GEOL 452/552

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GIS for Geoscientists I

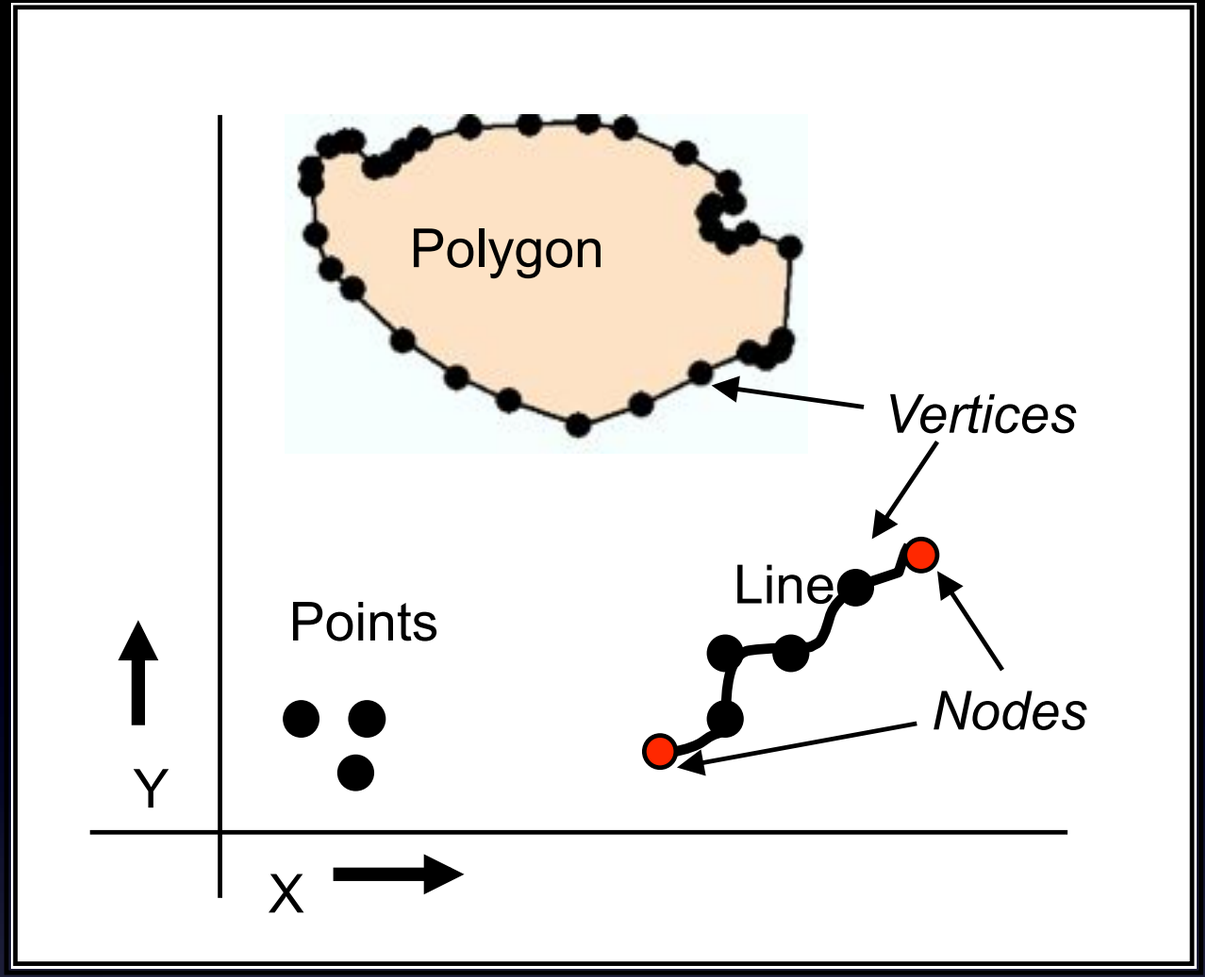
Lecture 2 (chapter 1)

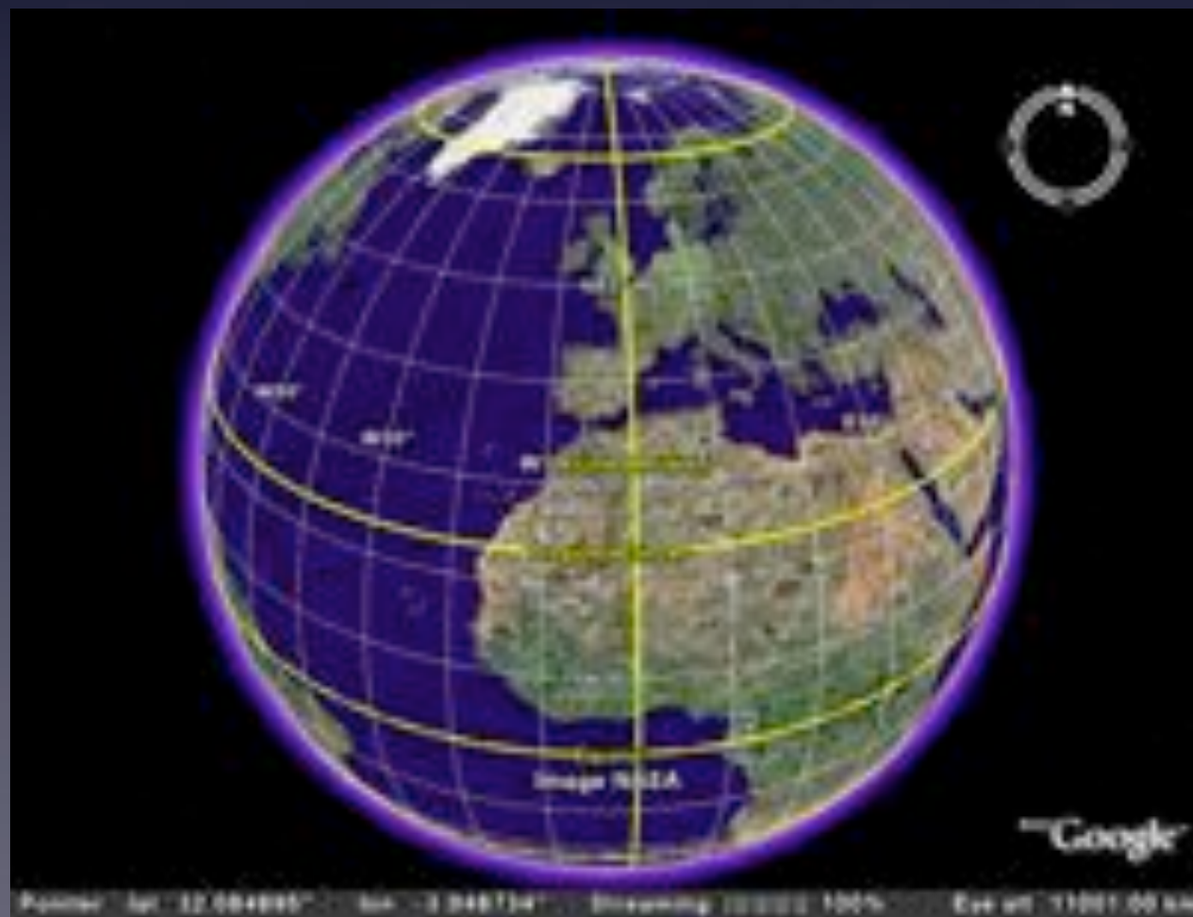
Plan for Today:

