



United States Department of Agriculture

Cartographic Tools

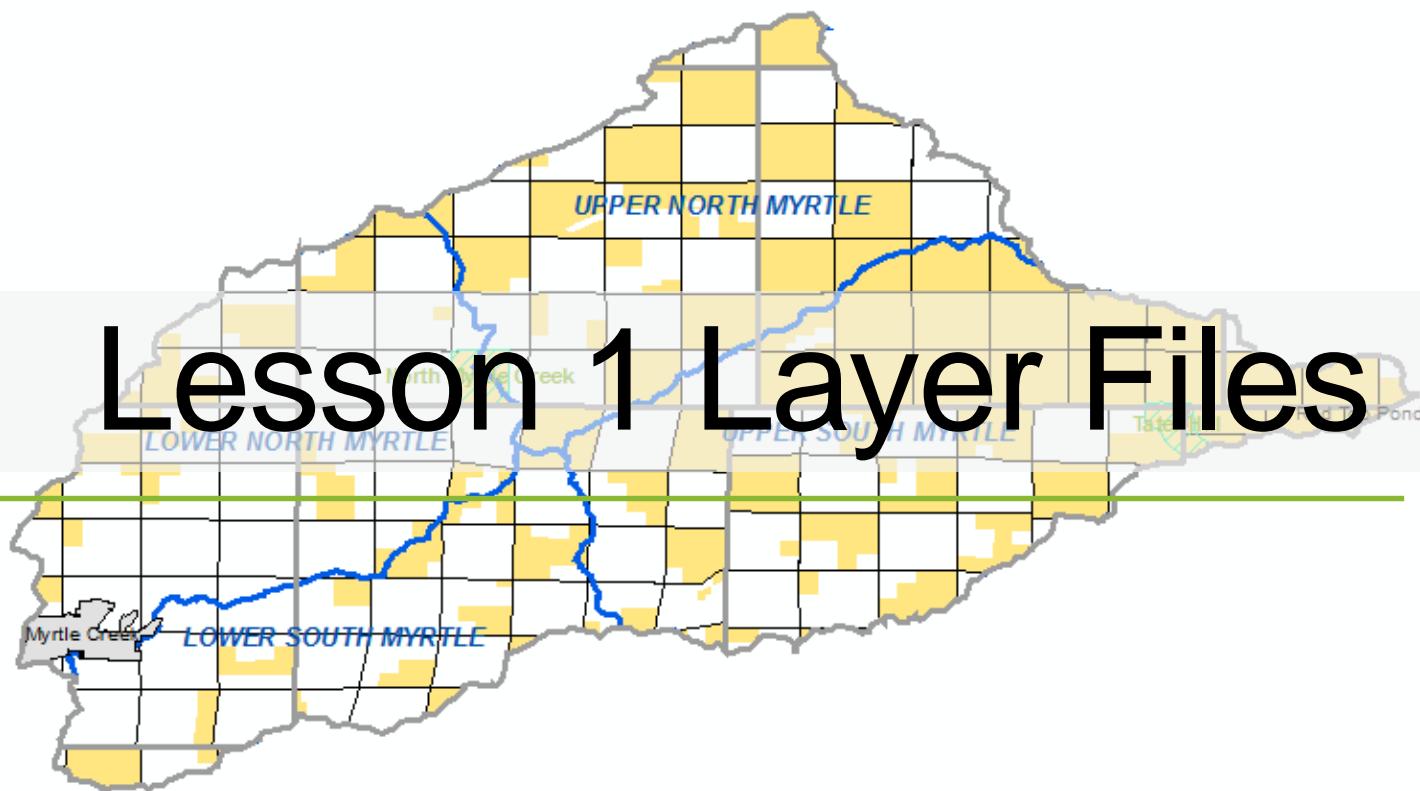


Forest Service



United States Department of Agriculture

Lesson 1 Layer Files



Forest Service

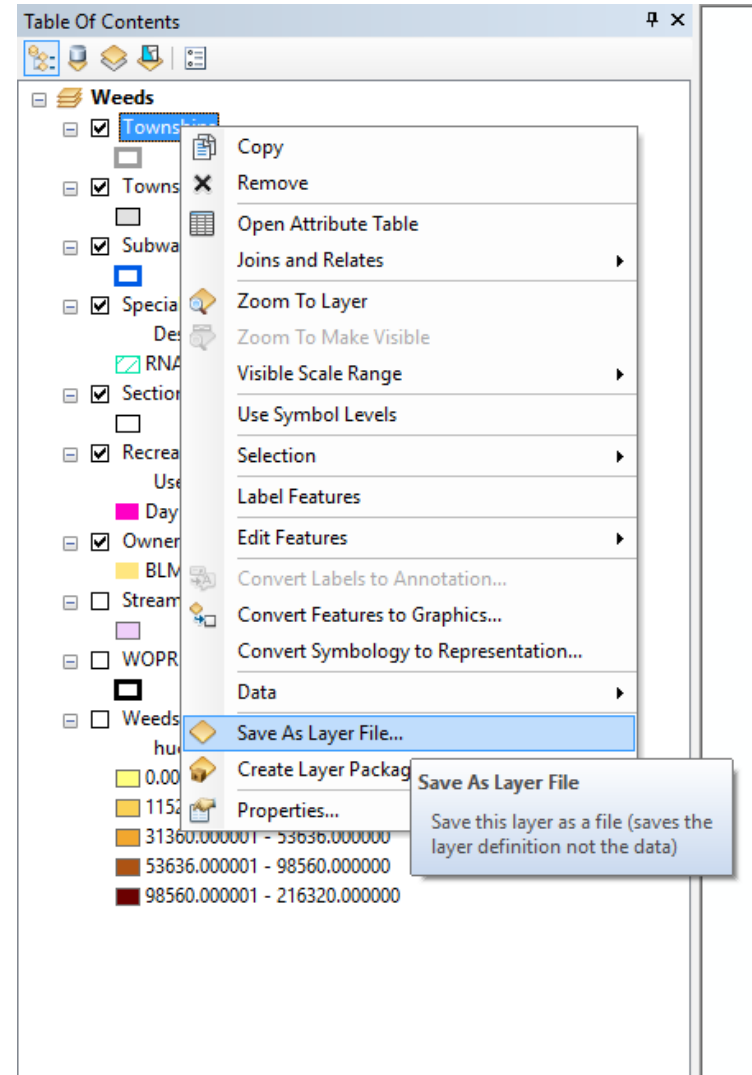
Course Outline

- Layer Files
 - Explore layer files
- Classification
 - Symbolize using unique values
 - Classifying quantitative data
 - Normalization
- Annotation & Labeling
 - Labeling tools
 - Maplex Label Engine
- Create a Final Map (optional)
 - Cartographic guidelines



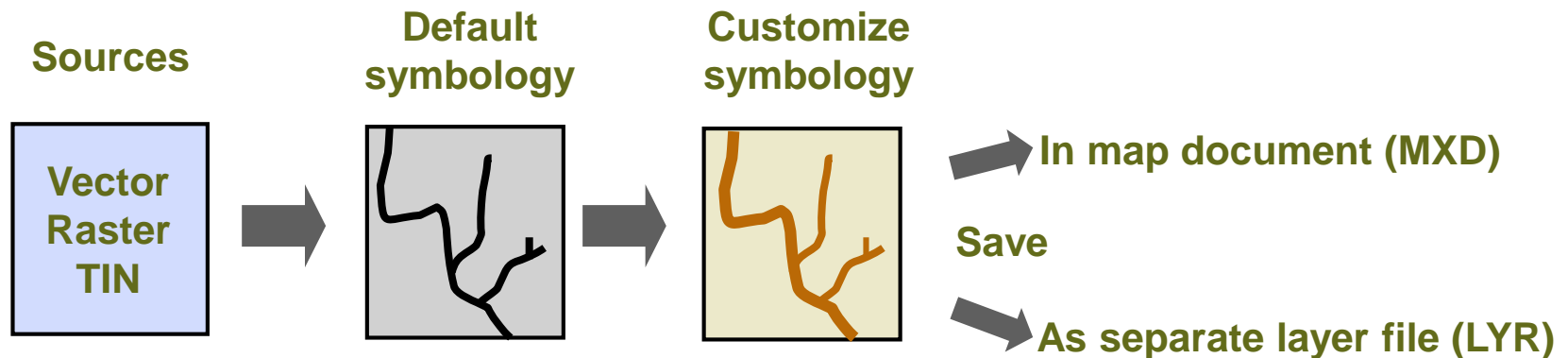
Layer File

- Stores a layer's properties
 - Name, symbology, labels, etc.
- Add to other map documents
 - Saves time in setting layer properties
- References source dataset
 - Stores absolute path name
- To create Layer File, right-click a layer | Save As Layer File
 - File extension = LYR



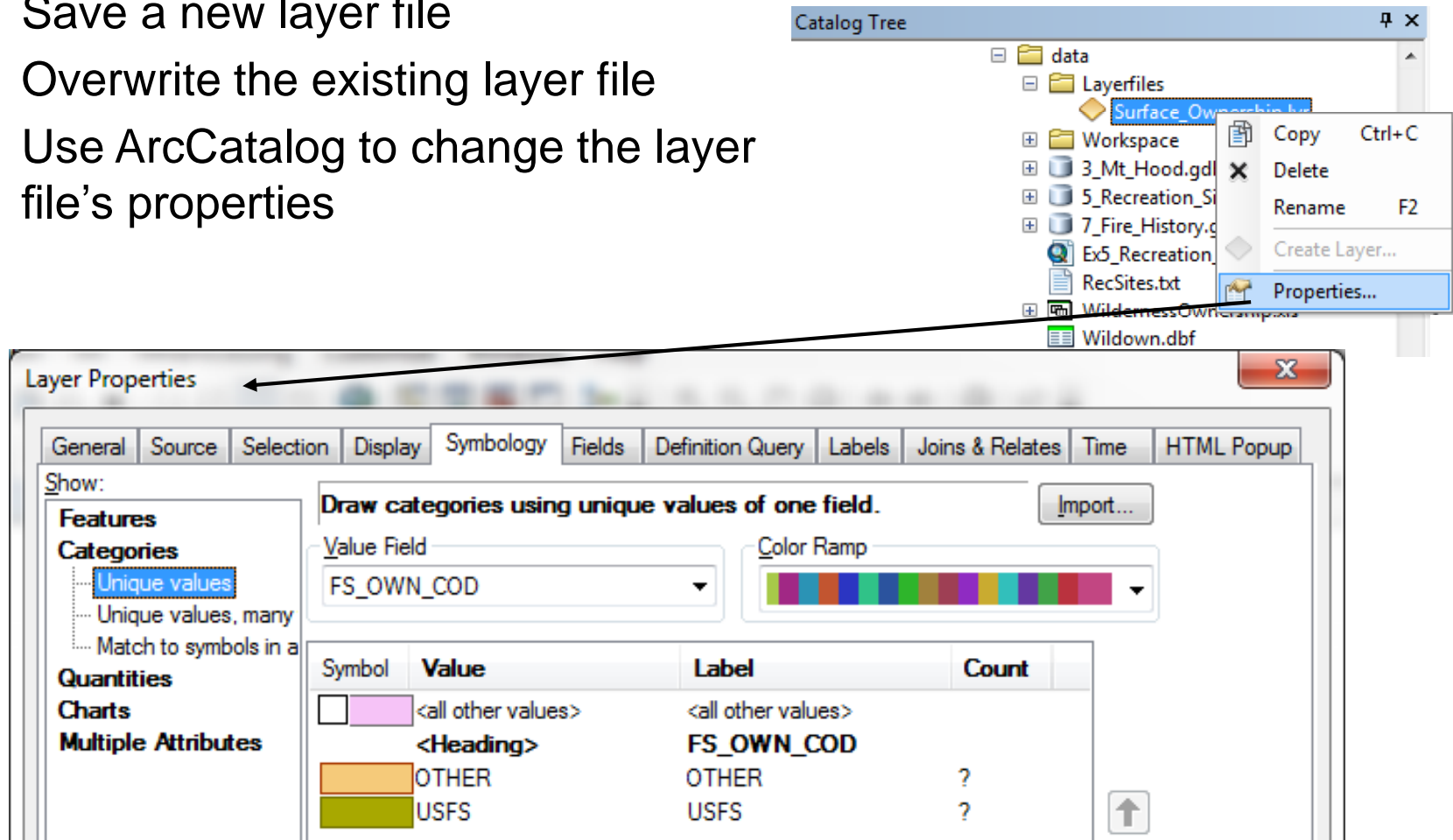
Working with layer files

- Save layer properties for use in other map document
- Layer files
 - .lyr extension
 - Save the layer's properties without saving an entire map document
 - Add data into another map document TOC
 - Import symbology into Layer Properties
 - Preview in ArcCatalog



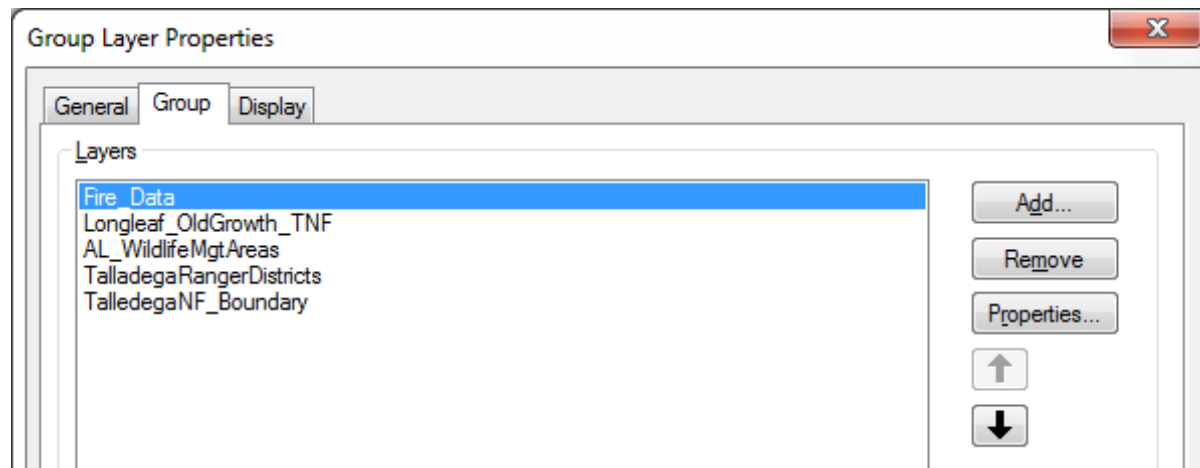
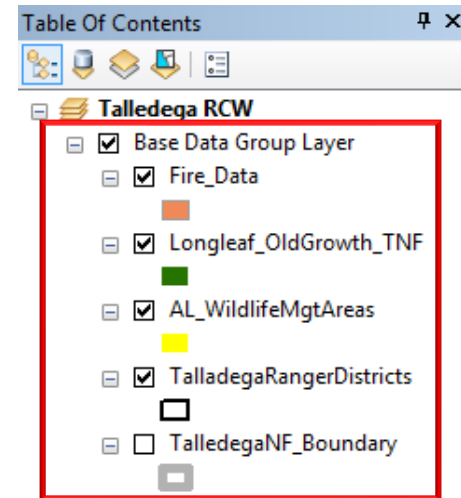
Modify a layer file

- To modify a layer file's properties, you can...
 - Save a new layer file
 - Overwrite the existing layer file
 - Use ArcCatalog to change the layer file's properties

