Watershed Sciences 4930 & 6920
ADVANCED GIS

WEEK Four

EDITING & ATTRIBUTING DATA & METADATA

Joe Wheaton
HOUSEKEEPING

- Are you guys getting the help you need?
  - You guys are worryingly low maintenance..
- Thursday last *official day* for WATS 6915
- Effects Toolbar... (Cliff Claven Trivia)
TODAY’S PLAN

I. Editing... What is it?
II. Some Editing Workflows
III. Attributes & Attributing
IV. Metadata
V. Some Comments...
WHAT DOES EDIT MEAN TO YOU?

- First not in GIS terms...
- Then in the context of GIS
EDITING IN GIS

• Why edit existing data?
  – Errors and inconsistencies from data entry such as
digitization (e.g. undershoots, overshoots, missing),
attribution errors (mislabeled)
  – Spatial data can change over time (augment it with
new data)
  – Positional data only so accurate

• Editing includes drawing in GIS
  – CAD is far more powerful at drawing

• Editing is also for editing data and attributes!
TODAY’S PLAN

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TWO WAYS TO START EDITING

1. Use the editor toolbar
2. Right-Click on the layer you want to edit
STARTING, SAVING, STOPPING

• Because your time is valuable and you’re paranoid...

• Save as frequently as you’re willing to redraw something...

• Because You need to start somewhere..

• Because you are done with your work... don’t worry it asks if you want to save your work.
THE EDITOR TOOLBAR

- Only active when you’ve started editing a layer
- Everything relies on feature templates..
- Encourages thinking about symbology, attributing, & drawing in one step
Templates impose symbology...

- You choose feature template
- Then choose construction tool
WHEN EDITING... JUST SKETCHING

• Whatever you are drawing is a sketch, until you complete it (F2)
• Feature construction dialog follows you
• Right-click context allows you to do a lot more...

[Diagram showing feature construction and sketching processes]
SNAPPING MAKES EDITING MORE ACCURATE

Snap Modes:
- Auto-snapping
- Manual-snapping

Snap Methods:
- Endpoint
- Vertex
- Midpoint
- Edge
- Intersection
- Tangent
Creating adjoining polygons

If you are creating polygons of land uses, soils, counties, or property ownership, for example, you often need to create polygons next to one another. The polygons should share a border, but you want to avoid digitizing the border twice or having overlaps or spaces between polygons. You can use the Auto-Complete Polygon construction tool when creating new polygons to help ensure that your data forms a continuous fabric. With Auto-Complete Polygon, you can digitize a new polygon that adjoins an existing polygon, using the existing polygon's geometry and the edit sketch to define the edges of the new polygon.

Steps:

1. Click a polygon feature template in the Create Features window.
2. Click the **Auto-Complete Polygon** tool on the Create Features window.
3. Starting from the boundary of an existing polygon in the same layer, digitize a boundary of the new polygon that will share a boundary with the existing polygon.
4. To change the shape of the sketch segment, click a construction method type on the Editor toolbar or on the Feature Construction mini toolbar. Segments can be created using a variety of methods—for example, as straight lines, with curves, or traced from the shapes of other features. You can also use keyboard shortcuts or right-click to access a menu of commands to help you place vertices in the sketch.
5. You can either snap the sketch to the edge of the existing polygon or finish the sketch just inside the existing polygon. The sketch must cross (or touch) the existing polygon edge at least two times for the new polygon to be created.
EDIT SKETCH PROPERTIES

- For manually entering coordinates (when it needs to be exact)
- Also useful for Z and/or M

Type a new z-value for the selected vertex.
Click inside the cell and type a new z-value.
EDITING EXISTING FEATURES

- Edit Vertices
- Moving
- Deleting
- Separating
- Reshaping
- Splitting
- Flipping
- Scaling
- Rotating
- Slipping
- Trimming
- Simplifying

QUERYING LEADS TO SMARTER SELECTION
DIGITIZING

Such fun!

Manual types:

1. On-Screen Digitizing
   1. Based on a scanned image
2. Hardcopy Map Digitizing
   1. Use a tablet, digitizer

In addition:

Scanned data can sometimes be automatically digitized but always requires fixing
DIGITIZING PROCESS

• Creation of digital vector data from either scanned images (i.e. raster data or physical hard-copy maps)
THE TABLET... NOT THE GIRL

= Death to:
• In practice, errors are random and normally distributed about zero (this is good)
• If not, there is bias in your digitization
ONE SOURCE OF BIAS: BLUNDERS

- Snapping can help!
- CAD would be better yet...
- Or Topology Rules!
TODAY’S PLAN

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GIS AND ATTRIBUTE DATA

Geographic (spatial) data, by default, has some type of attribute (non-spatial) data that need be stored such that they are easily accessible for query and analysis purposes.