- 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**

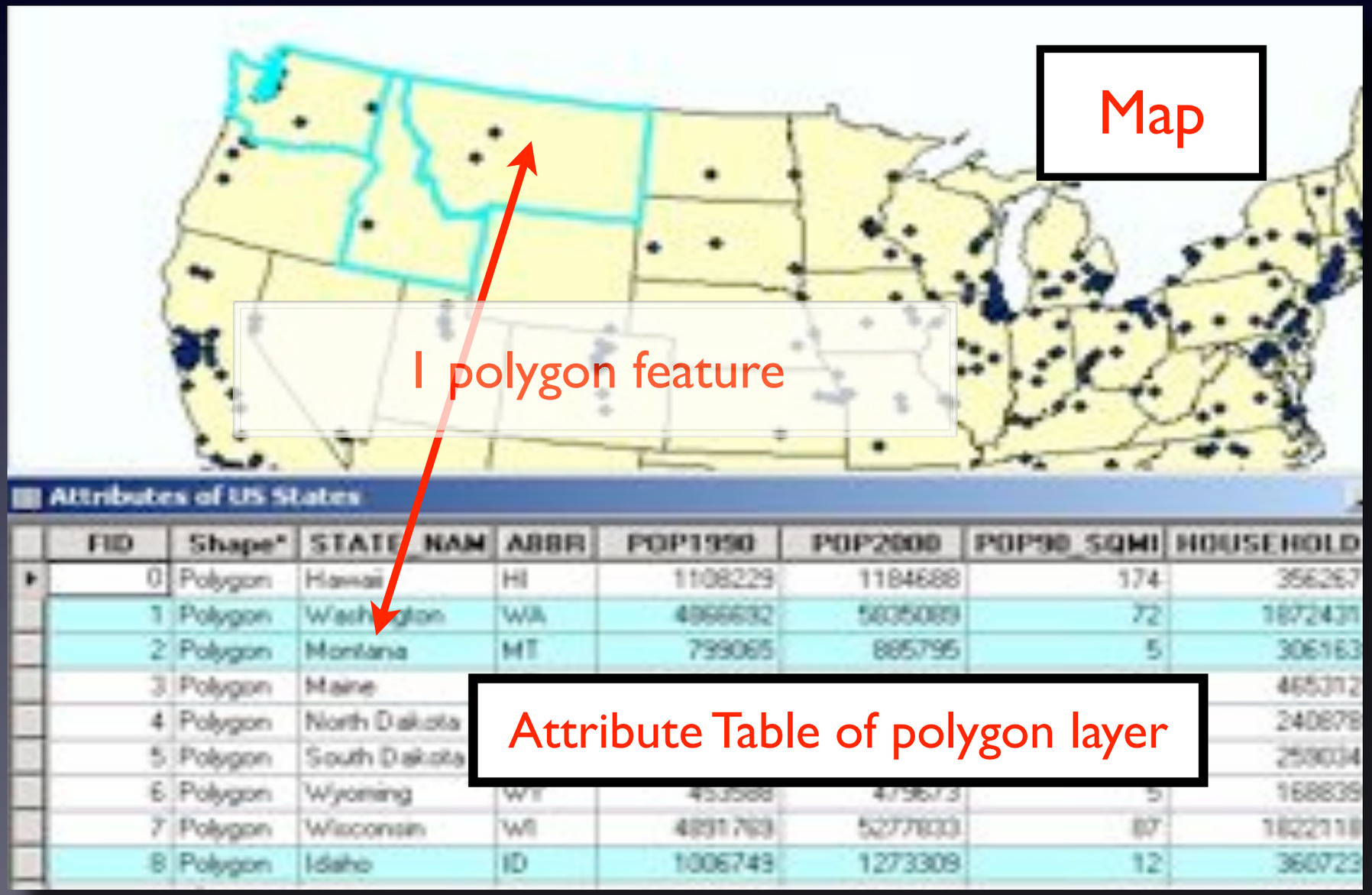
In GIS general lingo: A layer is a collections of many features

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

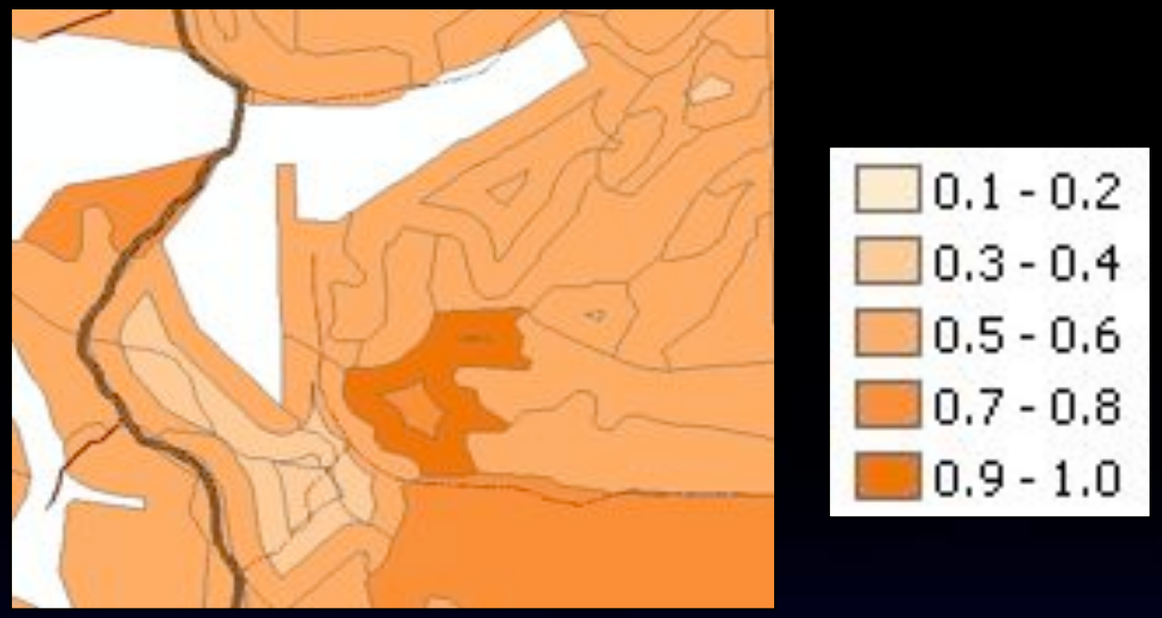
- geometry (Shape data): visible on map (point, line polygon outline)
- attribute data: "invisible" on map, stored inside a **table**
- each table **row** ("record") connects to one feature drawn on the map
- each table **column** ("field") contains values for an attribute
- How many households for the Montana polygon?



