Watershed Sciences 4930 & 6920
ADVANCED GIS

Week Three

EDITING & ATTRIBUTING DATA & METADATA

Joe Wheaton
HOUSEKEEPING

- Are you guys getting the help you need?
  - You guys are worryingly low maintenance..
- 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

I. Editing... What is it?

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IV. Metadata

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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
CREATING FEATURES WITH TEMPLATES

- Templates impose symbology...
  - You choose feature template
  - Then choose construction tool

- Open a dialog box to create and manage feature templates.
- Group or filter feature templates.
- Layer name
- Feature template
- Click a feature template to start creating that type of feature, such as a local road.
- Type text in the box and click Search to find feature templates.
- Clear the search.
- The list of feature templates for the currently visible layers that you are editing.
- Double-click a feature template to access its properties.
- Right-click to open a menu of commands for managing feature templates.
- The construction tools listed are determined by the type of feature template selected at the top of the window.
- The construction tool that will be used to create features.
- Use the feature template properties to set which tool is activated by default.

http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/What_is_editing/001t00000001000000
WHEN EDITING... JUST SKETCHIN'

- 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
SOME POLYGON TRICKS...

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

I. Editing... What is it?
II. Some Editing Workflows

**III. Attributes & Attributing**

IV. Metadata
V. Some Comments...
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.

<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...

![Diagram of the Attributes window with labels and explanations for various features.]
SUMMARIZE...

<table>
<thead>
<tr>
<th>AREA</th>
<th>PERIMETER</th>
<th>GEOLOGY</th>
<th>GEOLOGY_ID</th>
<th>UNITSYMBOL</th>
<th>UNITNAME</th>
<th>AGE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

1. Select a field to summarize:
   - AREA

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

3. Specify output table:
   - E:\et_al\Projects\UK\Scotland\Feshie\DCM\GIS\DOD\...
• What you can calculate depends on feature type
• You choose coordinate system
• You choose Units
FIELD CALCULATOR – SMART ATTRIBUTING

- Powerful form of spatial analysis...
- You can come up with just about anything that combines existing attributes...
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. Choose shapefile
2. Choose field type
3. Type the name of the field
4. Type the shapefile name
5. Tap OK
6. Tap Yes
7. Type a caption
8. Select the screen size
9. Tap OK
10. Add feature
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>Importing, copying, and converting tabular data sources</td>
<td>Importing tables An overview of adding datasets to the geodatabase To learn about the importing process and the geodatabase, see How data converts when importing</td>
<td>Table To Geodatabase Table To Table Table To dBASE Copy Rows</td>
</tr>
<tr>
<td>Adding fields</td>
<td>Adding and deleting fields</td>
<td>Add Field Delete Field</td>
</tr>
<tr>
<td>Displaying tables</td>
<td>Adding and viewing tables in ArcMap Previewing a table in ArcCatalog Setting field properties, aliases, and table display options</td>
<td>Make Table View</td>
</tr>
<tr>
<td>Creating associations among tables, such as joining, relating, and using relationship classes</td>
<td>About joining and relating tables Joining tables Relating tables Relationships and ArcGIS Deciding between relationship classes, joins, and relates</td>
<td>Add Join Remove Join Create Relationship Class</td>
</tr>
<tr>
<td>Editing attribute values</td>
<td>Editing values in a table Editing attributes</td>
<td></td>
</tr>
<tr>
<td>Calculating the values in fields</td>
<td>Making field calculations Working with date fields</td>
<td>Calculate Field</td>
</tr>
<tr>
<td>Printing tables</td>
<td>Printing a table</td>
<td></td>
</tr>
<tr>
<td>Creating a layer from a table with x,y coordinate data</td>
<td>Add x,y data to ArcMap to display it</td>
<td>Make XY Event Layer</td>
</tr>
<tr>
<td>Using linear referencing</td>
<td>An overview of linear referencing</td>
<td>An overview of the Linear Referencing toolbox</td>
</tr>
<tr>
<td>Geocoding a table of addresses</td>
<td>An overview of geocoding</td>
<td>An overview of the Geocoding toolbox</td>
</tr>
</tbody>
</table>
CHEAP DESIGN & MONITORING APPs...

• Transparently document design intent
• Articulate explicit, testable design hypotheses (THE EXPERIMENT)
• Combines design, installation & monitoring into one App

Nick Weber of Eco Logical Research, Inc.
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
FOR MORE INFORMATION...

- Check out EcoTech Solutions (http://www.ecotsolutions.com/)

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

Visit: http://champmonitoring.org
TODAY’S PLAN

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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
METADATA – OF THE MAP DOCUMENT

• 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
DID YOU KNOW... GEOLOGIC UNITS

How to I cite this data?