Associated Data: Attributes (non-spatial)

<table>
<thead>
<tr>
<th>Type</th>
<th>Color</th>
<th>LastFix</th>
<th>FlowRate</th>
<th>Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Hydrant</td>
<td>Red</td>
<td>6/23/03</td>
<td>200gpm</td>
<td>No</td>
</tr>
</tbody>
</table>

Spatial Location:
X: 756035.35
Y: 127844.94
WHAT IS THE KEY STEP YOU HAVE TO TAKE TO ADD ATTRIBUTES?

- Add a new field... (i.e. column in the attribute table)
SOME FUNNY RULES ABOUT ADDING FIELDS

• You cannot *Add Field* in an active edit session
  – Solution: Stop Editing
• You cannot (always) *Add Field* from ArcCatalog if the feature is a layer in the table of contents of an open ArcMap Document
  – Solution: Unload layer or close ArcMap
EDITING IN THE TABLE WINDOW

- In an active edit session...
- What does it typically mean when you try to change a value and Arc won’t let you?
THE ATTRIBUTES WINDOW...

• A powerful tool for query & editing...

- Sort fields alphabetically
- Sort fields by layer order
- Click the layer name to update values for all the selected features in that layer.
- Related table
- Field with highlighting enabled
- Subtype field
- Field used to symbolize the layer
- ArcGIS system field
- Expand all relationships in branch
- Set field appearance options
- The Blocks layer's display expression is "Block ID:" and an ID.
- Attribute values for this feature are shown below.
- Click a related item to edit its values.
- Click a cell to change the value.
- System information about the selected field

http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/About_editing_attributes/001t000000m1000000/
SUMMARIZE...

The Summarize tool creates a new table containing one record for each unique value of the selected field, along with statistics summarizing any of the other fields. To use the Summarize tool:

1. Select a field to summarize:
   - AREA

2. Choose one or more summary statistics to include in the output table:
   - FID
   - First
   - Last
   - PERIMETER
   - GEOLOGY
   - GEOLOGY_ID
   - UNITSYMBOL
   - UNITNAME
   - AGE
   - NOTES

3. Specify the output table:
   - E:\et_al\Projects\UK\Scotland\Feshie\DCM\GIS\DOD\_

   - Summarize on selected records only
**CALCULATE GEOMETRY – SMART ATTRIBUTING**

- What you can calculate depends on feature type
- You choose coordinate system
- You choose Units

![Calculate Geometry Window](image-url)

<table>
<thead>
<tr>
<th>Feature Type</th>
<th>Area</th>
<th>Perimeter</th>
<th>3D Perimeter</th>
<th>Length</th>
<th>X, y, or z-coordinate of centroid</th>
<th>X, y, or z-coordinate of start point</th>
<th>X, y, or z-coordinate of endpoint</th>
<th>X, y, or z-coordinate of midpoint</th>
<th>Min, max of z-coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polygon</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Line</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Annotation</td>
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<td>Point</td>
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<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

*Geometric properties that can be calculated for specific types of features*
FIELD CALCULATOR – SMART ATTRIBUTING

- Powerful form of spatial analysis...
- You can come up with just about anything that combines existing attributes...
YOUR EXERCISE

• Break into groups of 2-4 people
  – Define your overarching question or field monitoring problem
  – What type of information you want to collect (polygons, polylines or points)
  – How you would represent that as attributes and pop-up dialogs
  – What the field types would be (e.g. text, numeric, integer, drop-down, button, radios, images, etc.)
ARCPAD MAKES IT EASY (SORT OF)

• Attribute that data in the field (when collecting raw data) instead of back in the office...

• Build in error checking...
CREATE SHAPEFILE, THEN QUICKFORM

1. Create Shapefile
2. Choose shapefile
3. New Shapefile
4. Type: Point
5. Choose type
6. Type the name of the field
7. Text: Length
8. Import...
9. Create QuickForm
10. Type the name of the shapefile
11. Tap Save
12. Tap OK
13. Add feature
14. Tap Yes
15. Set other properties
16. Type a Caption
17. Select the screen size
18. Alter the default settings
19. Tap OK

Utah State University
WATS 4930
ArcPad STUDIO FOR FANCIER APPS.
ATTRIBUTING DURING DATA COLLECTION

An ArcPad extension with a suite of editing and text tools that integrate with GPS for the collection of **point** data.