FID	Shape*	STATE_NAM	ABBR	POP1990	POP2000	POP90_SQMI	HOUSEHOLD
0	Polygon	Hawaii	HI	1108229	1184688	174	356267
1	Polygon	Washington	WA	4866692	5656089	72	1872431
2	Polygon	Montana	MT	799065	885795	5	306163
3	Polygon	Maine					465312
4	Polygon	North Dakota					240878
5	Polygon	South Dakota					259034
6	Polygon	Wyoming	WY	453588	479673	5	168839
7	Polygon	Wisconsin	WI	4891769	5277833	87	1822118
8	Polygon	Idaho	ID	1006749	1273309	12	360723

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)

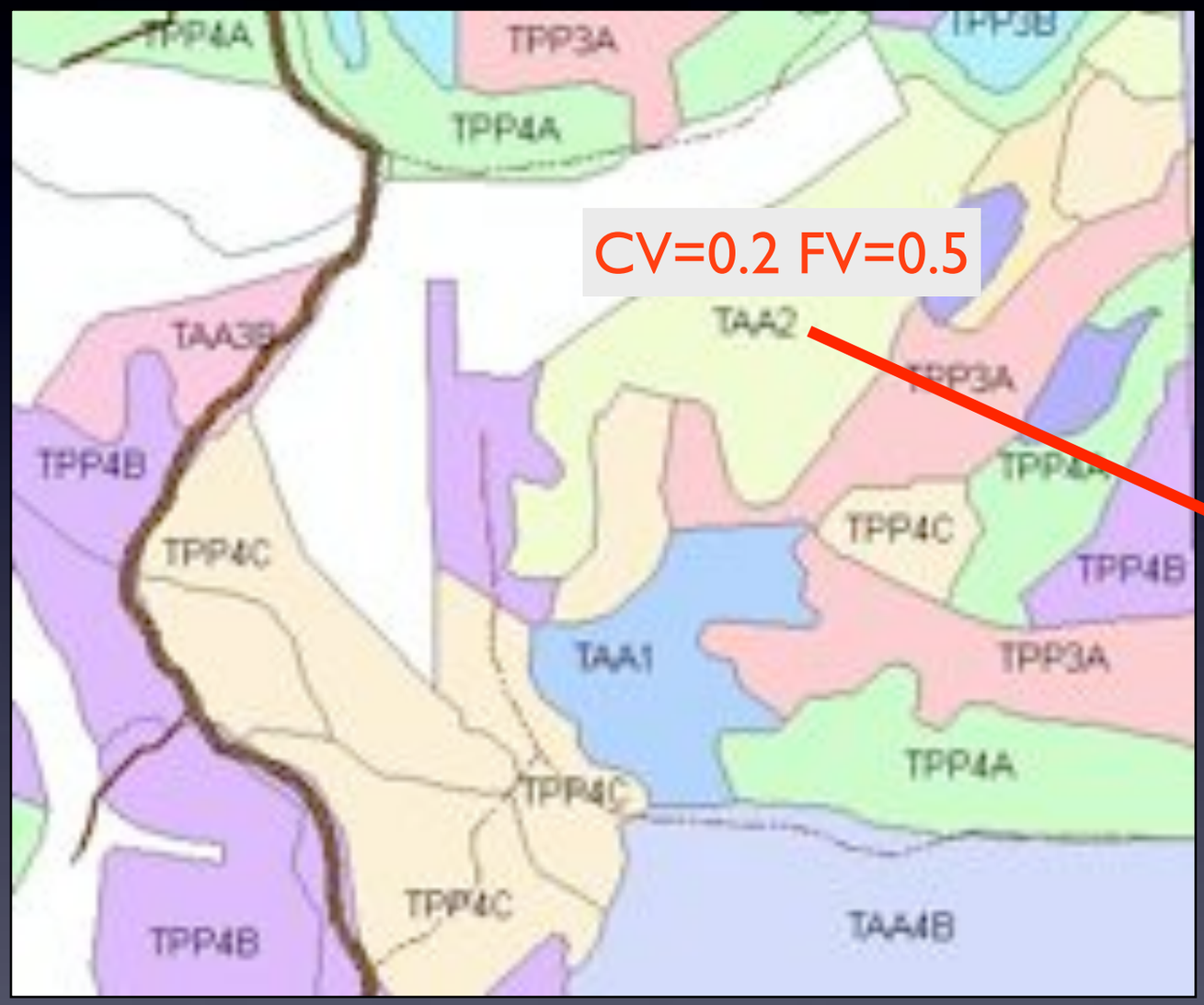


- **Suitability Map** shows Suitability (as 0.0 to 1.0)
- Map helps to manage forest
  e.g. how much area with tree type X? Good access? How much $ when selling it?)

- 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 = (**C**over**V**alue + 3 * **F**orage**V**alue + **P**roximity**V**alue) / 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"