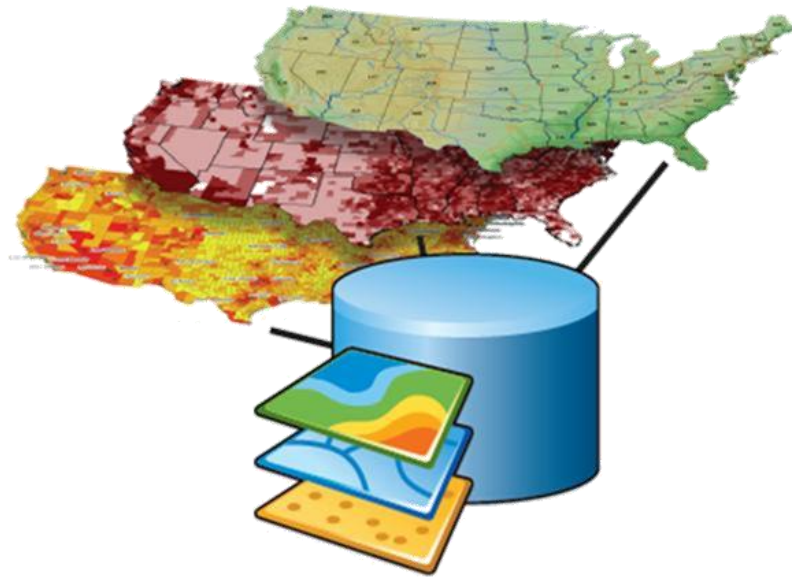


Working with a group layer file

- Manage multiple layers as a single layer
 - Organizes related layers
 - Turn layers on/off simultaneously
- Group Layer Properties
 - Change group name
 - Add/remove layers
 - Change drawing order

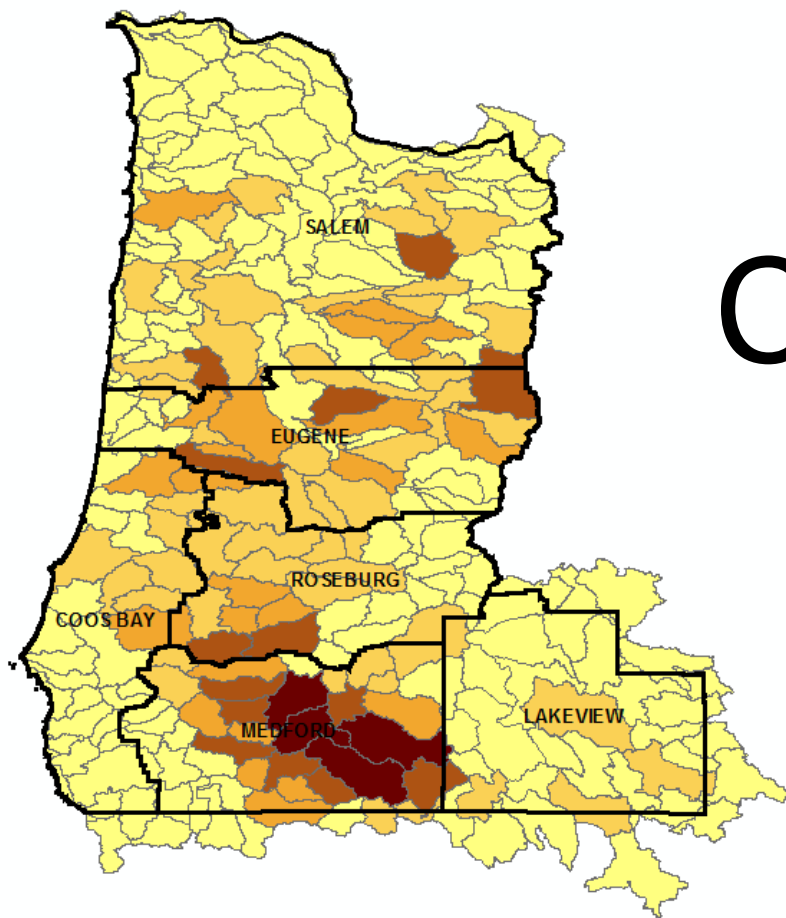


Demonstration





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Classifications



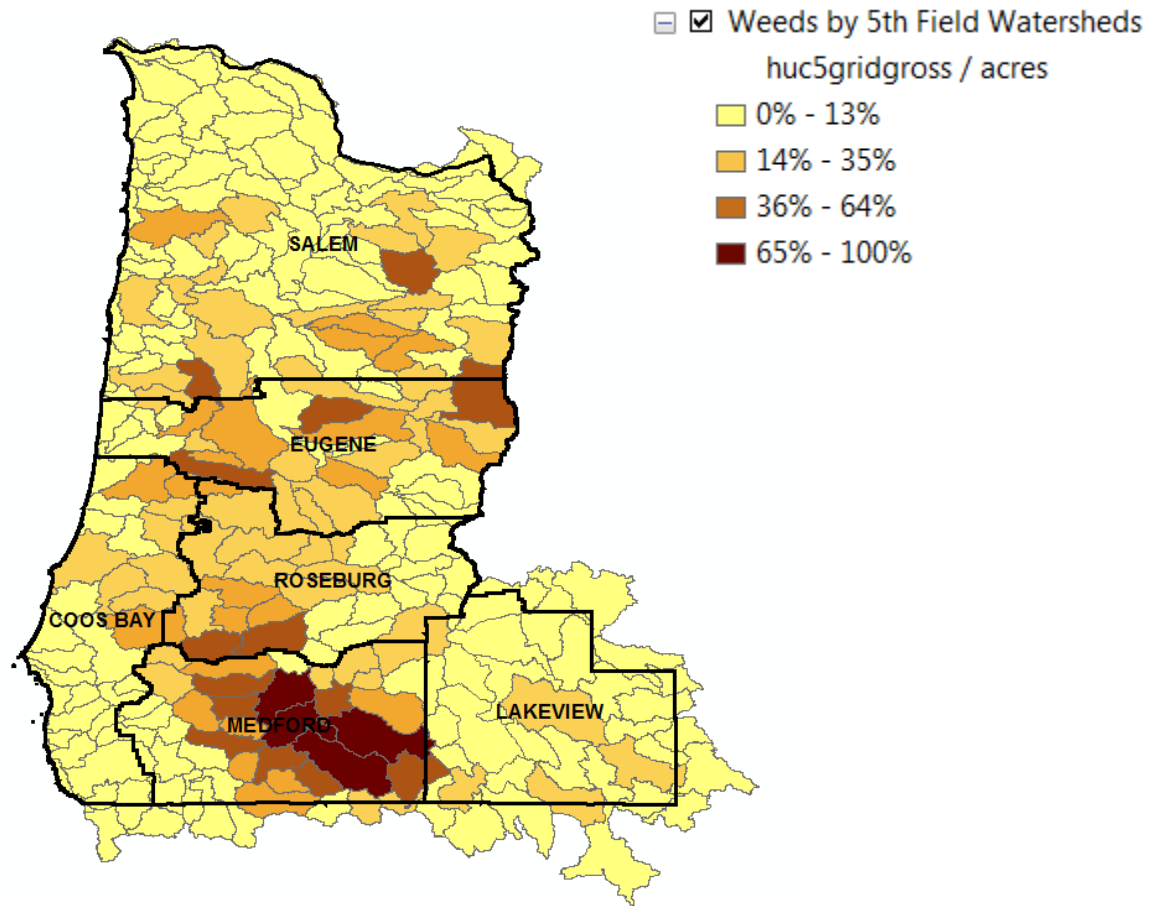
Forest Service

Lesson Overview

- Standard classification

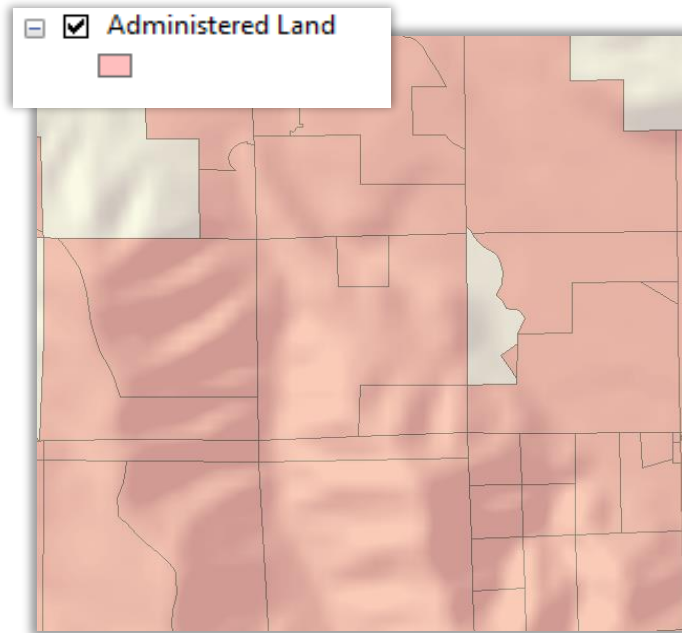
- Natural Breaks
- Equal Interval
- Quantile
- Standard Deviation
- Manual

- Normalization

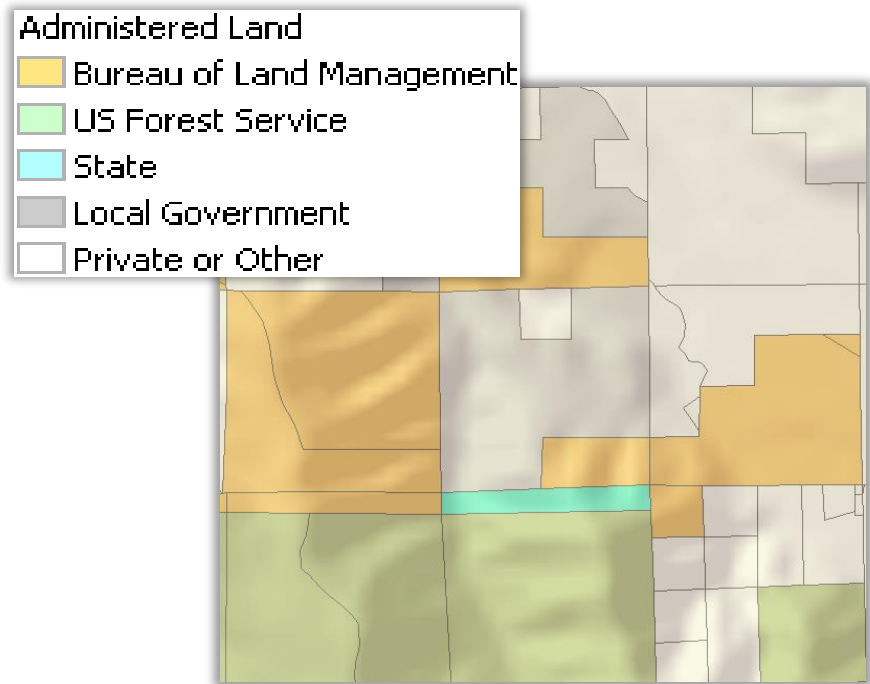


Symbolizing data

- **Single symbol:**
 - default symbology; one symbol and color
- **Unique values:**
 - unique symbols and colors based on unique attribute values



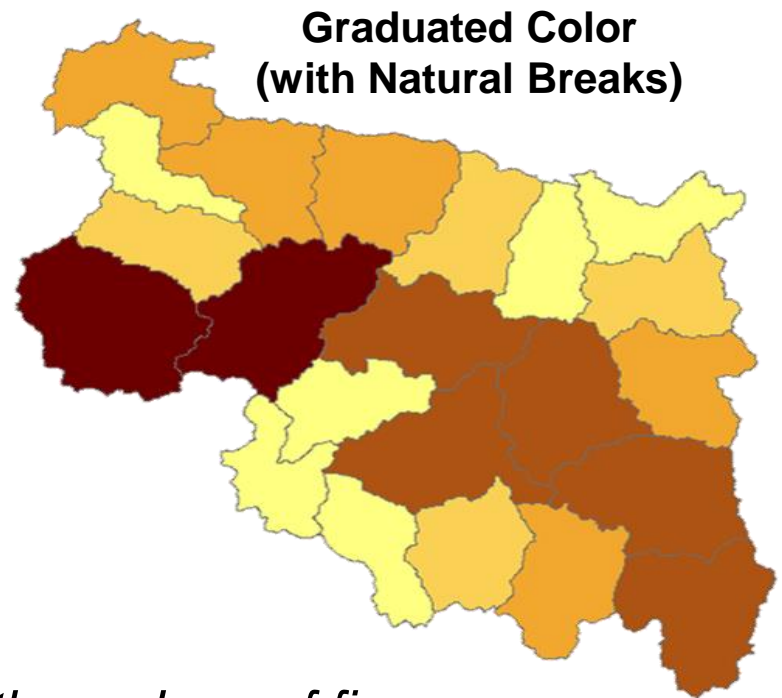
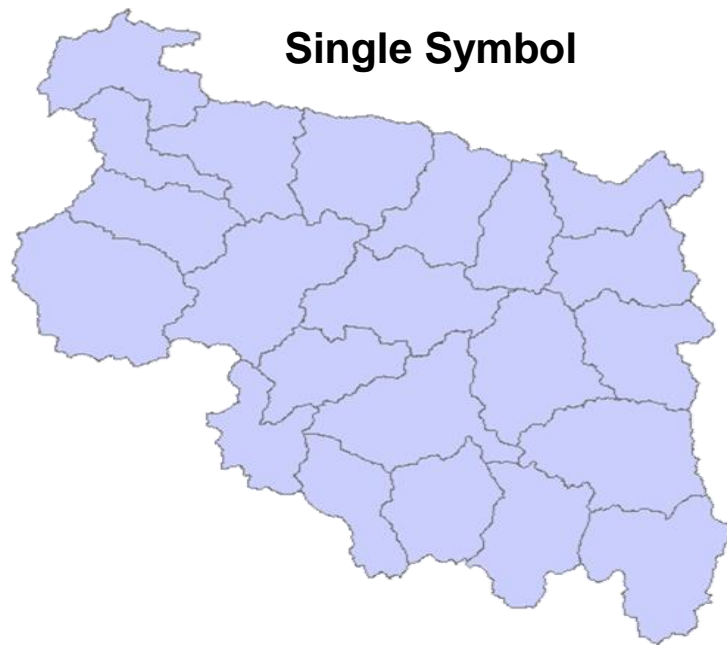
Single Symbol



Unique Values

Classifying quantitative data

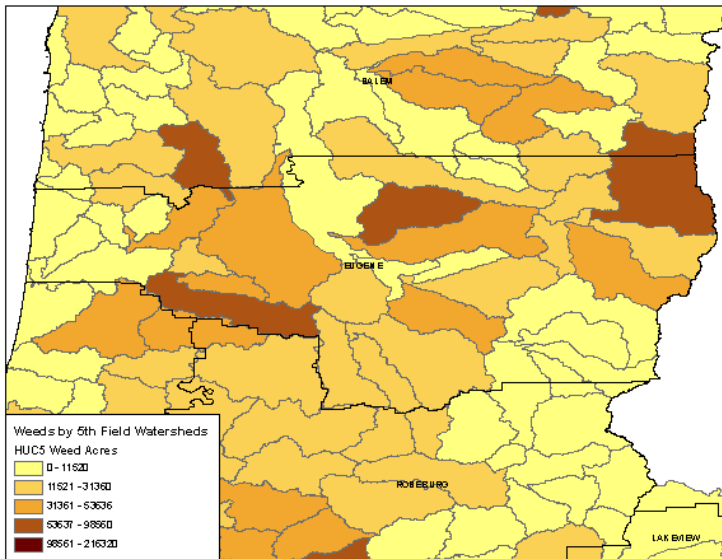
- **Class:** range of numbers organized into groups
- **Graduated color:** range of colors to visualize progression of numeric values