(Mapsmith example from MIT Geosciences)
<table>
<thead>
<tr>
<th>Common task or workflow</th>
<th>Where to go for more information</th>
<th>Available geoprocessing tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating a new table</td>
<td>Creating tables</td>
<td>Create Table</td>
</tr>
<tr>
<td></td>
<td>To learn about other types of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>data sources you can use in</td>
<td></td>
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<tr>
<td></td>
<td>tables, see About tabular data</td>
<td></td>
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<tr>
<td></td>
<td>sources.</td>
<td></td>
</tr>
<tr>
<td>Importing, copying,</td>
<td>Importing tables</td>
<td>Table To Geodatabase</td>
</tr>
<tr>
<td>and converting tabular</td>
<td>An overview of adding datasets to</td>
<td>Table To Table</td>
</tr>
<tr>
<td>data sources</td>
<td>the geodatabase</td>
<td>Table To dBASE</td>
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<tr>
<td></td>
<td>To learn about the importing</td>
<td>Copy Rows</td>
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<tr>
<td></td>
<td>process and the geodatabase,</td>
<td></td>
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<td></td>
<td>see How data converts when</td>
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<tr>
<td></td>
<td>importing.</td>
<td></td>
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<tr>
<td>Adding fields</td>
<td>Adding and deleting fields</td>
<td>Add Field</td>
</tr>
<tr>
<td></td>
<td>To learn about fields and their</td>
<td>Delete Field</td>
</tr>
<tr>
<td></td>
<td>data types, see Geodatabase</td>
<td></td>
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<tr>
<td></td>
<td>field data types.</td>
<td></td>
</tr>
<tr>
<td>Displaying tables</td>
<td>Adding and viewing tables in</td>
<td>Make Table View</td>
</tr>
<tr>
<td></td>
<td>ArcMap</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Previewing a table in ArcCatalog</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Setting field properties, aliases,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and table display options</td>
<td></td>
</tr>
<tr>
<td>Creating associations</td>
<td>About joining and relating tables</td>
<td>Add Join</td>
</tr>
<tr>
<td>among tables, such as</td>
<td>Joining tables</td>
<td>Remove Join</td>
</tr>
<tr>
<td>joining, relating, and</td>
<td>Relating tables</td>
<td>Create Relationship Class</td>
</tr>
<tr>
<td>using relationship</td>
<td>Relationships and ArcGIS</td>
<td></td>
</tr>
<tr>
<td>classes</td>
<td>Deciding between relationship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>classes, joins, and relates</td>
<td></td>
</tr>
<tr>
<td>Editing attribute</td>
<td>Editing values in a table</td>
<td></td>
</tr>
<tr>
<td>values</td>
<td>Editing attributes</td>
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<tr>
<td>Calculating the values</td>
<td>Making field calculations</td>
<td>Calculate Field</td>
</tr>
<tr>
<td>in fields</td>
<td>Working with date fields</td>
<td></td>
</tr>
<tr>
<td>Printing tables</td>
<td>Printing a table</td>
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<tr>
<td>Creating a layer from</td>
<td>Add x,y data to ArcMap to display</td>
<td>Make XY Event Layer</td>
</tr>
<tr>
<td>a table with x,y</td>
<td>it</td>
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</tr>
<tr>
<td>coordinate data</td>
<td>An overview of linear referencing</td>
<td>An overview of the Linear</td>
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<tr>
<td>Using linear referencing</td>
<td></td>
<td>Referencing toolbox</td>
</tr>
<tr>
<td>Geocoding a table of</td>
<td>An overview of geocoding</td>
<td>An overview of the Geocoding</td>
</tr>
<tr>
<td>addresses</td>
<td></td>
<td>toolbox</td>
</tr>
</tbody>
</table>
• Transparently document design intent
• Articulate explicit, testable design hypotheses (THE EXPERIMENT)
• Combines design, installation & monitoring into one App
GAFRA - GIS PRO

- $299 ... It isn’t perfect... but
STREAM RESTORATION DESIGN APP...
WHEN IT DOES NOT FIT IN THE FORM...

• A geotagged video or voice note captures the observations...
• Don’t let technology stifle the power of observation
• Designers record video & optionally installation crew records video
TYPICAL YouTube CAT DESIGN VIDEO

• Not going to win any
THIS IS NOT JUST ACADEMIC...

- Columbia Habitat Monitoring Program

- 12 Sub-Basins (600 Sites in Pilot Phase)
- 20+ Sub-Basins (>1200 sites) post 2014
- Automating methods
TODAY’S PLAN

I. Editing... What is it?
II. Some Editing Workflows
III. Attributes & Attributing
IV. Metadata
V. Some Comments...
WHAT IS METADATA?