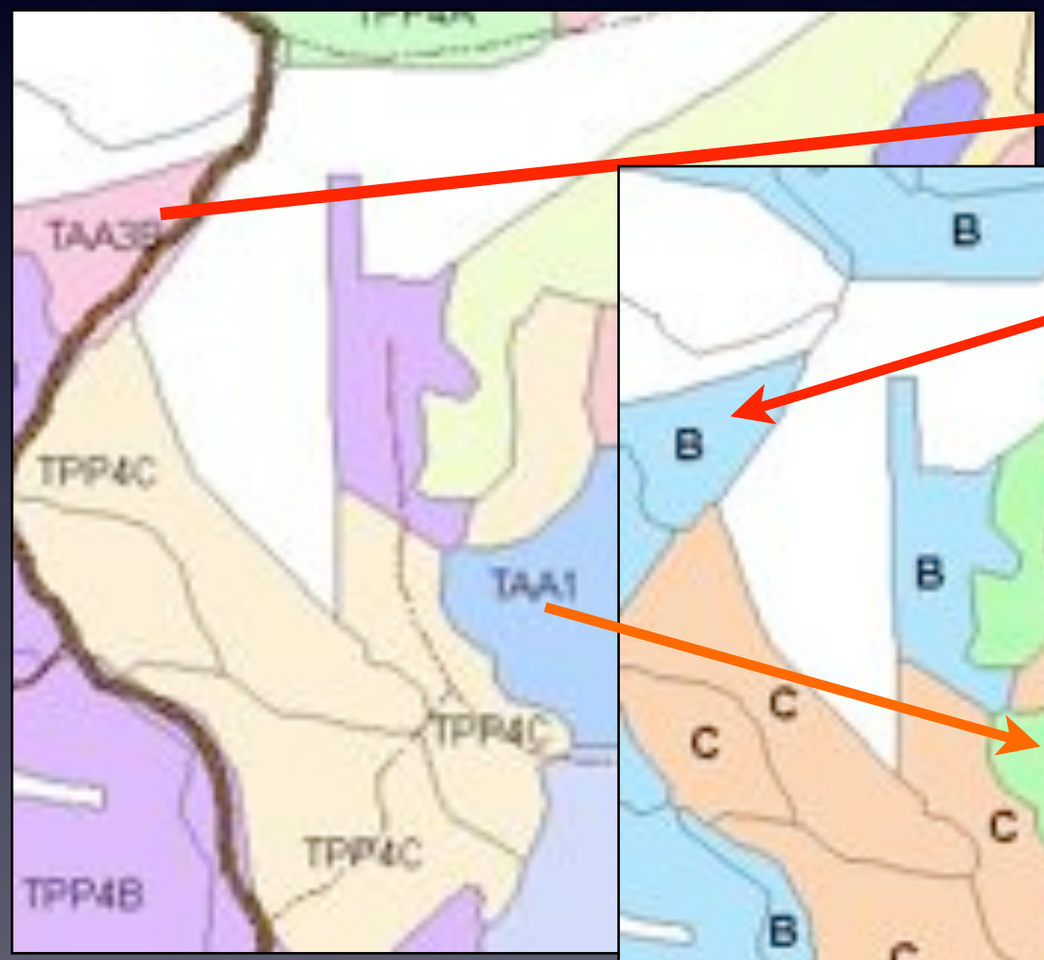
Attributes of coeff

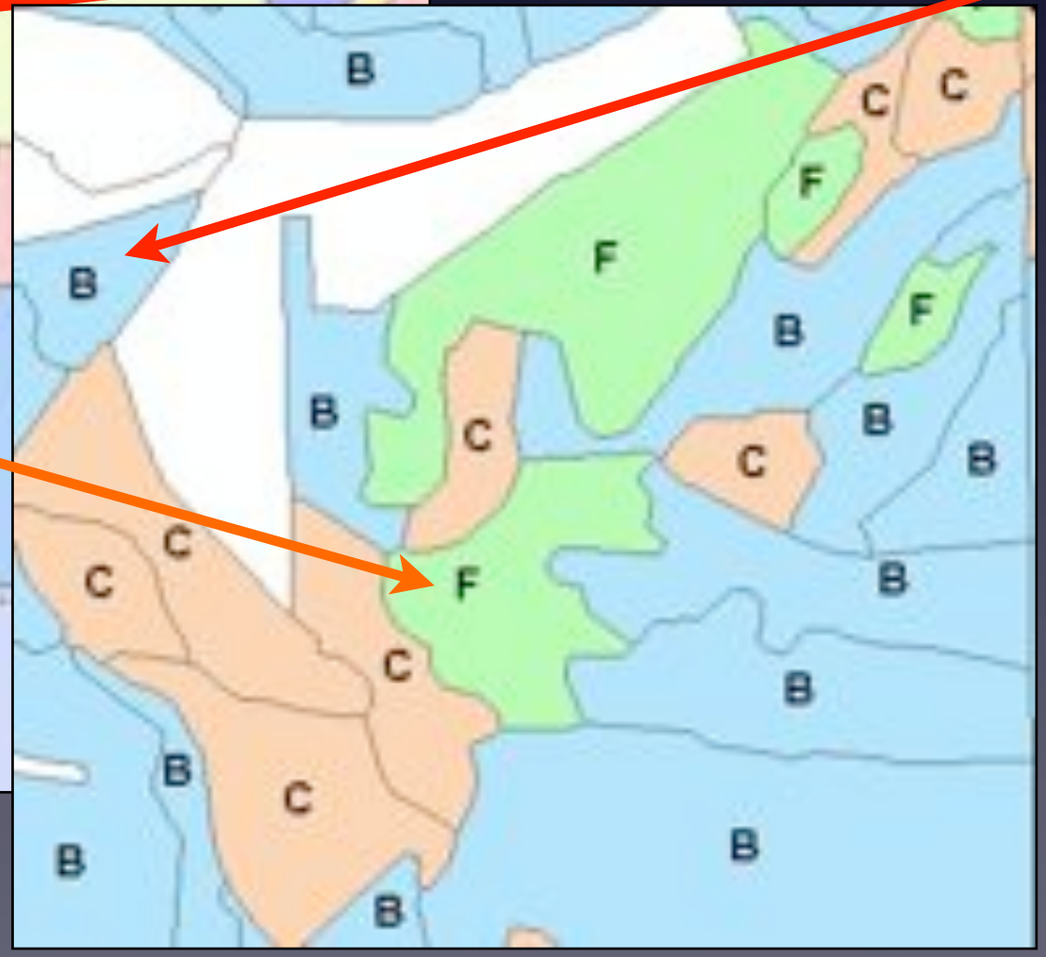
COVSS	CV	FV
GRAD	0	1
NFLO	0	0
TAA1	0.2	1
TAA2	0.2	0.5
TAA3A	0.5	0.5
TAA3B	0.5	0.5
TAA3C	1	0.2
TAA4A	0.2	0.5

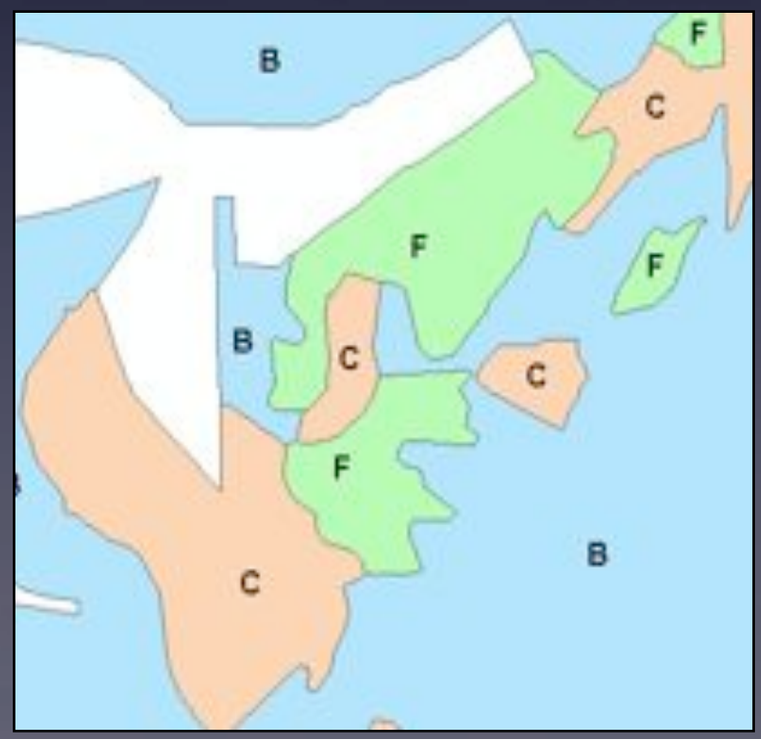
Each polygon also has a **cover** value (CV) and **forage** value (FV) as direct translation from the type of forest (COVSS)