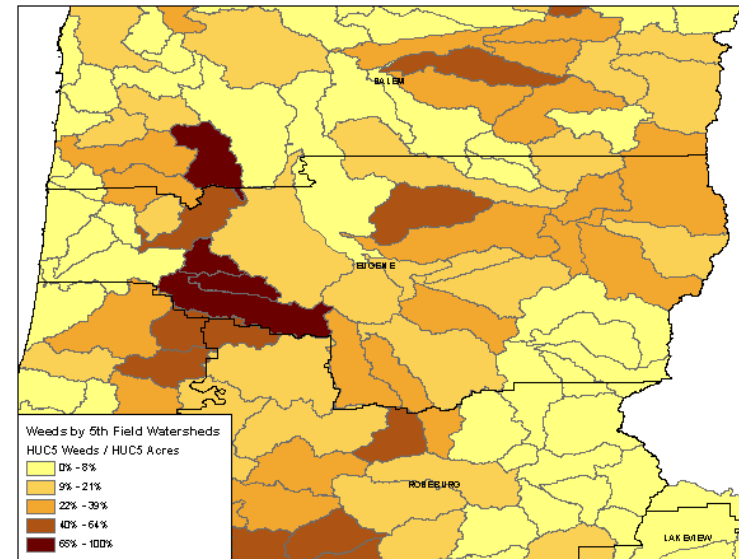
Example: Watersheds with numbers of fires

Classification using Normalization

- Normalizing divides one field's value by another to form ratios
 - Convert ratios to percentages to improve map readability



Non-normalized
weed acreage per watershed



Normalized
weed acreage per watershed acreage * 100%

Classification histogram

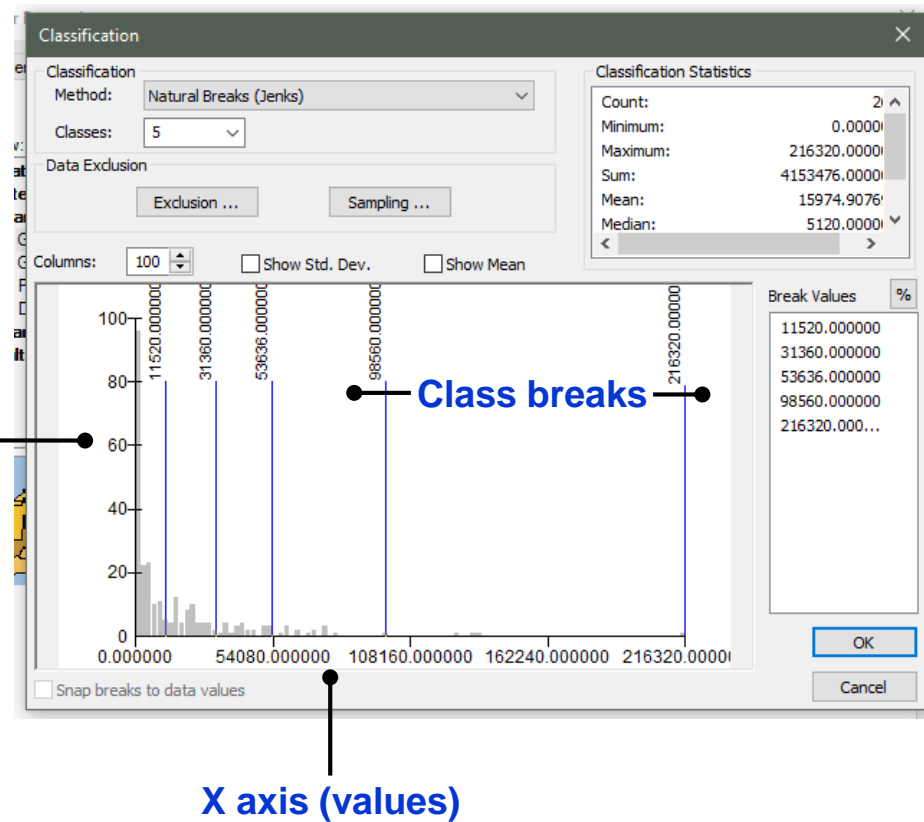
- XY graph showing distribution of data

X axis = data values

Y axis = frequency

Y axis
(frequency)

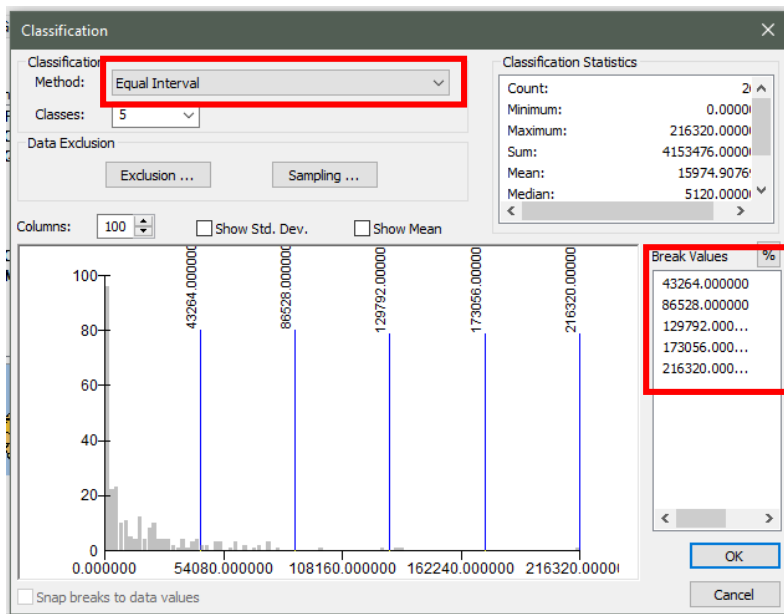
Class breaks based on classification, method, which the user can adjust.



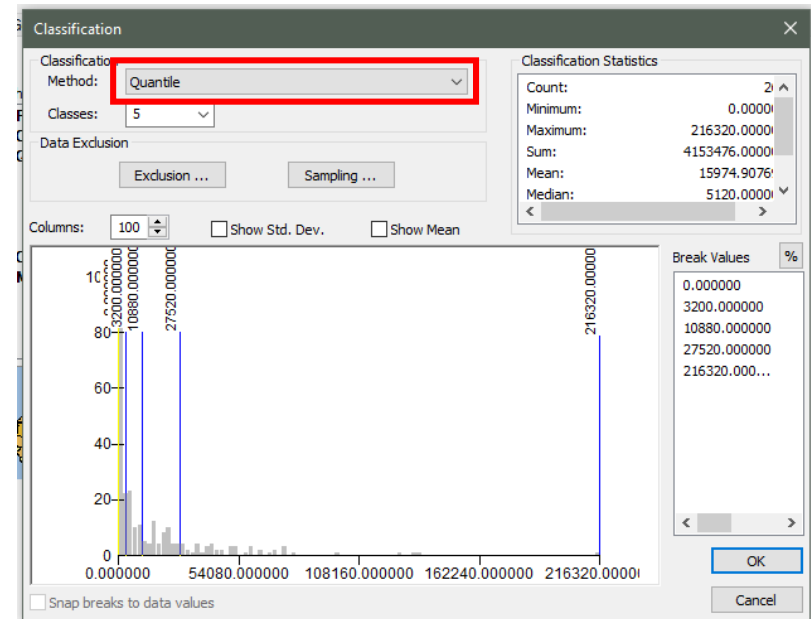
Interpreting classified data

- **Equal Interval: class breaks are equally spaced**
 - Left: each class increases by ~4,000 burned acres
- **Quantile: equal number of features in each class**
 - Right: each class represents four watersheds

Equal Interval



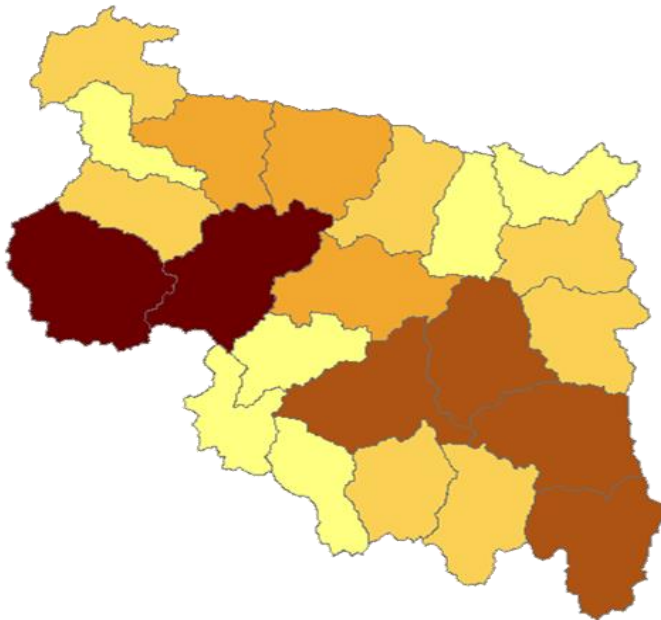
Quantile



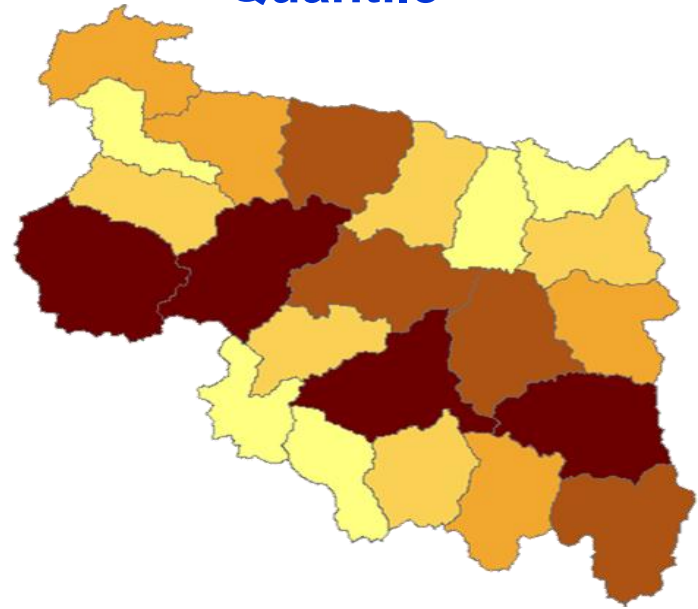
Interpreting classified data

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Equal Interval

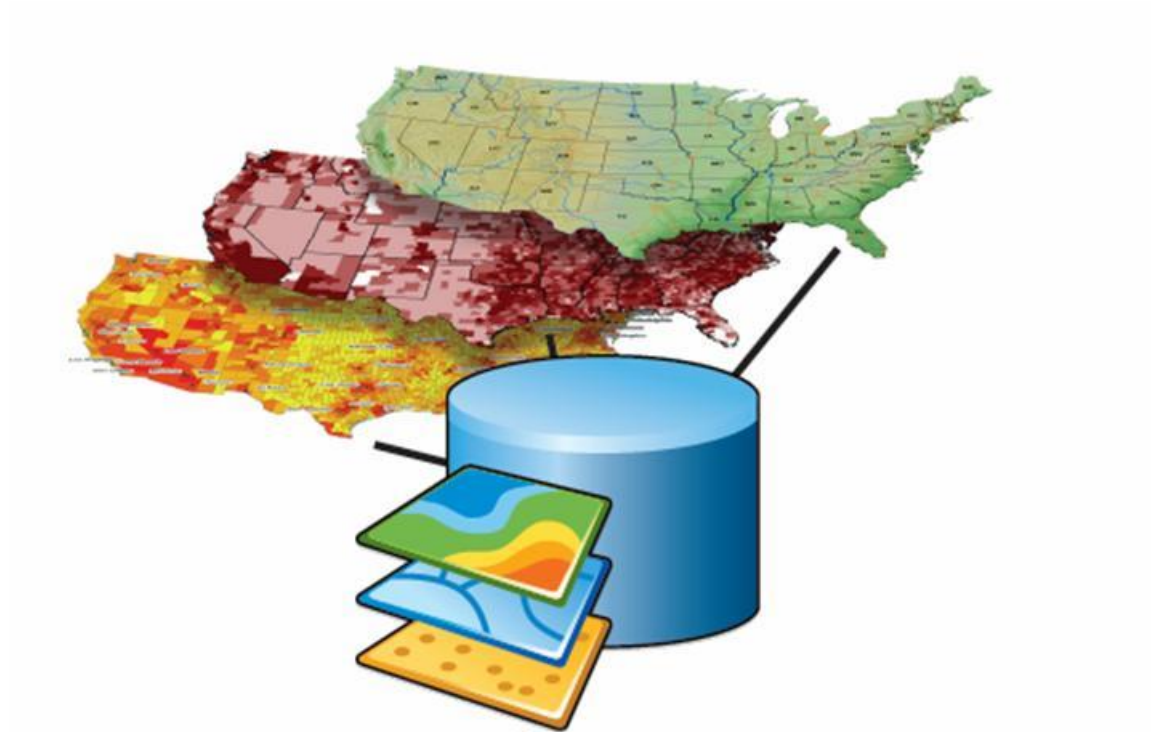


Quantile



Which classification best represents the data?

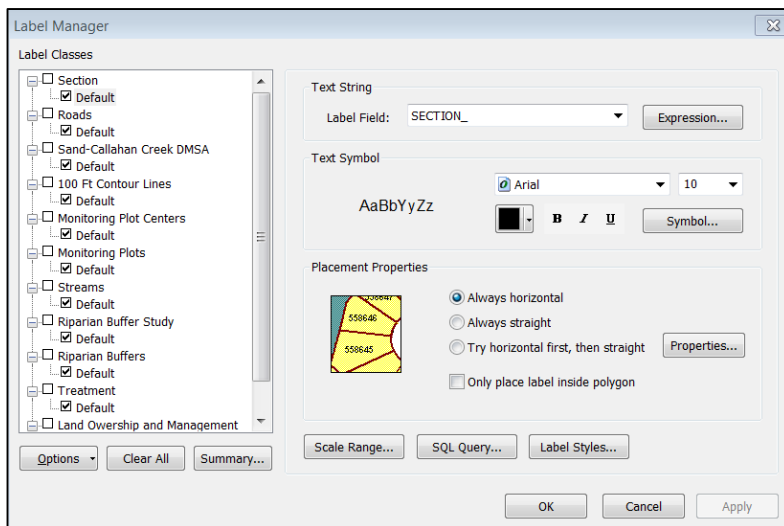
Demonstration





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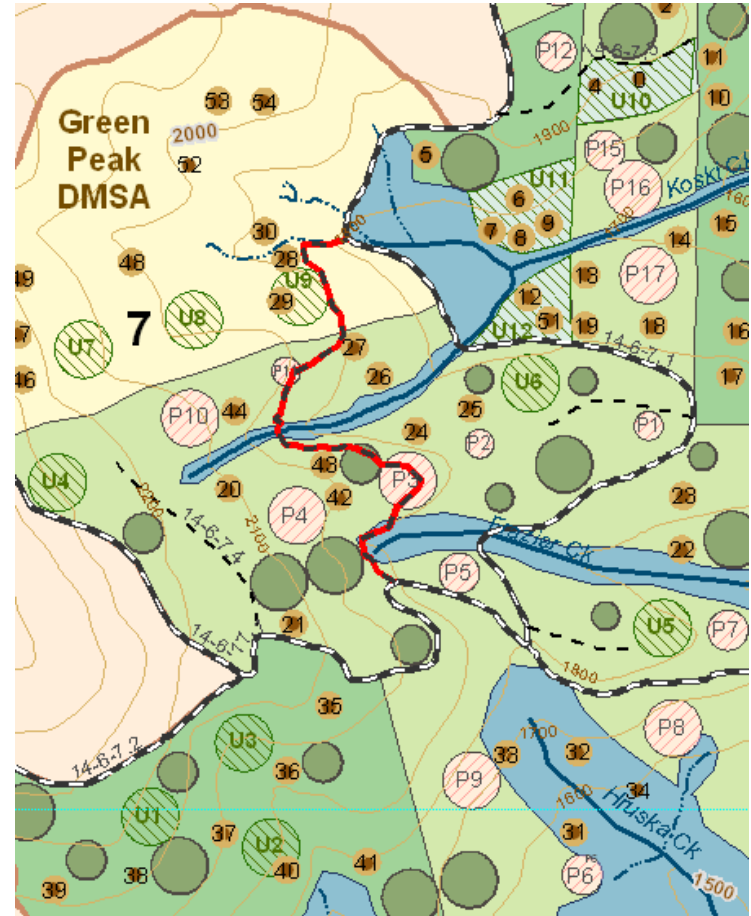
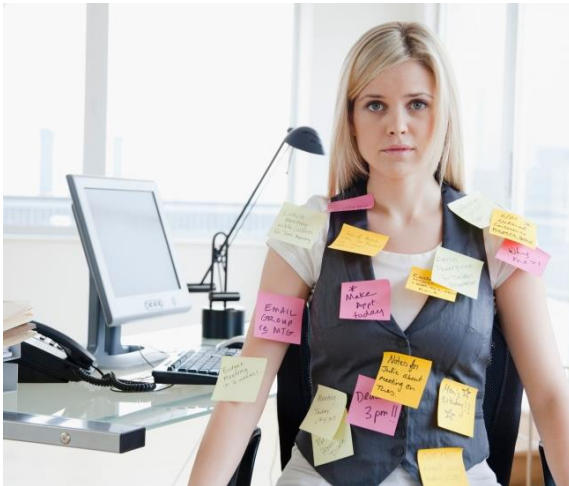
Labeling & Annotation