What is metadata?

Most items in ArcGIS have a description that relates what the item is. This description is technically referred to as the item's metadata. There are lots of things you can say about GIS resources. Many communities and organizations have tried to standardize what those things are to avoid miscommunication and wasted time with GIS resources that aren't quite what you needed. Some people must create metadata following a standard for their GIS resources, while others do not.

If you don't need to create complete metadata for an item following a metadata standard, use the default settings in ArcGIS Desktop. With the default Item Description metadata style, you can view and edit a concise description for an item that can be efficiently and effectively searched in ArcGIS and published with the item to ArcGIS online.

- The what
- The how
- The who
- The where
- i.e. CONTEXT
WHAT? THERE’S METADATA?

• Get to it from Table of Contents and our favorite right-click...
• Or from ArcCatalog... and a right-click
• How many of you have ever filled these things out?
METADATA FOR WHAT?

• Can be for:
  – A folder
  – A file
  – A geodatabase
  – A map document
How to I cite this data?

Summary
To provide basic geologic data at 1:100,000 in digital format for government, academic, and public users.

Description
This dataset represents the geology of the Logan 30' x 60' quadrangle. The source map was: Geologic map of the Logan 30' x 60' quadrangle, Cache and Rich Counties, Utah and Lincoln and Uinta Counties, Wyoming by J. H. Dover, U.S. Geological Survey Miscellaneous Investigations Series Map I-2210 (1995).

Credits
Project Manager: Jon K. King, UGS; GIS Data Preparation: Basia Matyjasik, UGS; Review: Jon K. King, Grant C. Willis, J. Buck Ehler, Robert Ressetar, UGS; Funding: Utah Geological Survey and U.S. Geological Survey under National Cooperative Geologic Mapping Program (STATEMAP agreement no. 05HQAG0084)

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MAKE IT SHOW MORE...

Steps:

1. Open the **Options** dialog box for your ArcGIS Desktop application.
   - In ArcMap, click **Customize > ArcMap Options**.
   - In ArcCatalog, click **Customize > ArcCatalog Options**.
   - In ArcGlobe, click **Customize > ArcGlobe Options**.
   - In ArcScene, click **Customize > ArcScene Options**.

   The **Options** dialog box appears.

2. Click the **Metadata** tab.

3. Click the drop-down arrow and click the style of metadata you want to create.

   ![Metadata Style screenshot](image)

4. Click **OK**.

---

[Image of ArcGIS Desktop menu with 'ArcMap Options' highlighted]
### RESOURCE IDENTIFICATION... GEOLOGIC UNITS

**ArcGIS Metadata**

**Resource Identification**

- **Citation**
  - **Title**: geounits
  - **Presentation Format**: digital map

**Tags for Searching**
- Geology, Contact, Fault, Marker Bed, Scarp, Shoreline, Water Boundary

**Keywords**
- 002

**Thesaurus**

**Abstract (Description)**
This dataset represents the geology of the Logan 30' x 60' quadrangle. The source map was: Geologic map of the Logan 30' x 60' quadrangle, Cache and Rich Counties, Utah and Lincoln and Uinta Counties, Wyoming by J. H. Dover, U.S. Geological Survey Miscellaneous Investigations Series Map I-1216 (1995).

**Purpose (Summary)**
To provide basic geologic data at 1:100,000 in digital format for government, academic, and public users.

**Dataset Languages**
- English (UNITED STATES)

**Resource Constraints**

**Constraints**
- **Limitations of Use**

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- Except for changes explained in Appendix.pdf file, the digital product is the same as the published map. For use at 1:100,000 scale only. The Utah Geological Survey (UGS) does not guarantee accuracy or completeness of data.

- The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

- Persons or agencies using these data specifically agree not to misrepresent the data, nor to imply that changes they made were approved by the Utah Geological Survey, and should indicate the data source and any modifications made on plots, digital copies, derivative products, and in metadata.