- 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

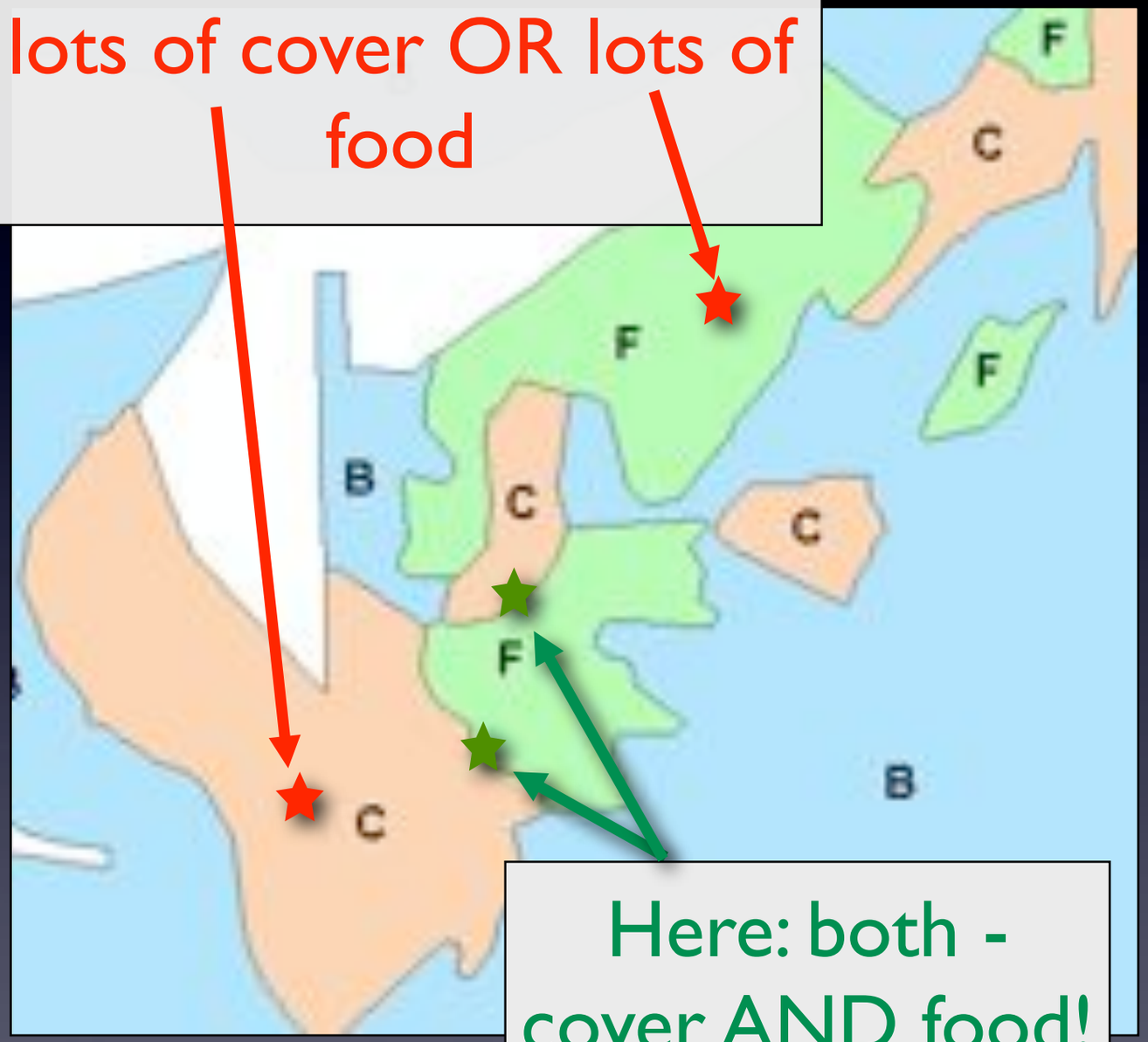
COVSS	CV	FV
GRA0	0	1
NFL0	0	0
TAA1	0.2	1
TAA2	0.2	0.5
TAA3A	0.5	0.5
TAA3B	0.5	0.5







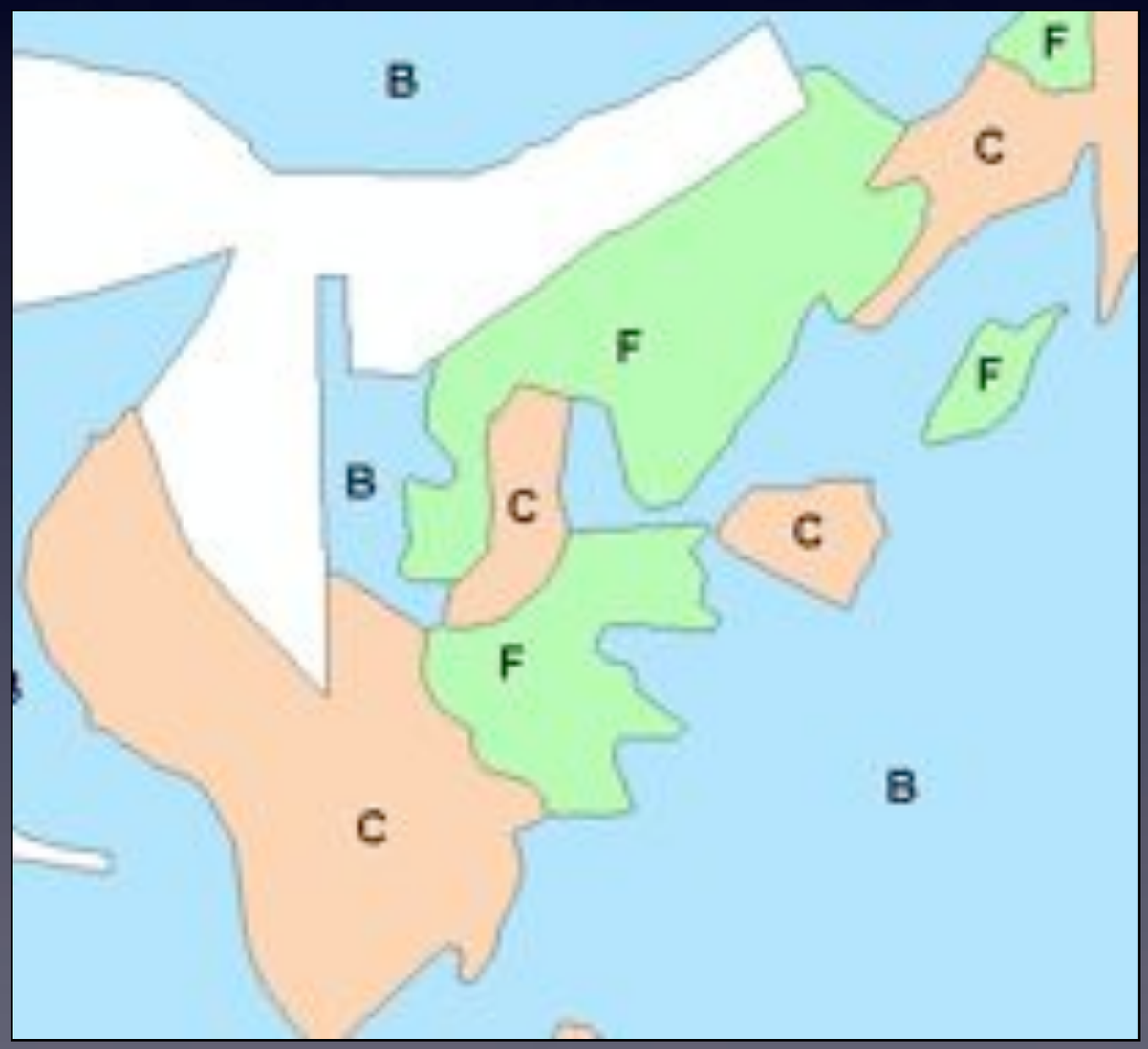
Proximity (distance) analysis:

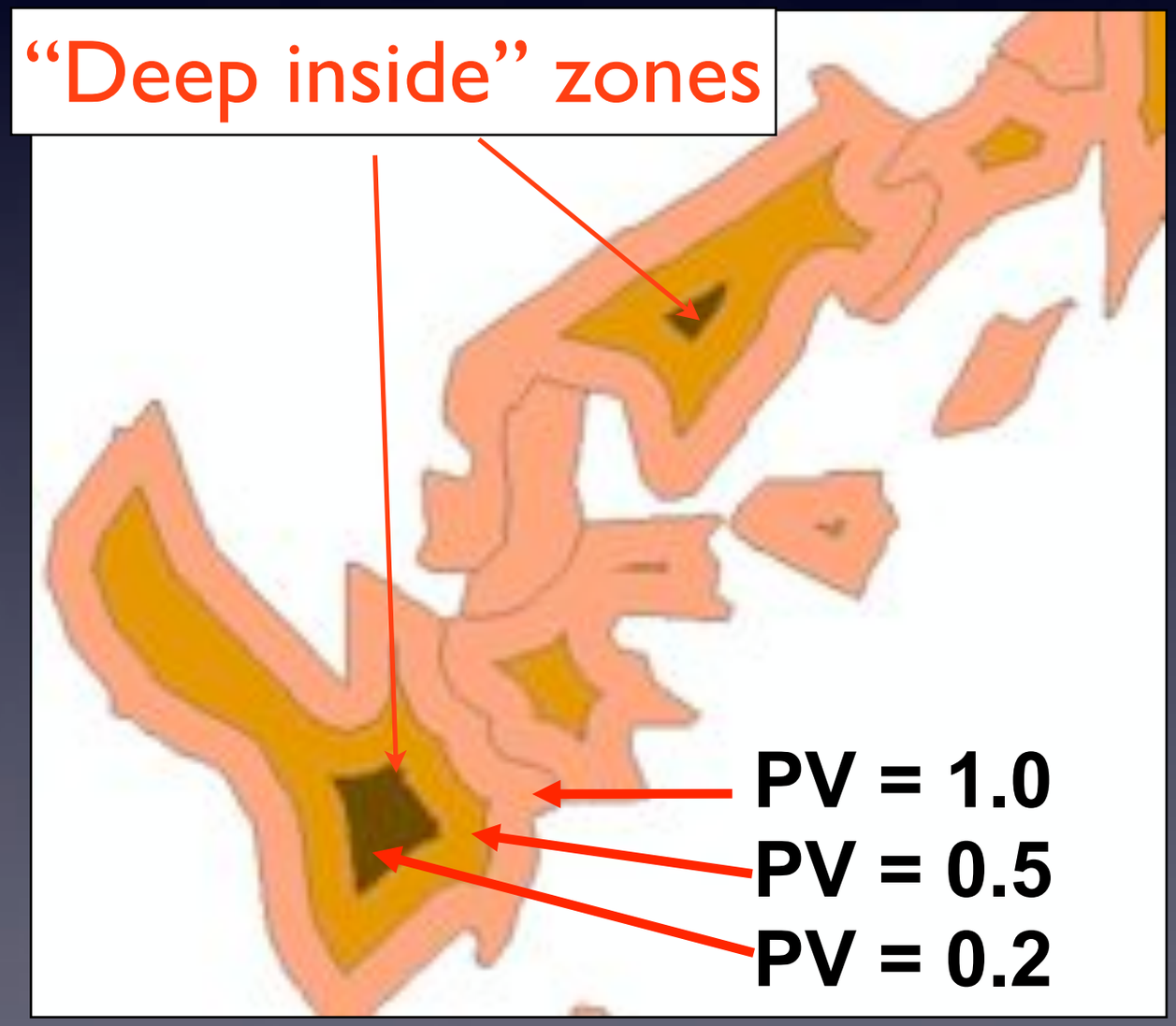


- Elk need to feed and hide (Elk life is simple)
- Being inside a B polygon is good (we know it has a mix of F and C)
- being in Cover (C) but close to Food (F) is also good
- "deep inside" a C polygon or a F polygon is not so good

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)



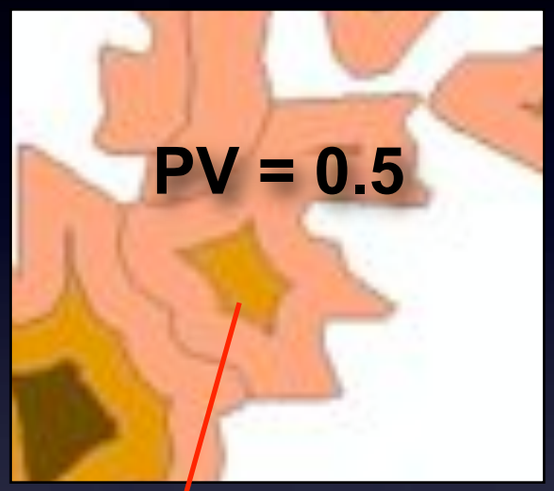


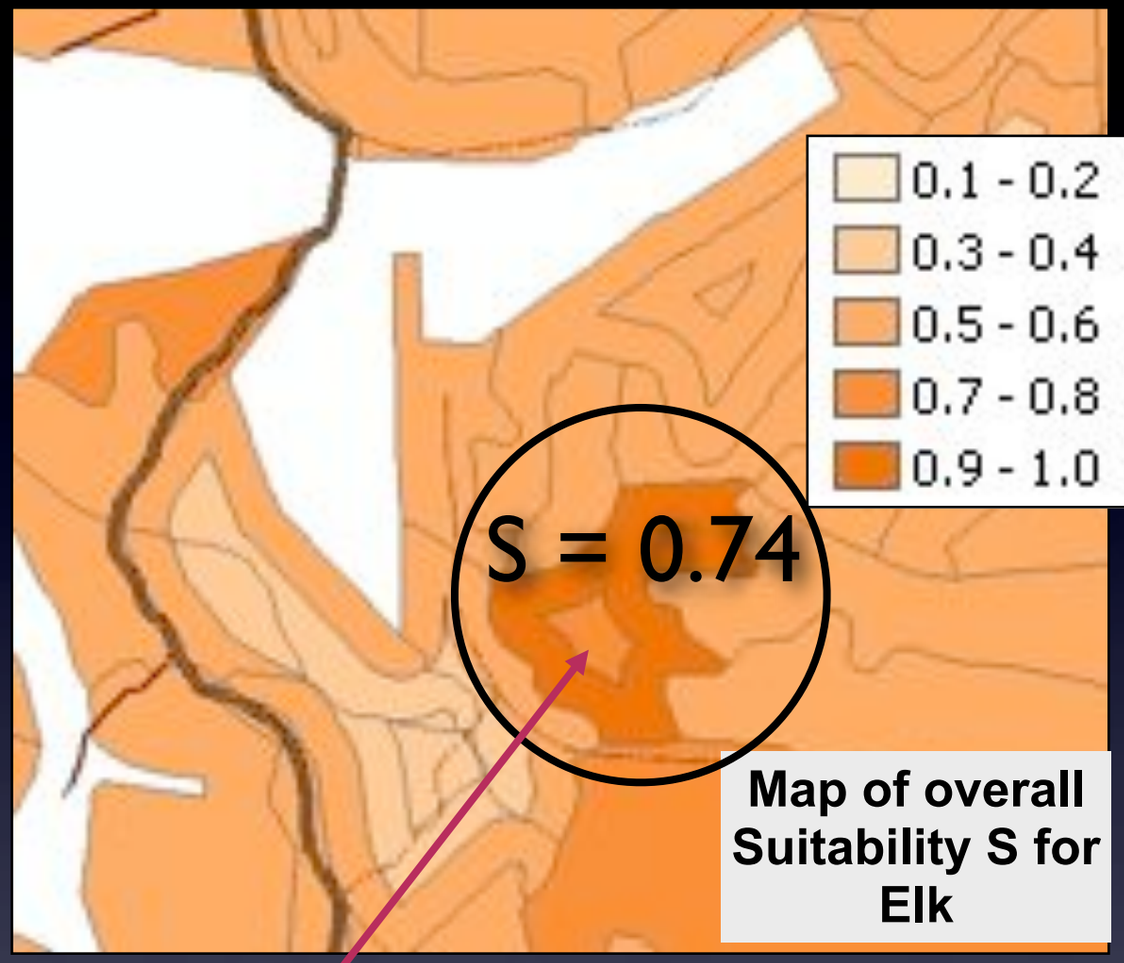
Calculation of overall suitability

Map of CV (Cover) and FV (Food)

COVSS	CV	FV
GRAD	0	1
NFLO	0	0
TAA1	0.2	1

Map of PV (Proximity)





Map of overall Suitability S for Elk

- Cover (CV) and Food (FV) from vegetation type, PV from distance
- S = (CV + 3 * FV + PV) / 5 = 3.7 / 5 = 0.74 (why is that always 0.0 to 1.0?)
- S is the final **elk habitat suitability** number for each polygon
- Q: Where should logging operations be conducted (high or low S)?