Forest Service

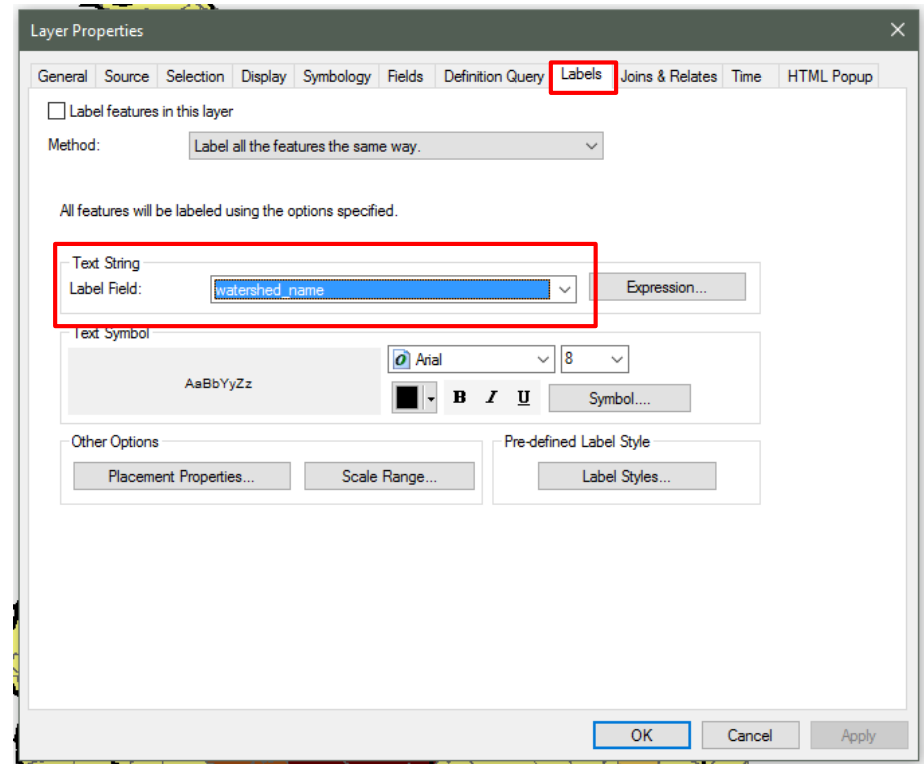
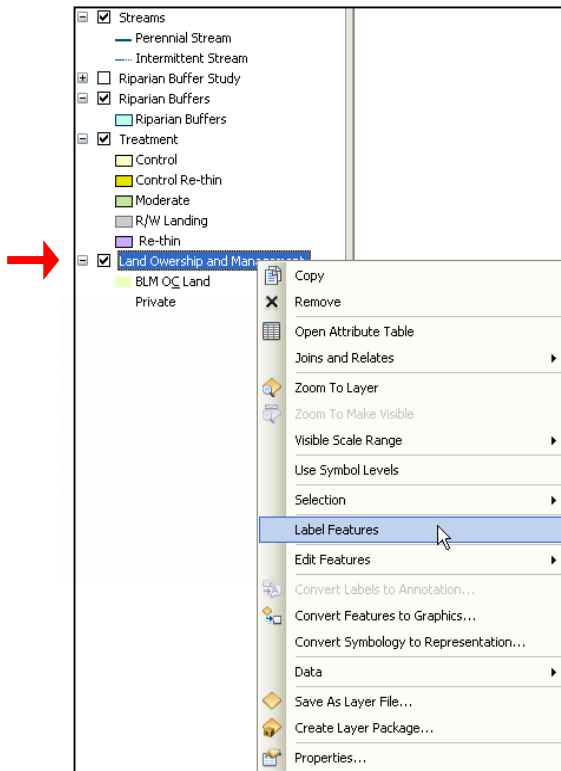
Lesson Overview

- Lesson Overview
 - Labeling Toolbar
 - Label Manager
 - Annotation
 - Maplex Extension



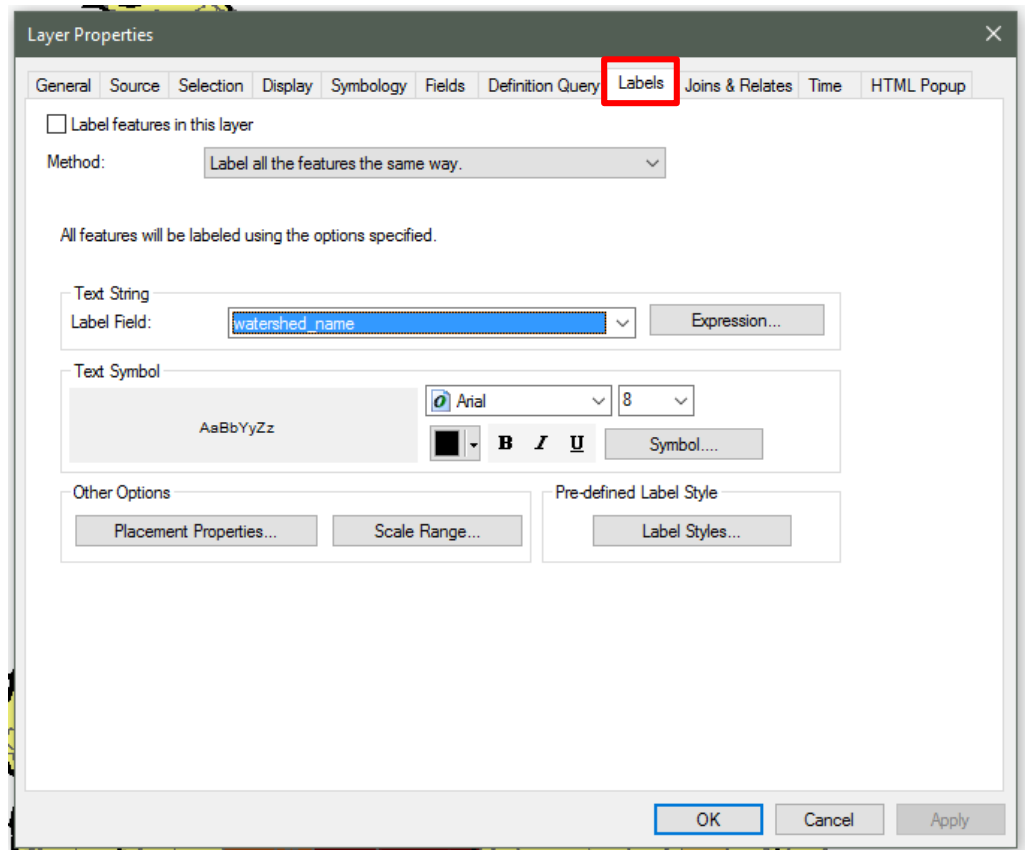
Quickly Label a Layer

- Right-click layer → Label Features On/Off
- Based on layer's 'Label Field'



Layer Properties: Labels Tab

- Label method (default): Label all features the same way
- Standard text symbol settings:
 - Font
 - Size
 - Color
 - Background
 - Style
- Common buttons:
 - Symbol
 - Placement Properties
 - Scale Range



Label Placement: Point

- Placement Properties

- Label around point
- Label on top of point
- Label at angles
- Label around point



- Conflict Detection

- Label weight vs.
- Feature weight
- Allow label overlap

A screenshot of the 'Placement Properties' dialog box in a GIS application. The 'Conflict Detection' tab is active. Under 'Point Settings', the 'Offset label horizontally around the point' option is selected. A 3x3 grid shows priority values: top row [2, 2, 1], middle row [3, empty, 2], bottom row [3, 3, 2]. The text 'Prefer Top Right, all allowed' is to the right. A 'Change Location...' button is below the grid. Below the grid, it says 'Priority: 0 = Blocked, 1 = Highest, 3 = Lowest'. Three other options are listed with radio buttons: 'Place label on top of the point', 'Place label at specified angles' (with an 'Angles...' button), and 'Place label at an angle specified by a field' (with a 'Rotation Field...' button). Under 'Duplicate Labels', 'Remove duplicate labels' is selected. At the bottom are 'OK' and 'Cancel' buttons.

Placement Properties

Placement Conflict Detection

Point Settings

☒ Offset label horizontally around the point

2	2	1
3		2
3	3	2

Prefer Top Right, all allowed

Change Location...

Priority: 0 = Blocked, 1 = Highest, 3 = Lowest

☐ Place label on top of the point

☐ Place label at specified angles

Angles...

☐ Place label at an angle specified by a field

Rotation Field...

Duplicate Labels

☒ Remove duplicate labels

☐ Place one label per feature

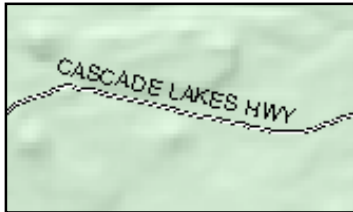
☐ Place one label per feature part

OK Cancel

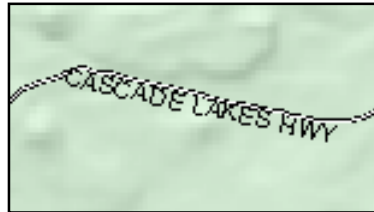
Label Placement: Line

- Placement Properties
 - Orientation
 - Position
 - Offset
 - Location (Along the Line)
 - Duplicate labels

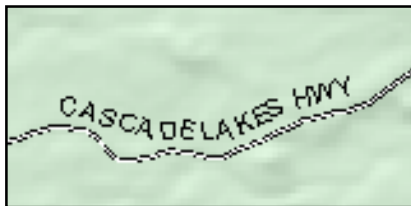
Above or to the Left



Below or to the Right



Following the curve of the Line



Placement Properties

Placement Conflict Detection

Line Settings

Orientation

☐ Horizontal

☒ Parallel

☐ Curved

☐ Perpendicular

Position

☒ Above

☐ On the line

☒ Below

Orientation System: Page

Offset: 0 map units

Location

Location along the line: At Best

Duplicate Labels

☐ Remove duplicate labels

☒ Place one label per feature

☐ Place one label per feature part

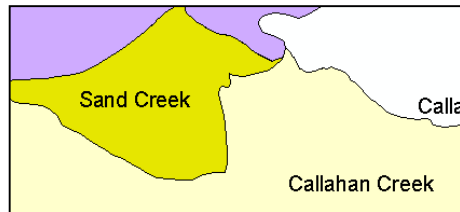
OK Cancel

Label Placement: Polygon

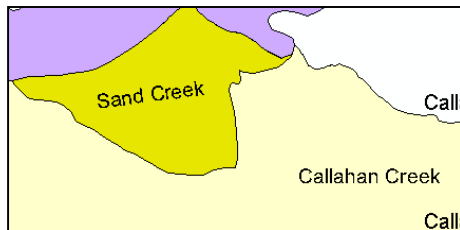
- Polygon settings

- Horizontal
- Straight

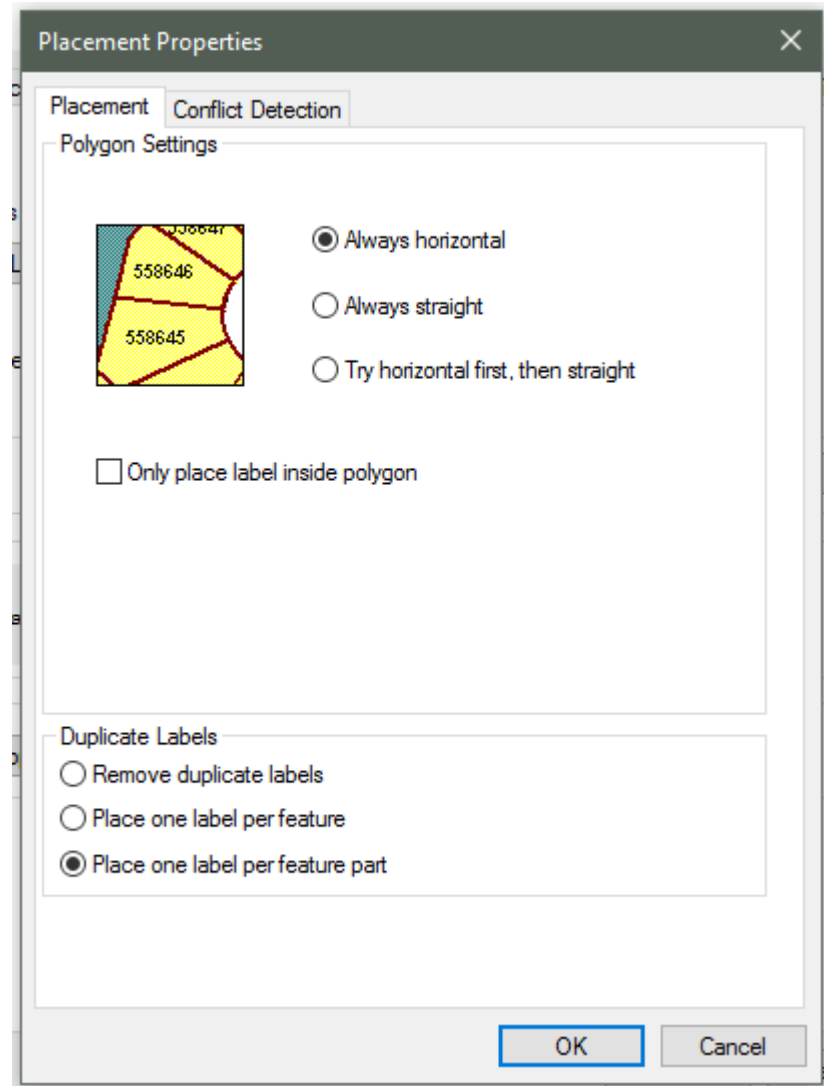
Always horizontal



Always straight

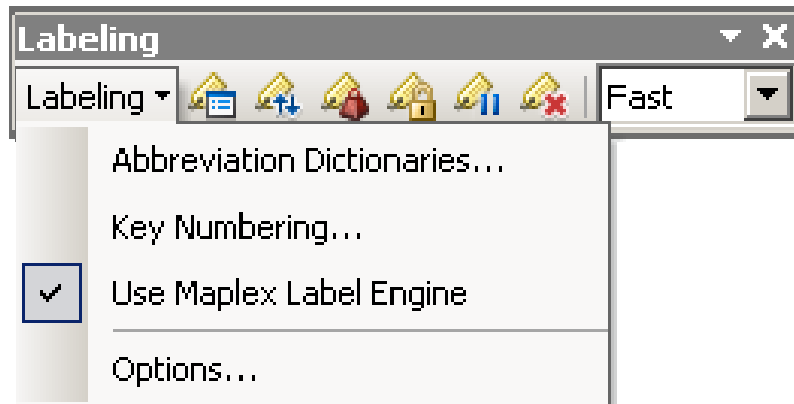



- Duplicate labels



Labeling Toolbar

- Tools:
 - Label Manager
 - Label Priority Ranking
 - Label Weight Ranking
 - Lock Labels
 - Pause Labeling
 - View Unplaced Labels



Button	Name
	Label Manager
	Label Priority Ranking
	Label Weight Ranking
	Lock Labels
	Pause Labeling
	View Unplaced Labels
	Placement Quality

Labels vs. Annotation

- Like labels, annotation is also descriptive text.
- If annotation is text, how do they differ from labels?

