GEOL 452/552
- GIS for Geoscientists I

Lecture 2 (chapter I)
Plan for Today:

• GIS data (vector data features)
• Example of a real-world GIS project
• lab: chapter 1 tutorial, HW 1

• Everybody got the textbook?

• Questions / problems? (See me during break)
**GIS Data**

- **feature**: a (single) entity: a point, a line or a polygon
- **features** => “vector data”
- **Line**: 2+ points (polyline)
- **Polygon**: line of 3+ points (always closed!)
- **Each point** (within a line or polygon) has a X,Y location*
- **(* the x/y location is on a sphere but we pretend the Earth is flat)**
GIS layers

In GIS general lingo: A layer is a collections of many features

A layer contains features of the same type of geometry (only point, only lines or only polygons)

ArcMap: each layer gets a separate entry in the table of content (TOC)
feature data: geometry + attributes

• geometry (Shape data): visible on map (point, line, polygon outline)
• attribute data: “invisible” on map, stored inside a table
• each table row (“record”) connects to one feature drawn on the map
• each table column (“field”) contains values for an attribute
• How many households for the Montana polygon?
GIS example Application: Wildlife habitat model

- **Q:** Where in the forest should we harvest timber and not disturb the elk population?

- **We have:** Data about vegetation (types of plants) good for food? good for cover?

- **Need a** *Suitability number* for each part of forest for cutting and NOT disturbing the local elk population
  - value of 0.0 means do not cut here!
  - value of 1.0 means OK to cut trees from here

- **Simplified HABCAP model (U.S. Forest Service)**
• **Suitability Map** shows Suitability (as 0.0 to 1.0)

• Map helps to manage forest e.g. how much area with tree type X? Good access? How much $ when selling it?)

• Calculate Suitability ($S$) from Cover ($CV$), Food ($FV$) and Proximity ($PV$); everywhere within the forest

• Suitability numbers $S$ ranges from 0 (bad) to 1 (good)

• $S = (\text{Cover Value} + 3 \times \text{Forage Value} + \text{Proximity Value}) / 5$

• (Q: What is more important: Forage Value or Cover Value?)
Getting numbers (0.0 - 1.0) for food value (FV) and cover value (CV)

Each polygon contains a COVSS “code” for “type of forest”

Each polygon also has a **cover** value (CV) and **forage** value (FV) as direct translation from the type of forest (COVSS)
• set to **C** (primarily cover) if polygon’s CV < FV
• set to **F** (primarily food) if polygon’s FV > CV
• set to **B** (both Food and Cover) if polygon’s CV = FV
• Also: Dissolve (merge) adjacent polygons of same value
Proximity (distance) analysis:

- Elk need to feed and hide (Elk life is simple)
- Being inside a B polygon is good (we know it has a mix of F and C)
- Being in Cover (C) but close to Food (F) is also good
- “deep inside” a C polygon or a F polygon is not so good

Deep inside a polygon: lots of cover OR lots of food

Here: both - cover AND food!
Proximity analysis (PV values)

- Use a buffer operation to divide polygons into “bands” - based on distance
- Each band gets a PV value
- “inside” band: low PV values (center = 0.0)

“Deep inside” zones

PV = 1.0
PV = 0.5
PV = 0.2
Calculation of overall suitability

- Cover (CV) and Food (FV) from vegetation type, PV from distance

\[ S = \frac{(CV + 3 \times FV + PV)}{5} = \frac{3.7}{5} = 0.74 \]

- Why is that always 0.0 to 1.0?

- S is the final \textbf{elk habitat suitability} number for each polygon

- Q: Where should logging operations be conducted (high or low S)?
Example of a “good” homework exercise

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Geol 352 – 2009
HW5 – Ex 2.) What is the coordinate system, projection, units and extent of US_lower48.shp

I opened Data Frame properties – Coordinate System in the layer’s data frame and looked at the text:

a. The coordinate system is the UTM in zone 13 North in NAD 83.
b. It is projected as Transverse_Cylindrical

c. The units are found in: Dataframe – General

The extend in North-South direction (y) and in East-West direction can be calculated from the frame coordinates found in Data frame – Data frame – Fixed Extent:

d. $y = T-B = 4888165.255196 - 4871783.046157 = 16382.209039$ m
   $x = R-L = 650253.625006 - 630271.058075 = 19982.566931$ m
Windows Network Access to delphi

Network drive (best way)

- Computer - Map Network Drive
- Drive: Z:
- Folder: \delphi\geol552\data

- Or:
- Enter \delphi\geol552\data as Address in File Manager

- Or: Start > Search programs > \delphi\geol552\data
• **Make sure ArcCatalog can see your student**

• start ArcMap now

• click on the ArcCatalog Tab on the right (yellow)

• Check that you can see U:\ArcGIS (with mgisdata) under **Folder Connections**

• If not Right-click on Folder Connections, Connect Folder > U:\ArcGIS > OK

• Always save your mxd files (ArcMap documents) and any GIS data you create in your student Folder

• With ArcMap open, let’s practice the magic window moving/docking
• Lab: Chapter 1 Tutorial + HW1
  - (copy the GEOL552/data/mgisdata folder into your to your student folder first)
  - ch 1 tutorial steps 1-44 (optional: 49-54: using internet maps)
  - I-> tutorial data will be in the mgisdata folder in your ArcGIS student folder (U:\ArcGIS) not in c:/MGIS/mgisdata (as the book says!)
  - ask us if you’re stuck, group work is OK
  - Write the answers to the tutorial questions in your text book
  - However: you do not need to send me these tutorial answers!
  - HW1 is on Bb, due before next Thursday
  - You’ll have more time for HW next Tuesday
How to operate any computer software (including ArcGIS)

(XKCD inspired)

- Textbook - Skills Reference part of chapter
- ArcMap/ArcCatalog - Help - ArcGIS Desktop Help