Example of a "good" home work exercise

- Name
- Which homework?
- What's the question number and text?
- (text will be in Bb, no need to type it in ...)
- Description of what you did
- (not super detailed, just the gist!)
- add 1-2 screenshots per answer
- screenshots: Alt-PrntScrn
- no need for captions

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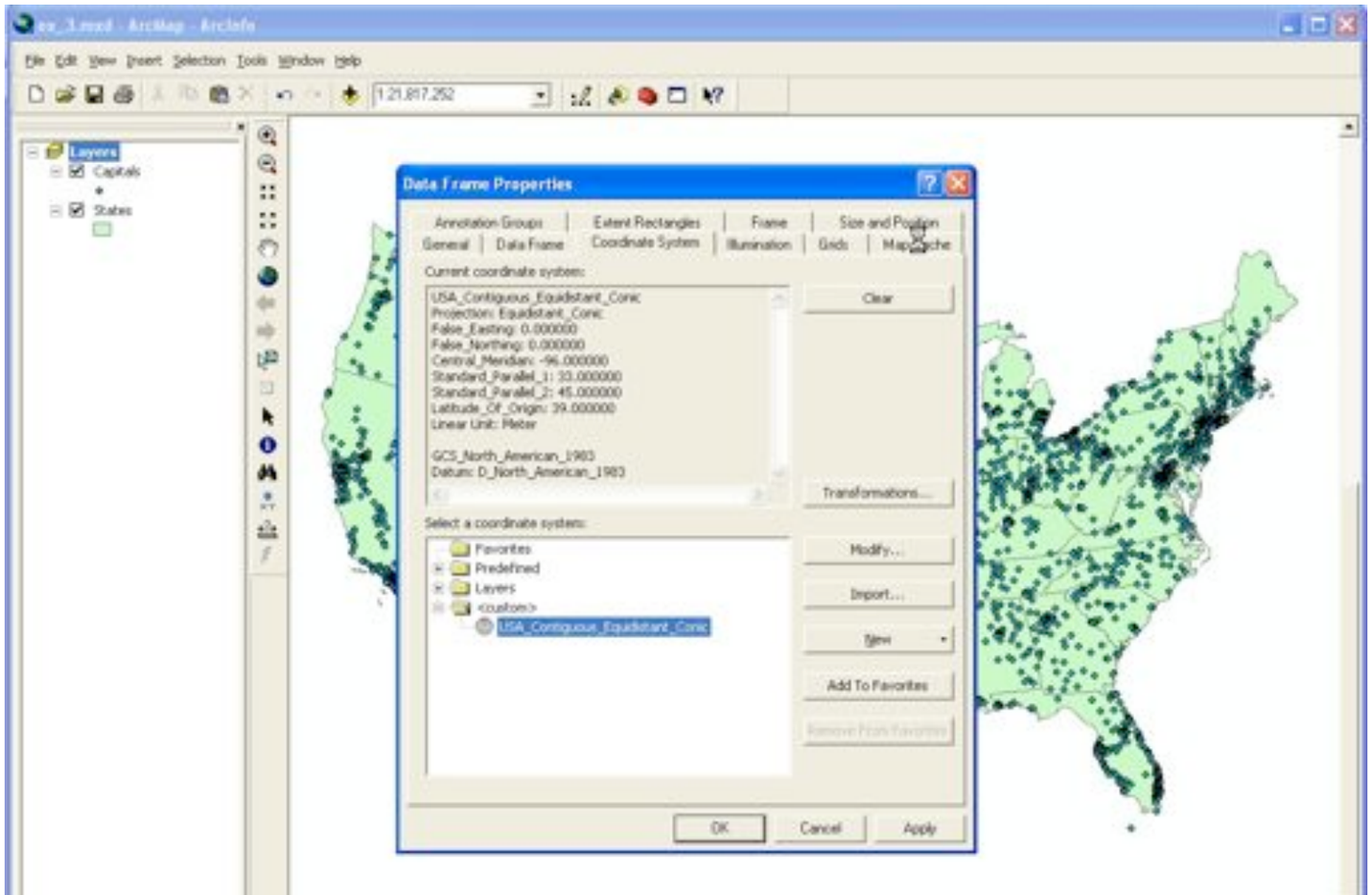
Geol 552 - 2009
HW5 –

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

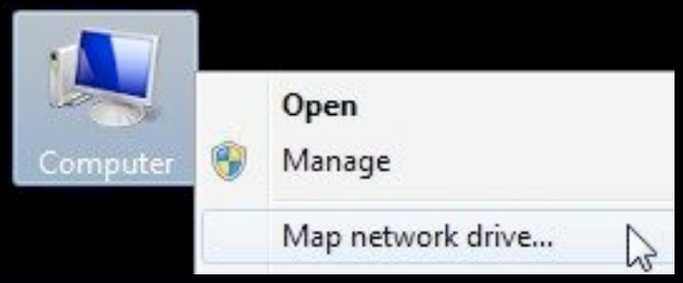
The units are found in: Dataframe – General
c. The map linear units are in meters and angular are in degrees.

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



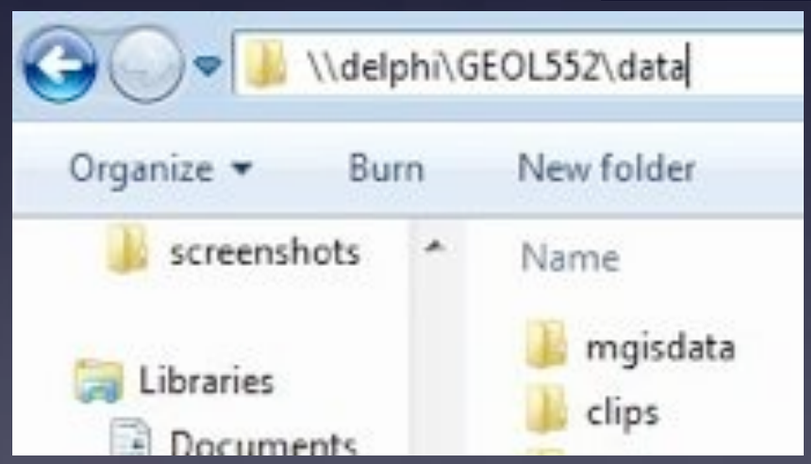
Windows Network Access to delphi

Network drive (best way)