LABELS

Dynamically placed

Managed as a group

Stored in MXD

Linked to features

ANNOTATION

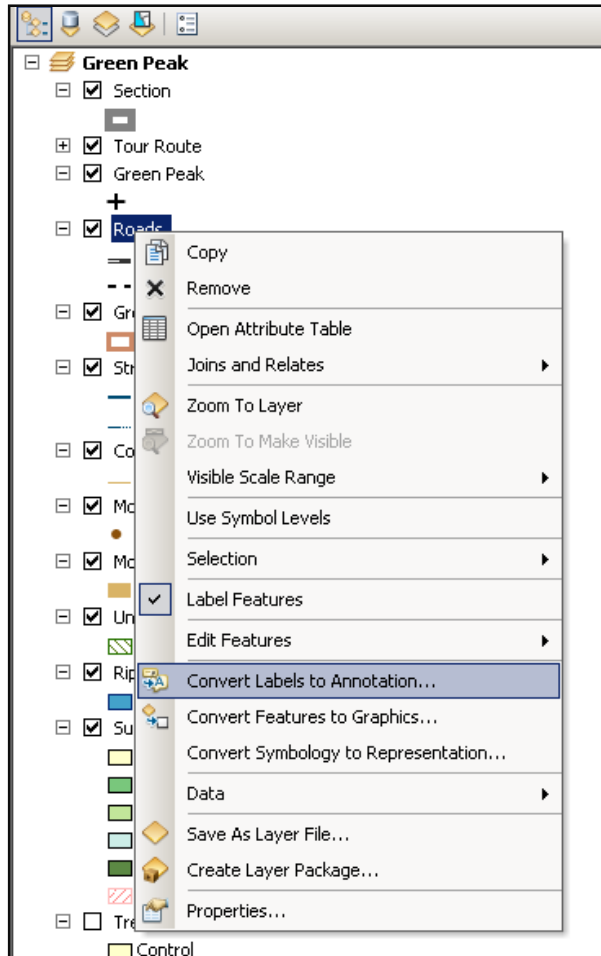
Static placement

Managed individually

Stored in MXD or GeoDB

Linked or unlinked to features



Converting Labels to Annotation

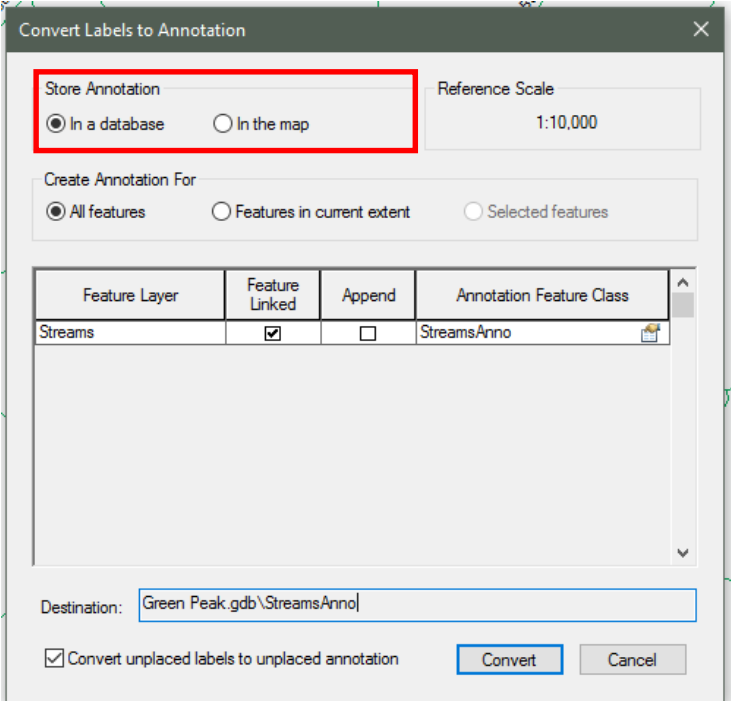


- Before you create annotation:
 - Turn on Labels for layer
 - Set the Reference Scale
 - Set the layer's label properties
 - Optional: Turn off labels from other layers (to minimize label conflict)
- Right-click layer name
- Select Convert Labels to Annotation

Annotation Storage

- Creating Annotation
- In the map – single use for current map
- In a database – extended use for future maps
 - Note: Database Annotations remain linked to features

- Annotation Tools
- To select and modify:
 -  Select Elements (Draw/Tools)
 -  Edit Annotation (Editor)



The dialog box titled "Convert Labels to Annotation" contains the following elements:

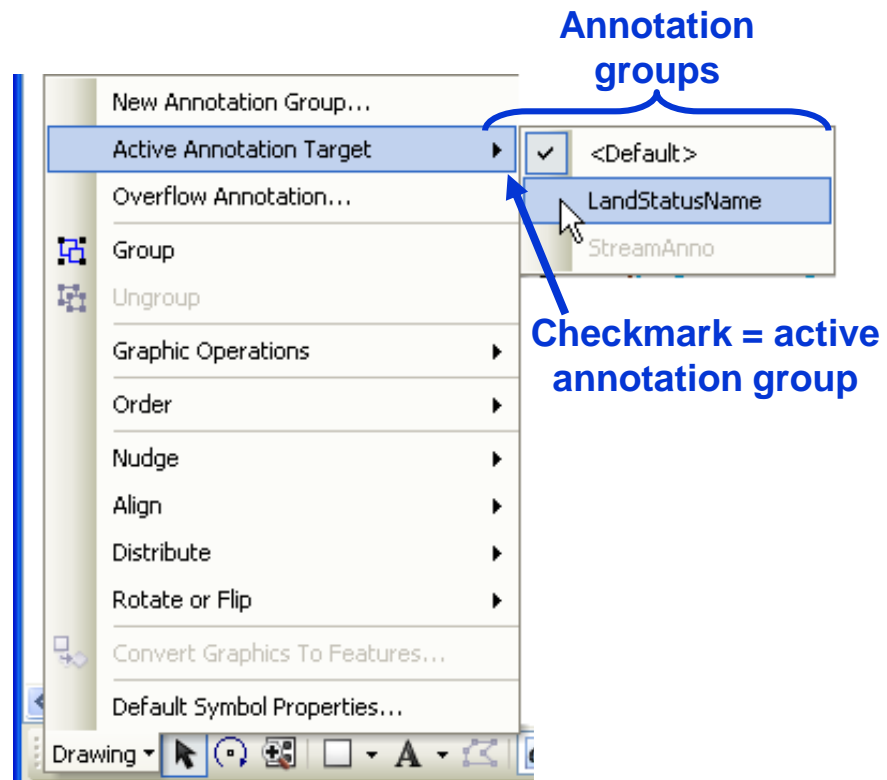
- Store Annotation:** A red rectangular box highlights two radio buttons: "In a database" (selected) and "In the map".
- Reference Scale:** A text field showing "1:10,000".
- Create Annotation For:** Three radio buttons: "All features" (selected), "Features in current extent", and "Selected features".
- Table:** A table with four columns: "Feature Layer", "Feature Linked", "Append", and "Annotation Feature Class".

Feature Layer	Feature Linked	Append	Annotation Feature Class
Streams	<input checked="" type="checkbox"/>	<input type="checkbox"/>	StreamsAnno
- Destination:** A text field containing "Green Peak.gdb\StreamsAnno".
- Options:** A checked checkbox labeled "Convert unplaced labels to unplaced annotation".
- Buttons:** "Convert" and "Cancel".

Annotation Groups

- Stores text and graphics created in map document
- Converting labels to graphics creates new annotation group

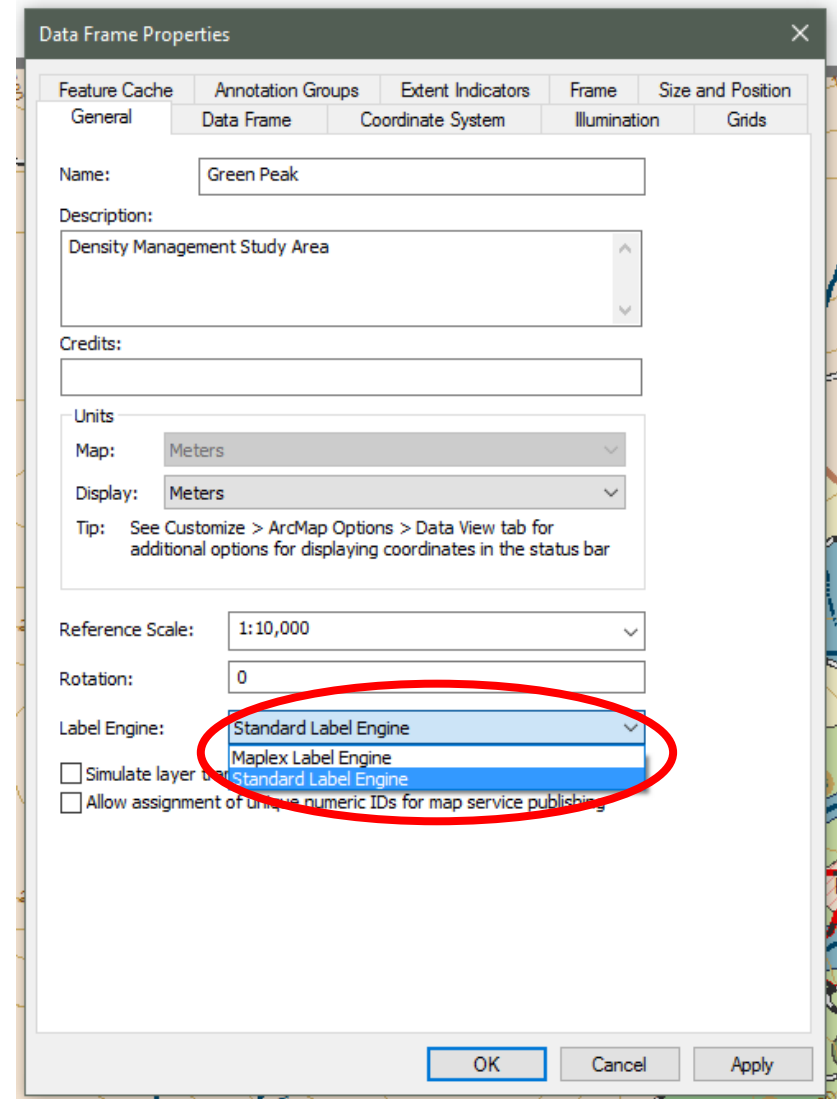
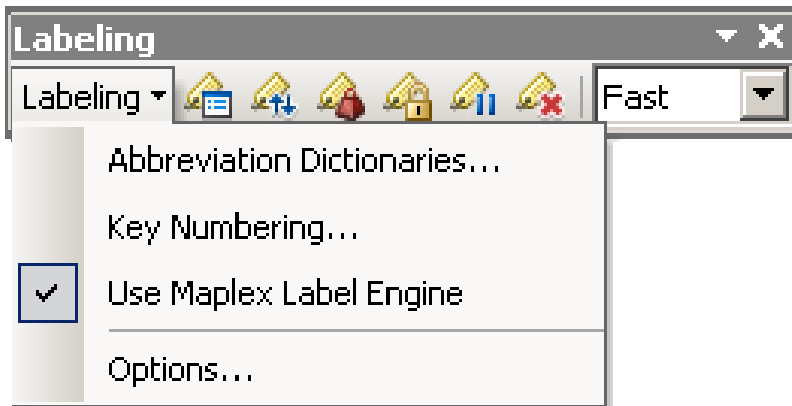
- To add text or graphics to annotation group
 - Drawing menu → Active Annotation Target
 - Map document always has <Default> group



ArcGIS's Label Engines

- Label Placement Engines

- ESRI Standard Label
- ESRI Maplex Label



Maplex Labeling

- Advanced label-placement engine
 - Allows for more labels to be placed on map
 - Greater flexibility in label placement
 - Label stacking
 - Font reduction
 - Abbreviation dictionaries



