ArcMap   **ArcCatalog**   **ArcToolbox**

ArcCatalog

With ArcCatalog, you can browse, manage, create, and organize your geographic and tabular data.

ArcCatalog comes with support for several metadata standards to allow you to create, edit, and view metadata.

ArcMap

ArcMap for all map-based tasks including cartography, map analysis, and editing. ArcMap gives you the power to:

• **Visualize.** Finding patterns you couldn't see before
• **Create.** It is easy to create maps to convey your message.
• **Solve.** Working geographically lets you answer questions such as "Where is...?", "How much...?", and "What if...?".
• **Present.** You can make publication-quality maps and create interactive displays that link graphs, tables, drawings, photographs, and other elements to your data.
• **Develop.** The ArcMap customization environment lets you tailor the interface to suit your needs .

ArcToolbox

ArcToolbox is an application containing many GIS tools used for geoprocessing.

❖ There are two versions of ArcToolbox: the complete ArcToolbox that comes with ArcInfo and a lighter version that comes with ArcView and ArcEditor software.

❖ ArcToolbox for ArcInfo comes with more than 170 tools for geoprocessing, data conversion, map sheet management, overlay analysis, map projection,and much more.

❖ ArcToolbox for ArcView and ArcEditor contains 40 commonly used tools for data conversion and management.

In ArcGIS 9.3 ArcToolbox is incorporated in ArcMap.
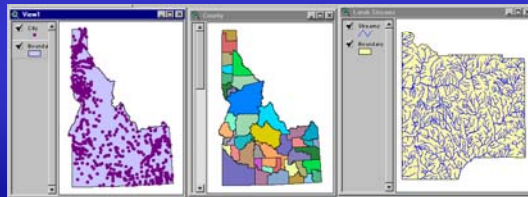
Spatial Data

Spatial Data is a record of the geographic location ......
.......of objects such as topographic contours, individual plants, roads, culverts or parcels.
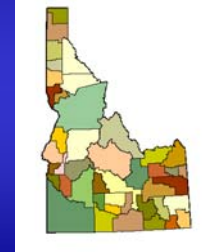
Vector Data

Coordinate-based data structures commonly used to represent map objects. Each object is represented as a list of X,Y coordinates

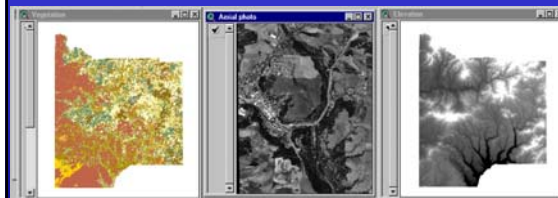Examples - tree, poles, roads, housing developments, zoning districts

| Points | Polygons | Lines |

Raster Data

Cell-based representation of map features. Each cell has a value. A group of cells with the same value represent a feature.

Examples - satellite imagery, aerial photography and some come from software packages like ArcInfo GRID and ERDAS.

| Grid | Image | Elevation model |

GIS basic elements

Points

Lines

Polygons

Pixels

Database   attribute values   - numbers
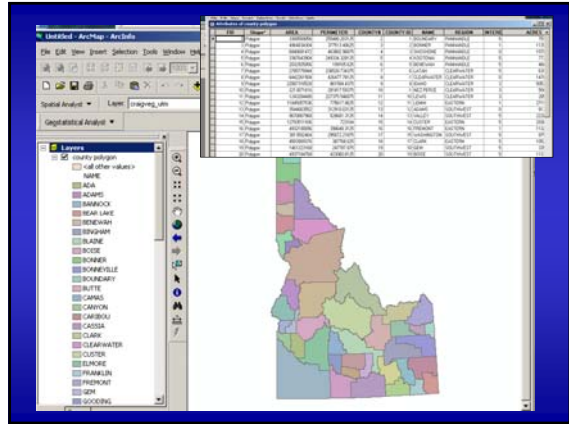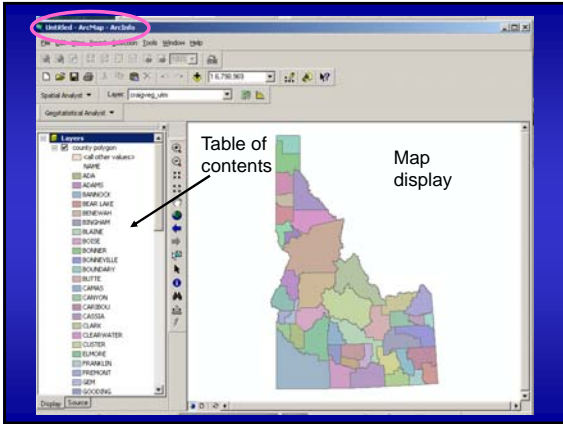   - text