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

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).

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.

4. Click OK.
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 THEMAURUS

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 Unita Counties, Wyoming by J. H. Dover, U.S. Geological Survey Miscellaneous Investigations Series Map I-2210 (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
   The Miscellaneous Publication series provides non-UGS authors with high-quality format for documents concerning Utah geology. Although review comments have been incorporated, this publication does not necessarily conform to UGS technical, editorial, or policy standards.

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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

   * EXTENT TYPE Full extent in the data's coordinate reference
   * WEST LONGITUDE 416534.375
   * EAST LONGITUDE 500000.000002
   * NORTH LATITUDE 46500046
   * SOUTH LATITUDE 4594051.5
   * EXTENT CONTAINS THE RESOURCE Yes

   * EXTENT TYPE Full extent in decimal degrees
   * WEST LONGITUDE -112.00779
SPATIAL REPRESENTATION... GEOLOGIC UNITS
DISTRIBUTION INFORMATION... GEOLOGIC UNITS

Data Source Item Description - geologic units

Spatial Representation ▼
Reference System ▼
Distribution Information ►

DISTRIBUTOR
Available format
* FORMAT NAME Shapefile

TRANSFER OPTIONS
* TRANSFER SIZE 7.357

ONLINE SOURCE
* ONLINE LOCATION (URL) file://\NRUGSBMAYASIK\DS\webgis\Logan3060\geounits.shp
* CONNECTION PROTOCOL Local Area Network
* DESCRIPTION Downloadable Data

DISTRIBUTION FORMAT
* FORMAT NAME Shapefile

TRANSFER OPTIONS
* TRANSFER SIZE 6.013

Hide ▲

Metadata Details ▼
ESRI Metadata and Item Properties ▼
ESRI Spatial Information ▼
ESRI Feature Class ▼
ESRI Fields and Subtypes ▼

FGDC Metadata ►
SPATIAL INFORMATION... GEOLOGIC UNITS

Metadata Details ▼

ESRI Metadata and Item Properties ▼

ESRI Spatial Information ▶

EXTENT IN THE ITEM'S COORDINATE REFERENCE
BOUNDING RECTANGLE
* WEST LONGITUDE  416534.375000
* EAST LONGITUDE  500000.000002
* NORTH LATITUDE  4650046.000000
* SOUTH LATITUDE  4594051.500000
* EXTENT CONTAINS THE RESOURCE  Yes

COORDINATE REFERENCE
  TYPE Projected
  PROJECTION NAD_1927_UTM_Zone_12N
  GEOGRAPHIC COORDINATE REFERENCE GCS_North_American_1927
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Hide ▲

ESRI Feature Class ▼

ESRI Fields and Subtypes ▼
FEATURE CLASS... GEOLOGIC UNITS
FIELDS & SUBTYPES... GEOLOGIC UNITS

ESRI Spatial Information

ESRI Feature Class

ESRI Fields and Subtypes

geounits Feature Class

* ROW COUNT 5341

FIELD FID
* ALIAS FID
* DATA TYPE OID
* WIDTH 4
* FIELD DESCRIPTION Internal feature number.
  * DESCRIPTION SOURCE ESRI
  * DESCRIPTION OF VALUES Sequential unique whole numbers that are automatically generated.

FIELD Shape
* ALIAS Shape
* DATA TYPE Geometry
* FIELD DESCRIPTION Feature geometry.
  * DESCRIPTION SOURCE ESRI
  * DESCRIPTION OF VALUES Coordinates defining the features.

FIELD AREA
* ALIAS AREA
* DATA TYPE Double
* WIDTH 19
* PRECISION 18
* SCALE 3
* OUTPUT WIDTH 5
* FIELD DESCRIPTION Internal node number for the beginning of an arc (from-node).
  * DESCRIPTION SOURCE ESRI
  * DESCRIPTION OF VALUES Whole numbers that are automatically generated.
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...
TODAY’S PLAN

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II. Some Editing Workflows
III. Attributes & Attributing
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V. Some Comments...
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 STICKED 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 150,000.

SATELLITE IMAGERY
from the IKONOS satellite is unable to penetrate heavy foliage.

 Lidar
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).

PEERING THROUGH THE FOREST
A lidar scan along a straight track from an airplane. Inset shows reflections off of the ground and different layers of foliage, revealing the cross-section of a pyramid-shaped structure. This image the measured points are colored according to height, and are accurate to about six inches.

Source: Allan F. Chase, Diane Z. Chase and John F. Bullock, University of Central Florida