Label Stacking

- Options:
 - Stacking character
 - Justification
 - Line breaks

BEFORE



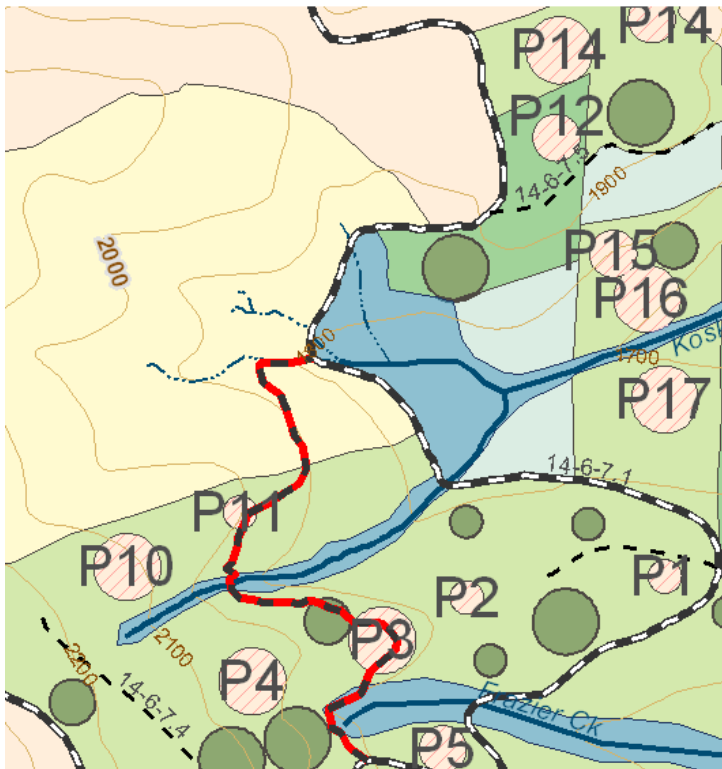
AFTER



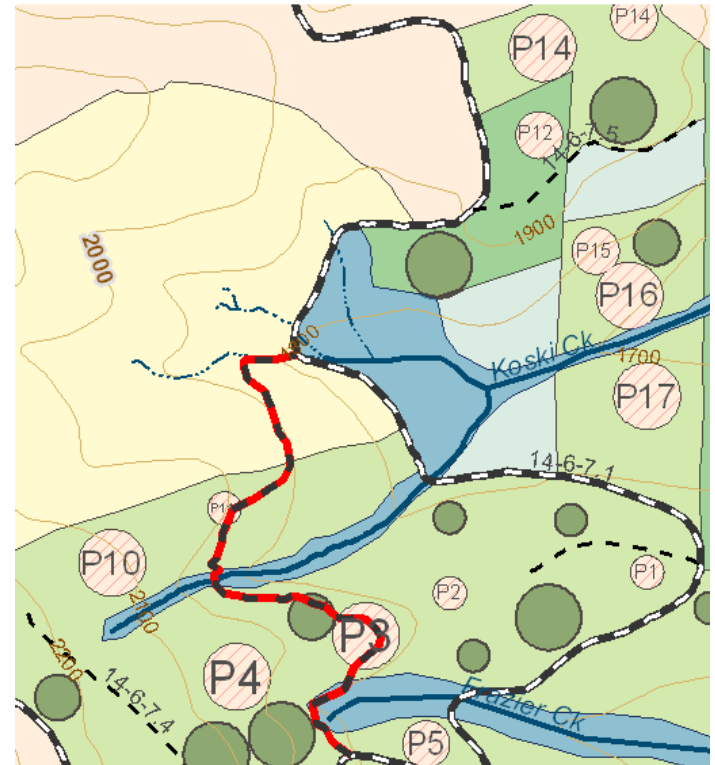
Font Reduction

- Dynamically reduces label size

BEFORE



AFTER



Abbreviation Dictionary

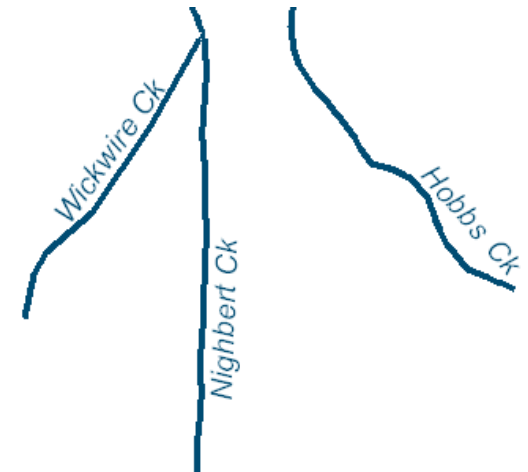
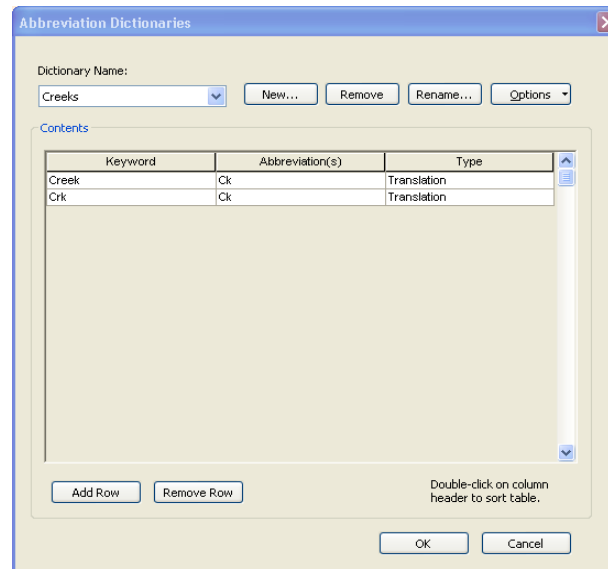
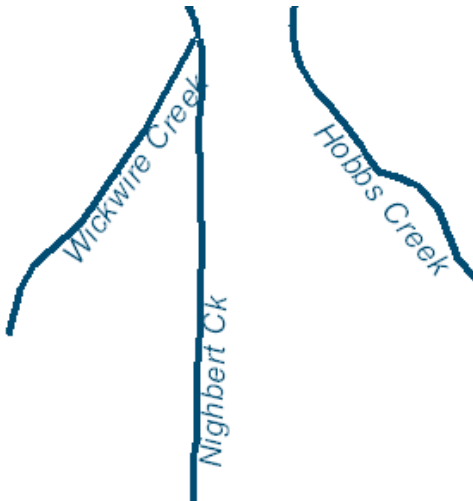
- Words in abbreviation dictionary used to shorten labels

Keyword	Abbreviation(s)	Type
Creek	Ck	Translation
Crk	Ck	Translation
		Keyword
		Ending

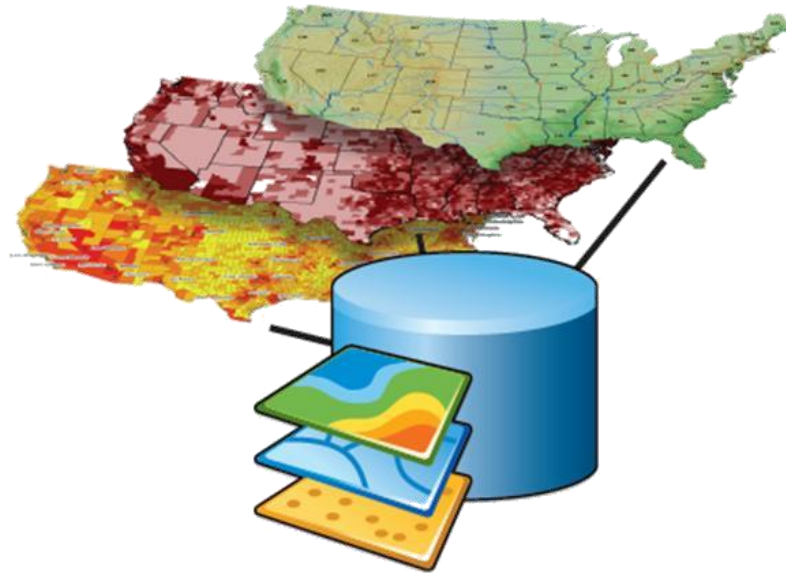
STANDARD LABEL ENGINE



MAPLEX LABEL ENGINE



Demonstration



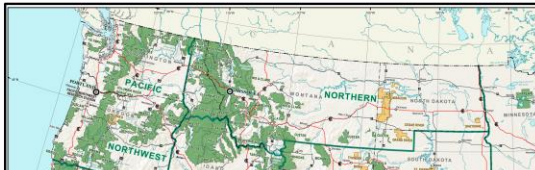


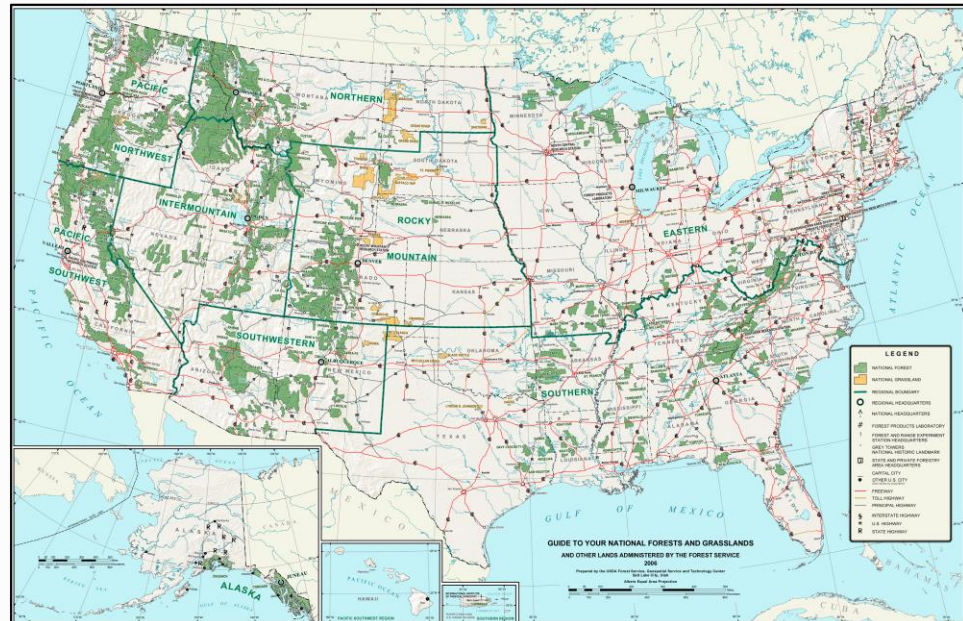
Lesson overview

- Learn how to make a final map product in ArcMap
- Concepts covered ...
 - Map design
 - Layout View and Layout toolbar
 - Adding map elements
 - Title
 - North arrow
 - Scale bar
 - Legend
 - Cartographic guidelines



What is a final map product?

- A map can be used to ...
 - Share geographic information
 - Highlight spatial relationships
 - Illustrate results of an analysis
 - ArcMap can output a final map to a ...
 - Printer/plotter
 - Graphic
 - PDF
- 



Map design: Where to start?

- The map's purpose drives its creation and design
 - Objective?
 - Map for print or in a report
 - Audience?
 - Representation of reality?
 - Scale?
 - Mode of use?
- First impressions
 - What is the first thing seen or stands out?
 - Does the title match the subject?
 - Is the map cluttered?
- Keep it Simple



Preparing to make a map

- Layers needed to make a map are ...
 - Collected
 - Organized
 - Symbolized
- Data View
 - Zoom to Area of Interest
 - Do you need a Fixed Scale (e.g., 1:24,000)?
 - Do you need a Reference Scale?



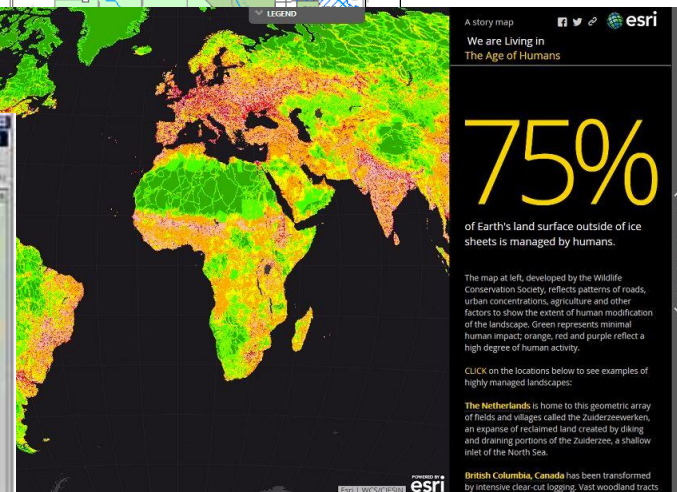
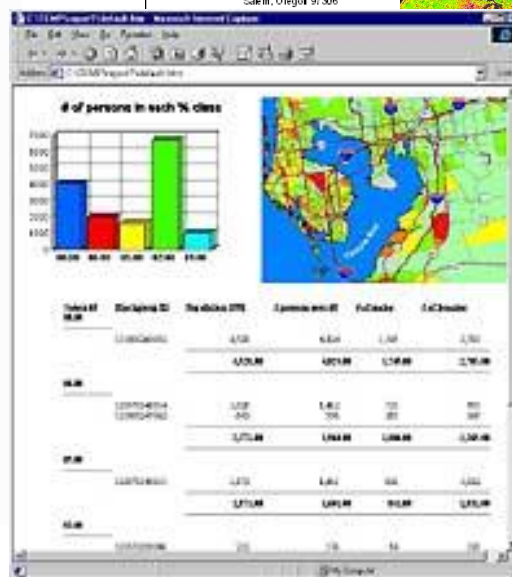
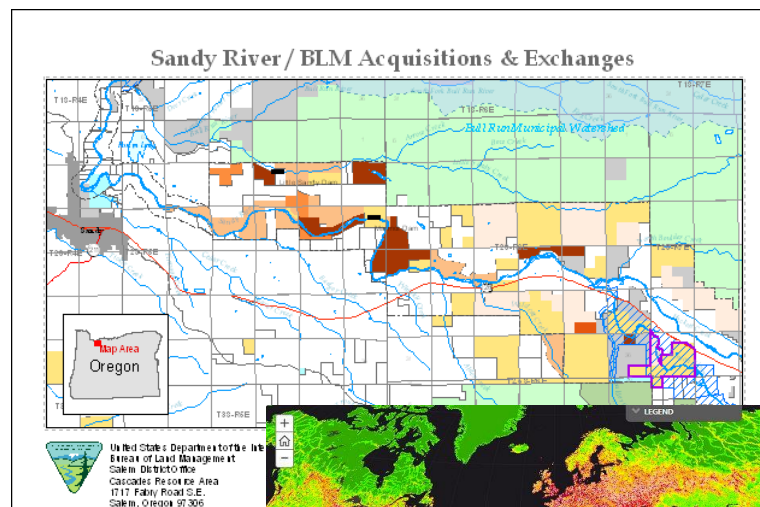
Outputting data from ArcMap

- Map outputs

- Printer/plotter
- MXD
- Digital image
- PDF
- Internet Map Server (IMS)