**Spatial Representation Type**
- vector

**Processing Environment**
- Microsoft Windows Server 2008 R2 Version 6.1 (Build 7600) ; ESRI ArcGIS 10.0.0.2414

**Bounding Rectangle**

- **Extent Type**: Full extent in the data's coordinate reference
- **West Longitude**: 416534.375
- **East Longitude**: 508900.000002
- **North Latitude**: 46500046
- **South Latitude**: 4594051.5
- **Extent contains the resource**: Yes

**Bounding Rectangle**

- **Extent Type**: Full extent in decimal degrees
- **West Longitude**: -112.00779
DISTRIBUTION INFORMATION... GEOLOGIC UNITS
METADATA & ITEM PROPERTIES... GEOLOGIC UNITS

ArcGIS Metadata ▼

Resource Identification ▼
Spatial Representation ▼
Reference System ▼
Distribution Information ▼
Metadata Details ▼

ESRI Metadata and Item Properties ▼

METADATA PROPERTIES
ArcGIS  ESRI-ISO
CREATED IN ArcGIS  2006-12-08T15:10:51
LAST MODIFIED IN ArcGIS  2011-02-01T06:49:05

AUTOMATIC UPDATES
LAST UPDATE  2011-02-01T06:49:05
HAVE BEEN PERFORMED  Yes

ESRI-ISO METADATA IDENTIFIER  {77ef527a-3fad-45a3-80aa-d9aed840be9c}

ITEM PROPERTIES
NAME  geounits
Size  6.013
CONTENT TYPE  Downloadable Data

ESRI Spatial Information ▼
ESRI Feature Class ▼
SPATIAL INFORMATION... GEOLOGIC UNITS
FEATURE CLASS... GEOLOGIC UNITS
HOW DO I EDIT/CREATE META DATA?
MORE THAN YOU PROBABLY CARE TO FILL OUT...
EDITING METADATA IS EASY... BUT

• Populating such that your metadata is effective can take some effort and time...
HOW FAR TO GO (POPULATING METADATA)?

• Who is the audience you are sharing with?
  – Is it yourself (reminder)
  – Is it a colleague?
  – Is it the general public?

• What is the purpose of the data & therefore the metadata?

• When sharing a paper map or PDF what is value of metadata?

• When sharing GIS data what is value of metadata?

• How to cite? – Metadata gives an answer...
6 C’S & METADATA

1. **Colorful** - (but not cluttered) *An effective use of color to distinguish features and emphasize key aspects of your map.*
2. **Creative** - (but not confusing) *There are lots of creative ways to display your geographic data and analyses.*
3. **Correct** - *All analyses, calculations and labels are correct.*
4. **Context** - (location, coordinates, projections, scale, orientation, setting) *All maps should have enough context for the user to discern where it is, what it’s about and what the scale is within the context that its presented (e.g. stand-alone map vs. within a report).*
5. **Convincing** - (fit for purpose) *All maps have a purpose, and your map should be effective at conveying the message it is intended to.*
6. **Consistent** - *There should be logical, graphical and typographic consistency both within a single map and amongst multiple maps in the same assignment or project.*

- 4 of ‘em anyway...
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WHAT WILL YOU USE THE TOOL DO?

• What is GIS?
  – Just a tool?
  – A powerful medium for making persuasive arguments!

• Make a persuasive argument
  – For the right reasons
  – For the wrong reasons

What we don’t teach you in school...
WHAT WERE THE STORIES THAT STUCK WITH YOU?

**Laser Survey of a Maya City**

A small aircraft flying back and forth above the ancient Maya city of Caracol, in Belize, used a laser to penetrate the dense forest canopy. Viewed in three dimensions, the data revealed new ruins, causeways, and agricultural terraces of the sprawling city. A detail of Caracol's city center is shown here.

**CAUSEWAYS**
Numerous constructed stone roads lead from the city center to more distant settlements.

**TERRACES**
Agricultural terraces fed a peak population of more than 115,000.

**SATELLITE IMAGERY**
From the IKONOS satellite, it is possible to penetrate heavy foliage.

**LISSAR**
Using a laser instrument called lidar, for light detection and ranging, to scan the upper canopy shows little detail (left). But some of the laser pulses penetrate the foliage and reflect off of the ground, revealing ruins and extensive terracing (right).

**PUCHTUK**
Once surrounded by hundreds of open terraces, the hilltop settlement of Puchtuk is now obscured by the forest.

**PEERING THROUGH THE FOREST**
A lidar scan along a straight track (orange line) finds slight reflections of the ground and different layers of foliage, revealing the cross-section of a pyramid-shaped structure. In this image, the measured points are colored according to height, and are accurate to about six inches.
**THIS WEEK’S LAB**

Lab 3: Reproducing Maps – Geologic Map

- Teach you how to manipulate display properties and symbology to reproduce a map in as close as possible a fashion to the original.
- Teach you how to extract summary statistics and data from existing data.
NEXT WEEK’S LAB

Lab 4: Digitizing, Editing & Sharing Data

- Edit existing Vector Data
- Create new vector data layers and edit them (i.e. digitizing)
- Edit and create tabular data
- Share vector and tabular data with other GIS users