ArcGIS File Formats

Vector data

- Shape files
- Coverages
- CAD drawings (dxf/dwg)

Raster data

- GRIDS
- Images

- Personal Geodatabases
- Multiuser Geodatabases

GIS Analysis

· Overlay Analysis
• Proximity Analysis
• Distance analysis

• Working with tables
 - export table to Excel
 - work with tables in ArcMap

Analysis Tools in Arc Toolbox

Extract (clip)
Overlay (Intersect, union)
Proximity (buffer)

Overlay analysis point data

"Piercing Needle" Approach

Multiple layers of data are in relative position with one another - inserting a "digital pin" through the stack of overlayed data.

This allows questions to be answered concerning *everything* occurring at a particular location.

This view of the world limits focus to a particular point and precludes wide-area landscape analysis

Overlay Analysis for Regions

Region Wide: "Cookie Cutter Approach"

 Vector data
• **Clip**
• **Intersect – Union**

Raster data
• **GRID clip (masking)**
• **Zonal statistics (GRID)**
• **Combine**

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Questions that can be answered with GIS overlay analysis

➢How much ponderosa pine forest is there on Moscow Mountain?

➢How much mature timber burned in the Roberts fire?

➢How many harvesting units on the UI Experimental Forest grow on slopes steeper than 30%

➢What is the typical vegetation within 200 m of Lewis's woodpecker nests?

➢ What is the area of aspen woodlands in the game management area?

Overlay Analysis - points

| Overlay type	Tool to use in ArcGIS 9x
Point to Polygon	**Join and Relates: Join – Join data based on spatial location** **Hint: Right-click on the point layer, select Joins and Relates**

Point to Grid	**Spatial Analyst: Convert the point file to a raster based on a unique point ID.**
	Perform the overlay analysis in the Spatial Analyst Raster Calculator by typing at the command line:
	Overlaygrid **= combine(***pointgrid, valuegrid***)**
	 where *overlaygrid* **is the name of the output grid**
	     pointgrid **is your converted point grid**
	      valuegrid **is the grid you want to extract**
	       information from

Overlay Analysis - area

Overlay type	Tools to use in ArcGIS 9x
Poly to Poly	ArcToolbox- Analysis Tools - Overlay – Clip, Intersect or Union
Poly to Grid	Convert the polygon cover to a grid or the grid to a polygon and use the 'poly to poly' or 'grid to grid' techniques Spatial Analyst – Zonal Statistics (can handle overlay between polygon layers and grids)
Grid to Grid	Spatial Analyst: Raster Calculator *Outgrid* = Combine(*grid1, grid2*) or ArcToolbox – Spatial Analysis Tools

Xtools

Third party software, available free www.esri.com (support - downloads)

➢Update area after overlay or proximity analysis

➢Table frequency (table summations)

➢ Add XY coordinates to a table

What is a summary table
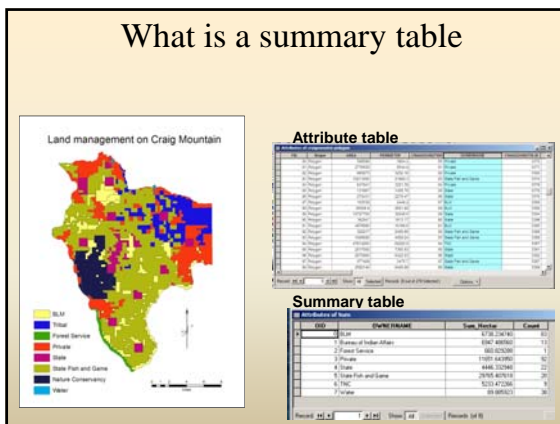
Questions?

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