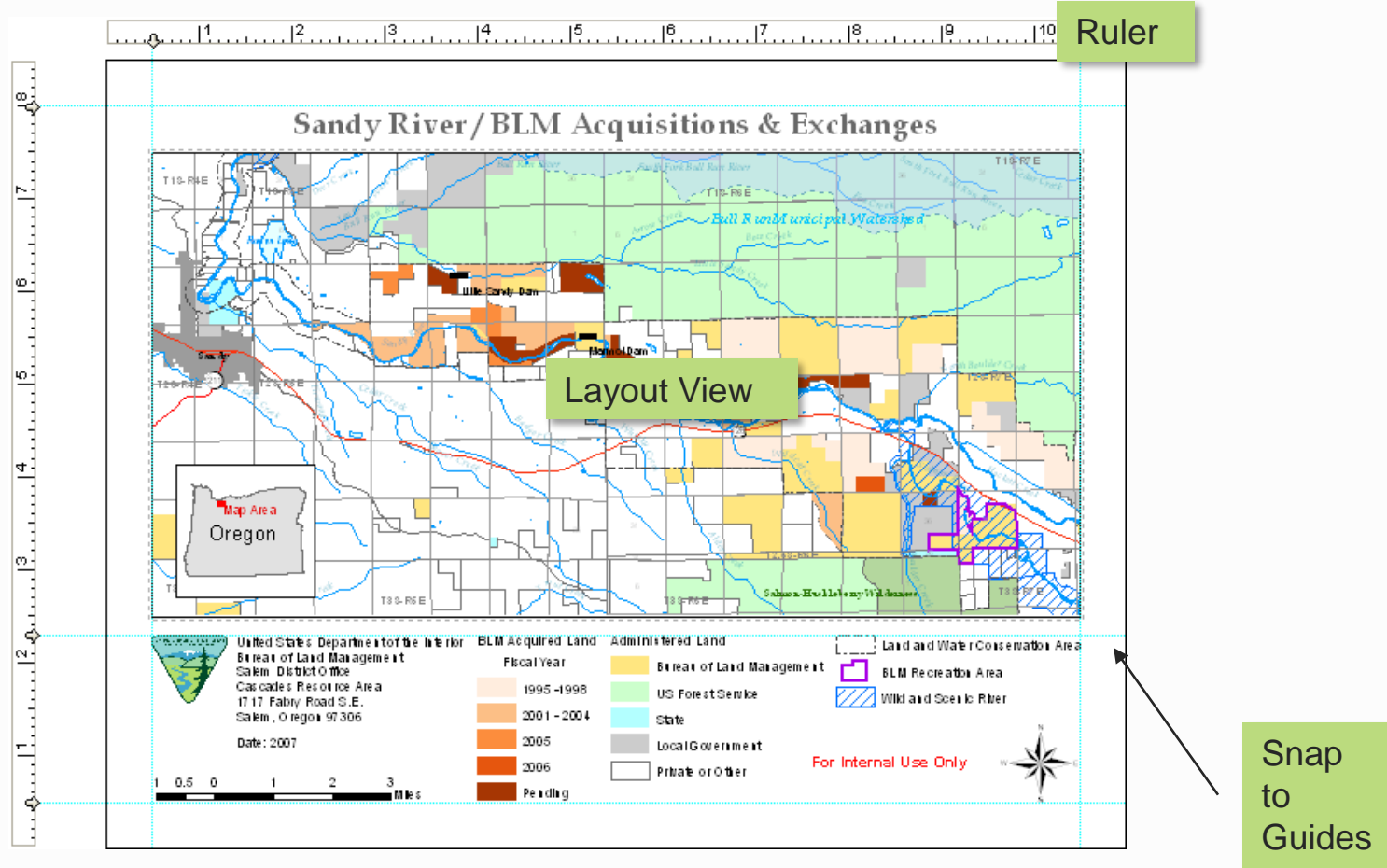
- Table outputs

- Charts
- Simple reports
- Crystal Reports



Layout View and Layout

- The environment for making a final map product



Layout toolbar

- Tools for navigating the Layout

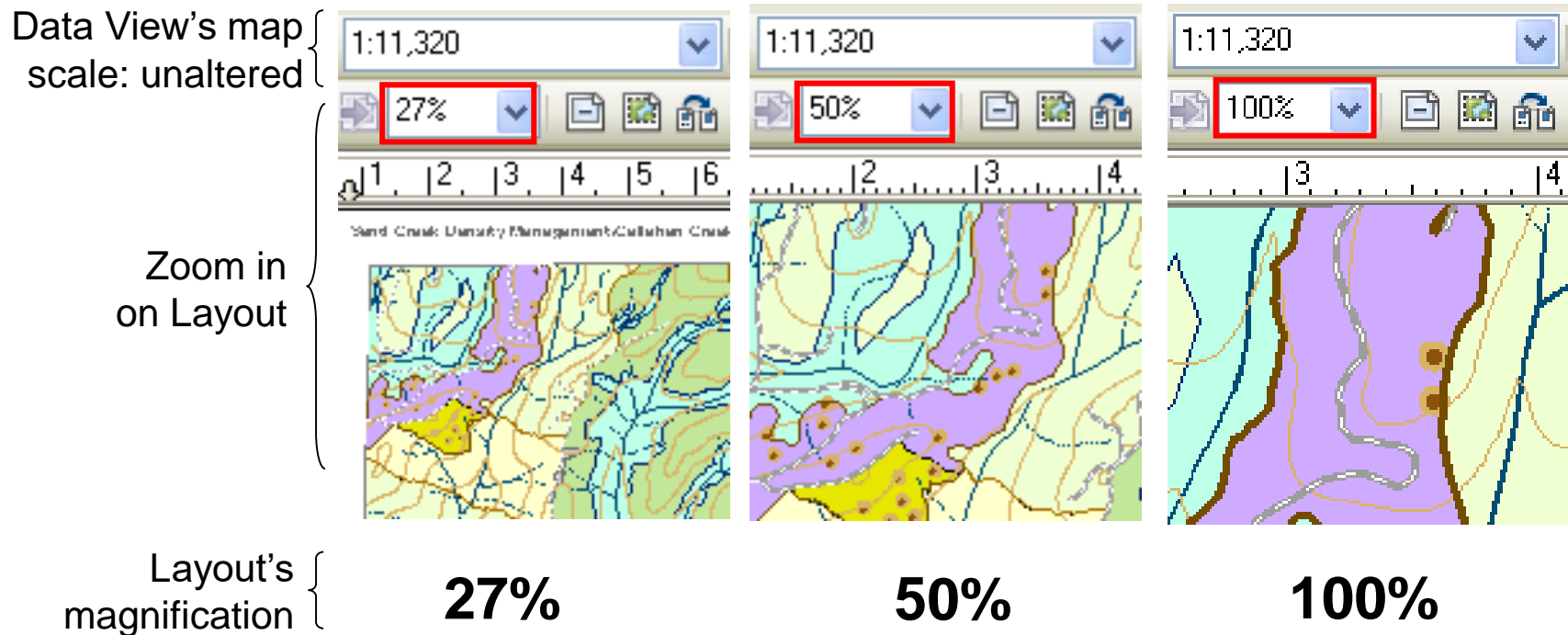




- Layout Zoom tools
 - Use for changing Layout's magnification
- Avoid using Data View's navigation tools
 - Use for changing Data View's map scale



Example using the Layout's Zoom In tool

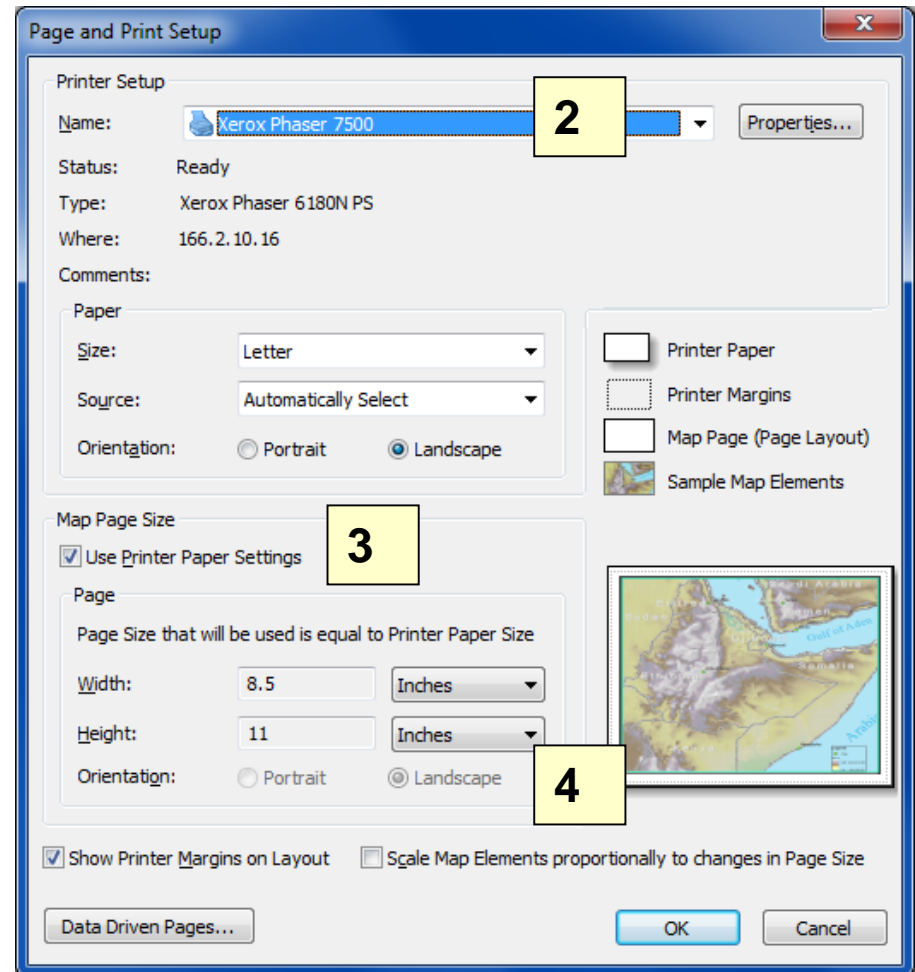
- Layout's Zoom In tool 



- To see entire Layout, use Zoom Whole Page; not  

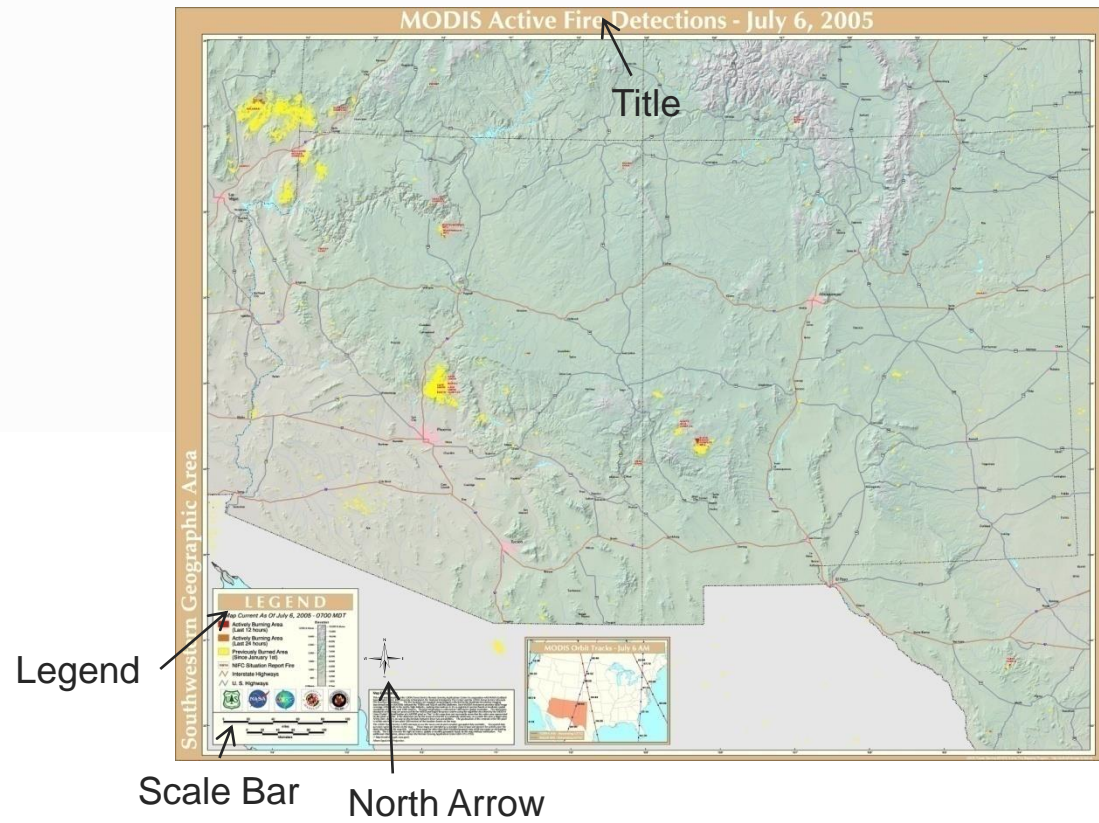
Map's Page Size

- Map's dimensions impact size and placement of map elements
1. File menu → Page and Print Setup
 2. Select printer/plotter
 3. Use printer's paper settings?
 4. Select orientation
 - Match map orientation to data's directional trend



What are map elements?

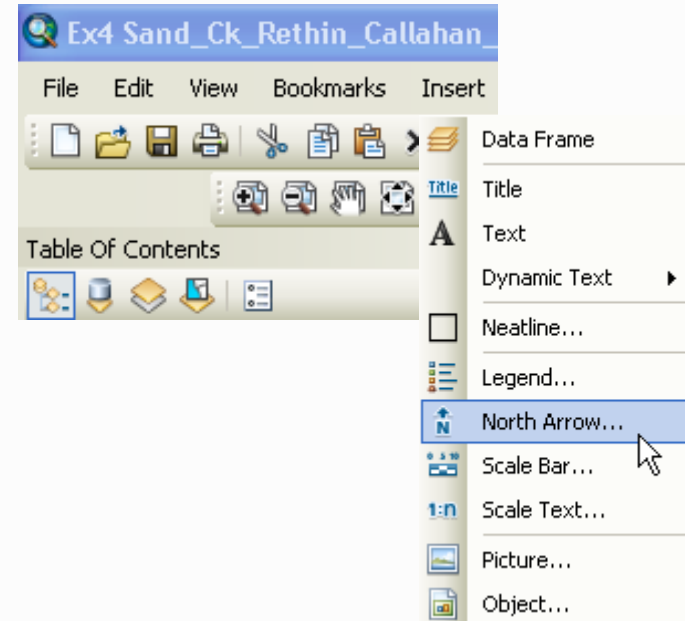
- Distinct objects or graphics
- Distributed maps should include a ...
 - Title
 - Text/labels
 - North arrow
 - Scale bar
 - Legend
 - Disclaimer



Map elements can be customized through their properties.

How to insert map elements

- Insert menu
 - Data Frame
 - Example: Reference map
 - Map elements
 - Legend
 - North arrow
 - Scale bar
 - Pictures
- Draw toolbar

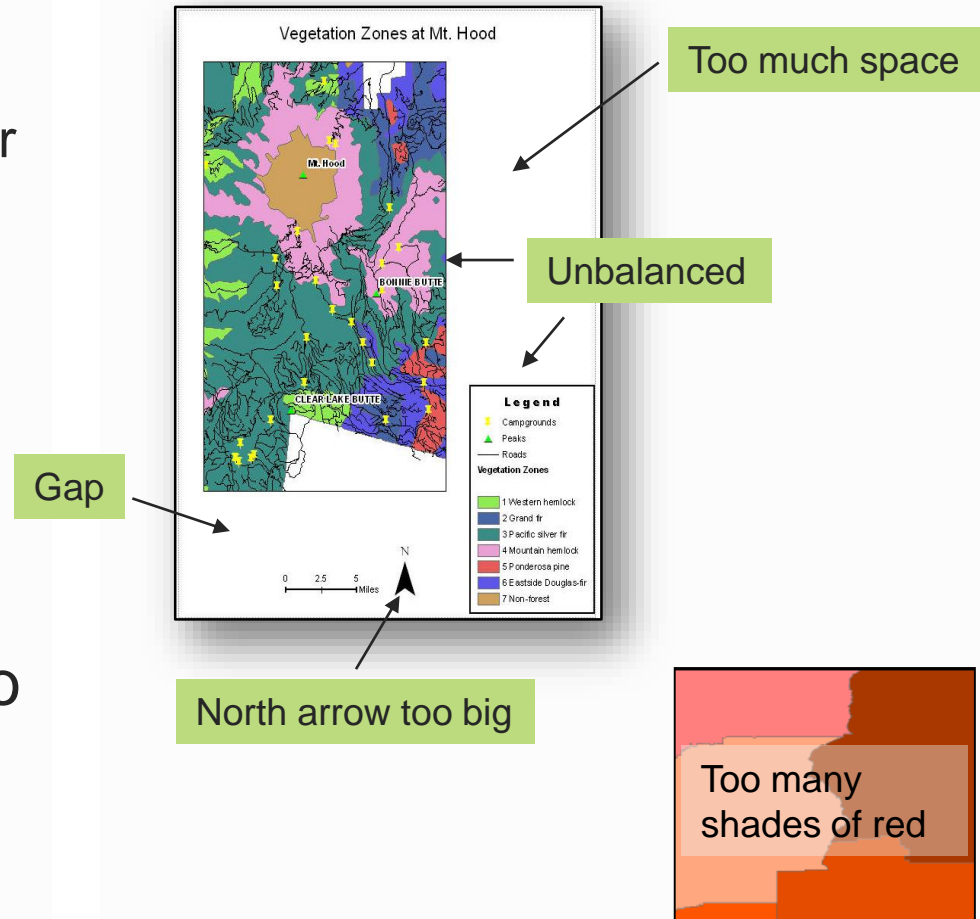


- Text and graphics
- Graphics toolbar



Cartographic guidelines: Visual considerations

- Visual balance
 - Map's focus should cover $\frac{2}{3}$ to $\frac{3}{4}$ of the Layout
 - Avoid white space
- Limit individual colors and color shades
 - Is map reader color-blind?
- Is your map pleasing to look at?