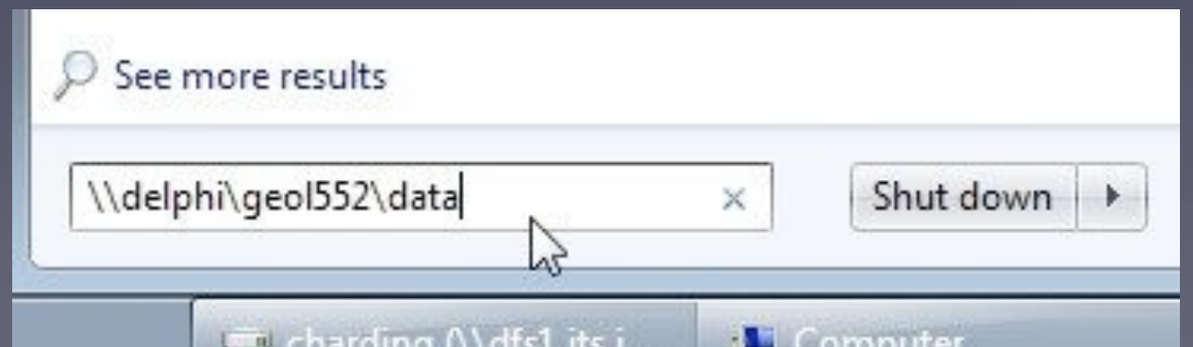


- Computer - Map Network Drive
- Drive: Z:
- Folder: \\delphi\geol552\data

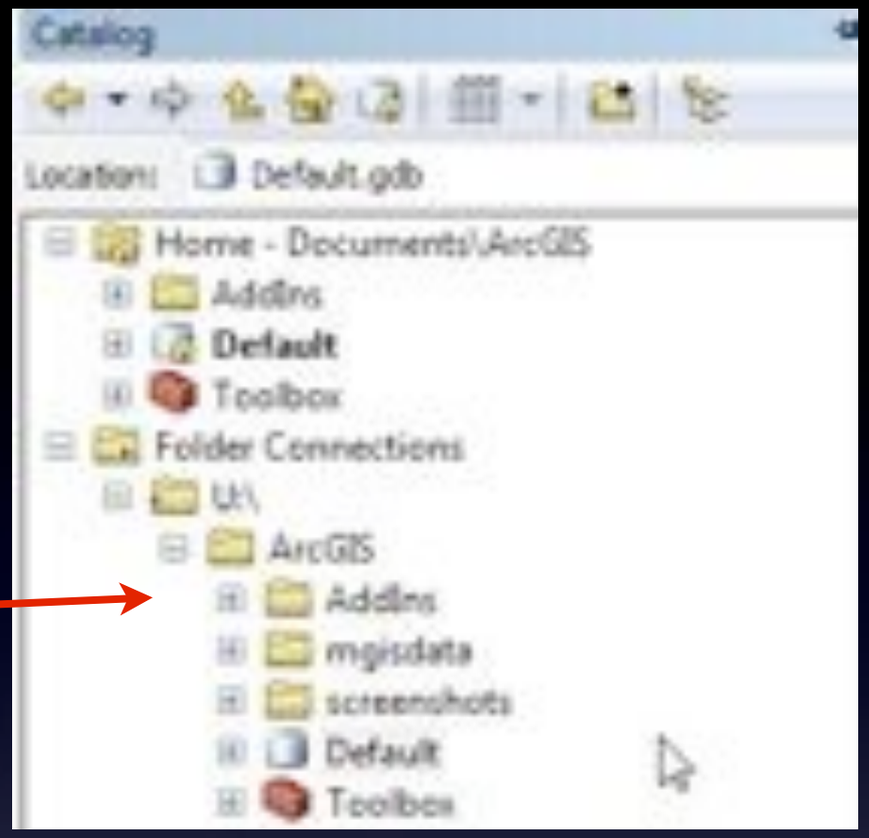
- Or:
- Enter \\delphi\geol552\data as Address in File Manager



- 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



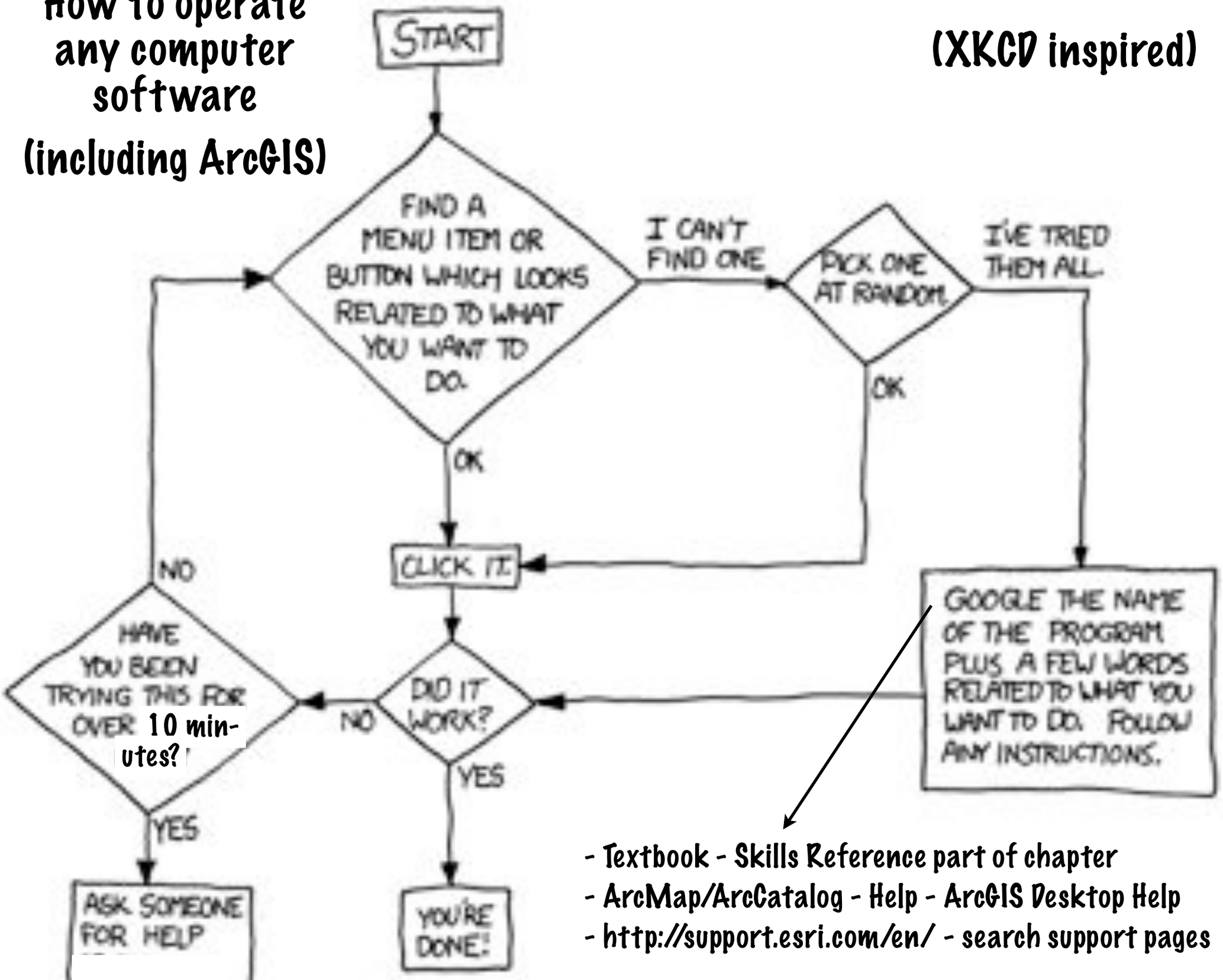
- With ArcMap open, let's practice the magic window moving/docking

- 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)
  - 1-> 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
- http://support.esri.com/en/ - search support pages