Cartographic guidelines: Text & labels

- Avoid overlap with other labels
- Label's color should be similar to feature's color
- Font type and style
 - Water features → *italic*, serif font
 - Natural features → *italic*, sans serif
 - Cultural features → sans serif
 - Avoid all upper case
- Font size
 - Standard size: 10 pt to 12 pt
 - Never less than 6 pt
 - Watch font size on poster size maps
 - Easy to use huge font due to size of map



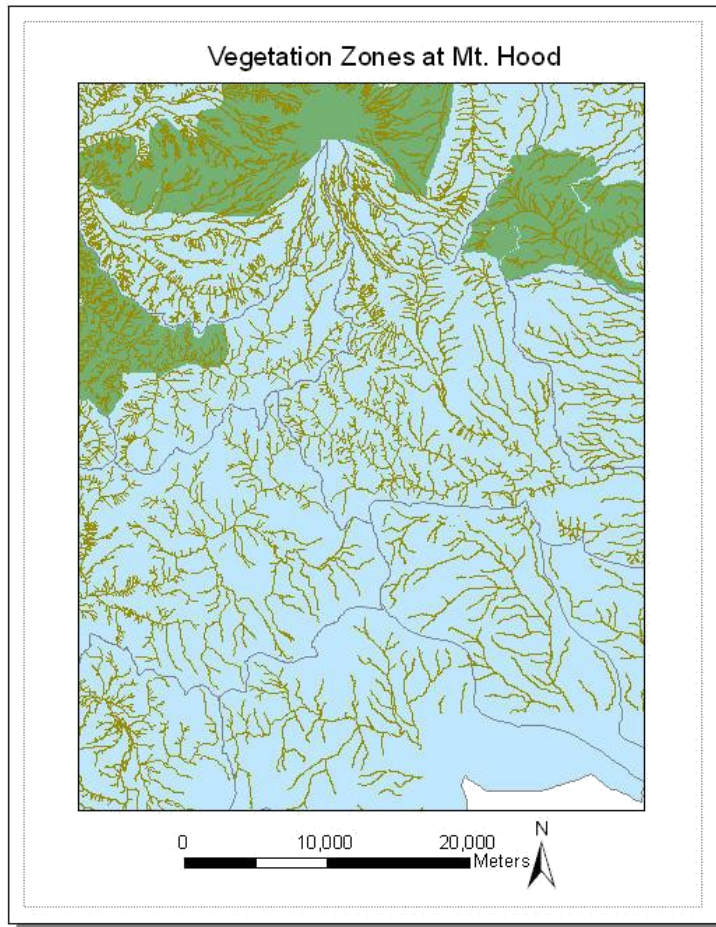
Cartographic guidelines: North arrow and scale bar

- North arrow
 - Not required if graticule or grid present on map
- Scale bar
 - Size depends on paper size
 - E.g., 8.5"x11" map → 3" scale bar
 - Divisions and subdivisions:
 - Use familiar units (e.g., miles)
 - Easy-to-read increments (e.g., fives, tens, etc.)
 - Only two or three divisions
 - Subdivisions left of zero only

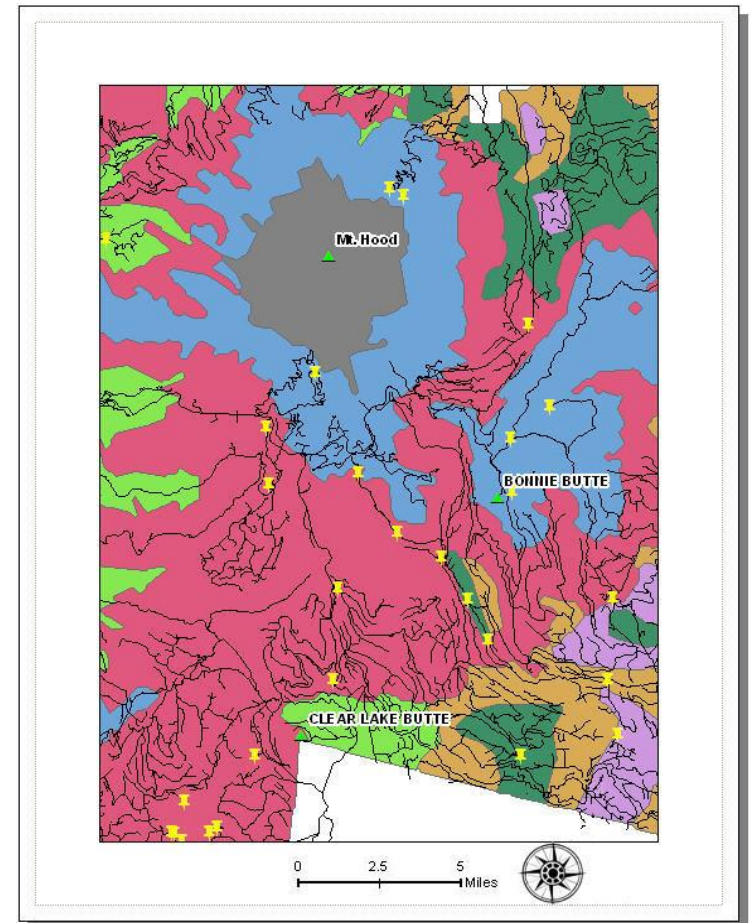


How to create a North arrow

Well Defined North Arrow



Overbearing North Arrow



How to create a Scale bar

Scale Bar

Scale and Units Numbers and Marks Format

Scale

Division value: Auto

Number of divisions: 4

Number of subdivisions: 4

☒ Show one division before zero

When resizing...
Adjust division value

Units

Division Units: Meters

Label Position: after labels

Label: Meters

Gap: 3 pt

OK Cancel Apply

Scale Bar

Scale and Units Numbers and Marks Format

Numbers

Frequency: divisions and first mid point

Position: Above bar

Gap: 3 pt

☐ Use fraction characters

Marks

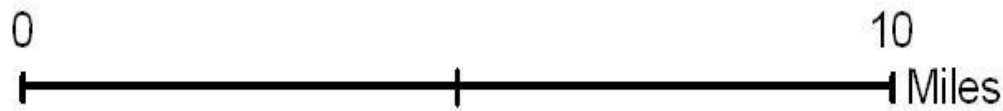
Frequency: no marks

Position: Above bar

Division Height: 7 pt

Subdivision Height: 5 pt

OK Cancel Apply



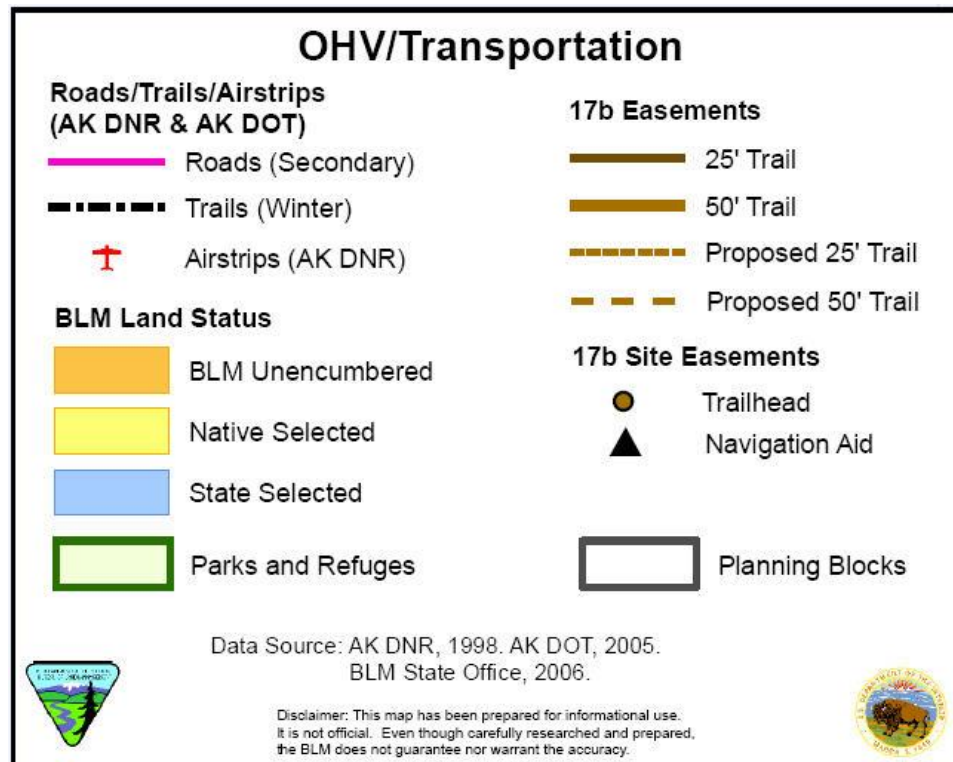
Cartographic guidelines: Legend

- Rules of the legend:
 - Unlabeled features need to be identified in legend
 - A legend symbol must be on the map
 - Transparent colors in the legend and in TOC
- Order of legend items:
 - Grouped by category
 - Major map info first; base map info last
- Singular or plural legend text?
 - Normally singular (e.g., Stream)
 - If symbol represents multiple objects, use plural (e.g., Birds)

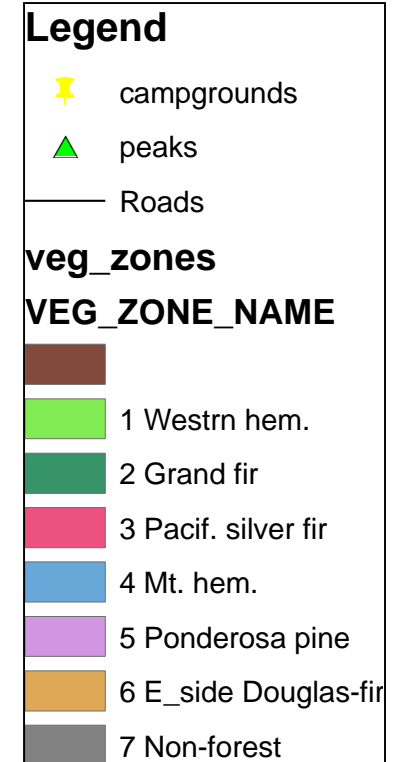


How to create a Legend

Organized map legend



Unorganized map legend



Cartographic guidelines: Supplemental text

- Disclaimer: use only agency-accepted disclaimers
- Identifying text and logos – use as applicable:
 - Agency titles
 - Resource area, district, and/or state
 - Plan project title and date
 - Map number or map name



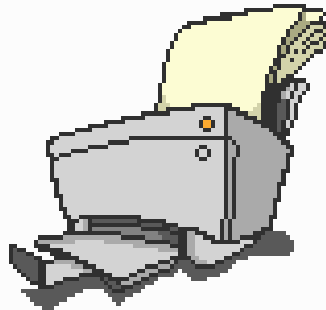
USDI - Bureau of Land Management
Spokane District
1103 N. Fancher
Spokane, WA 99212
(509) 536-1200

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information was developed through digital means and may be updated without notification.

- Do not use individual names on government maps
- You can use coded authorship (e.g., initials and a date)

Cartographic guidelines: Paper size

- Layout page size vs. maximum printable size
 - Default printer margin space = 0.5 inches
 - E.g., 8.5" x 11" page size → 7.5" x 10" map
 - For binding a map, add additional 0.5" to binding side
- See "Page Setup/Paper Choices" included in Extra zipfile
- Printer/plotter results vary. Always make a test printout

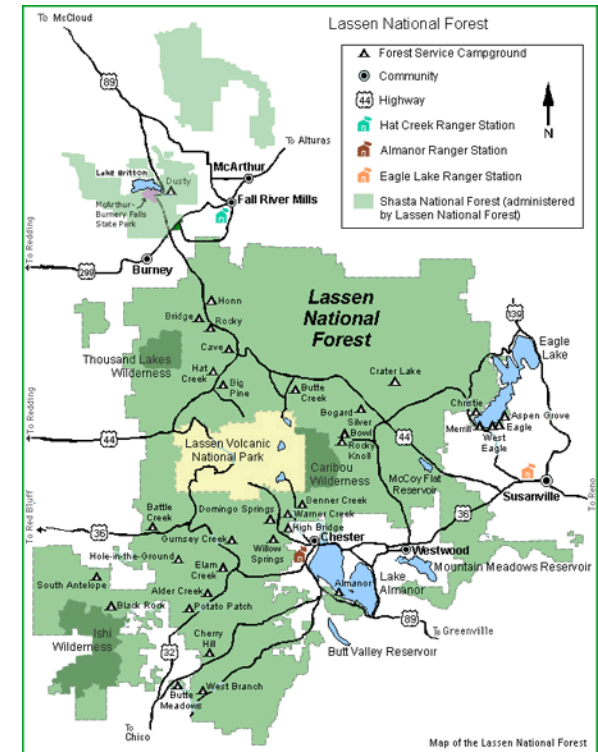
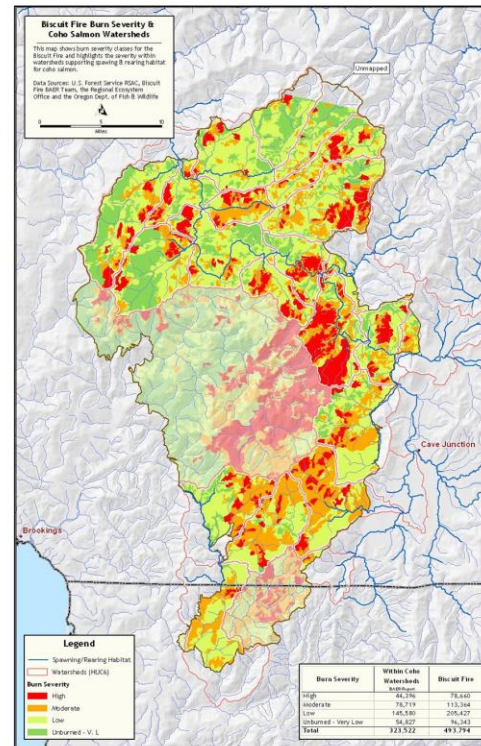
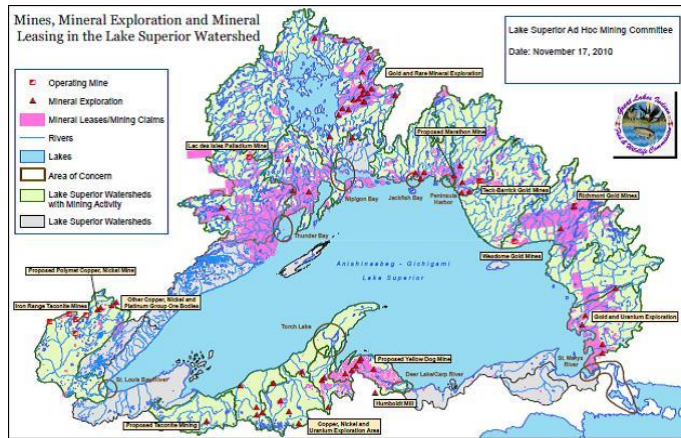


When making maps, have fun.

- Cartographic guidelines serve to give government maps...
 - Consistency
 - Uniformity
 - Readability
- Quality maps go beyond the rules...
 - Usability
 - Interpretation
 - Artistic expression
- As map complexity increases, so does the need for artistic creativity



Some Good Maps



Well laid out, no negative space

Demonstration

