Cartography: Modeling GIS Data for Map Making

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Please!
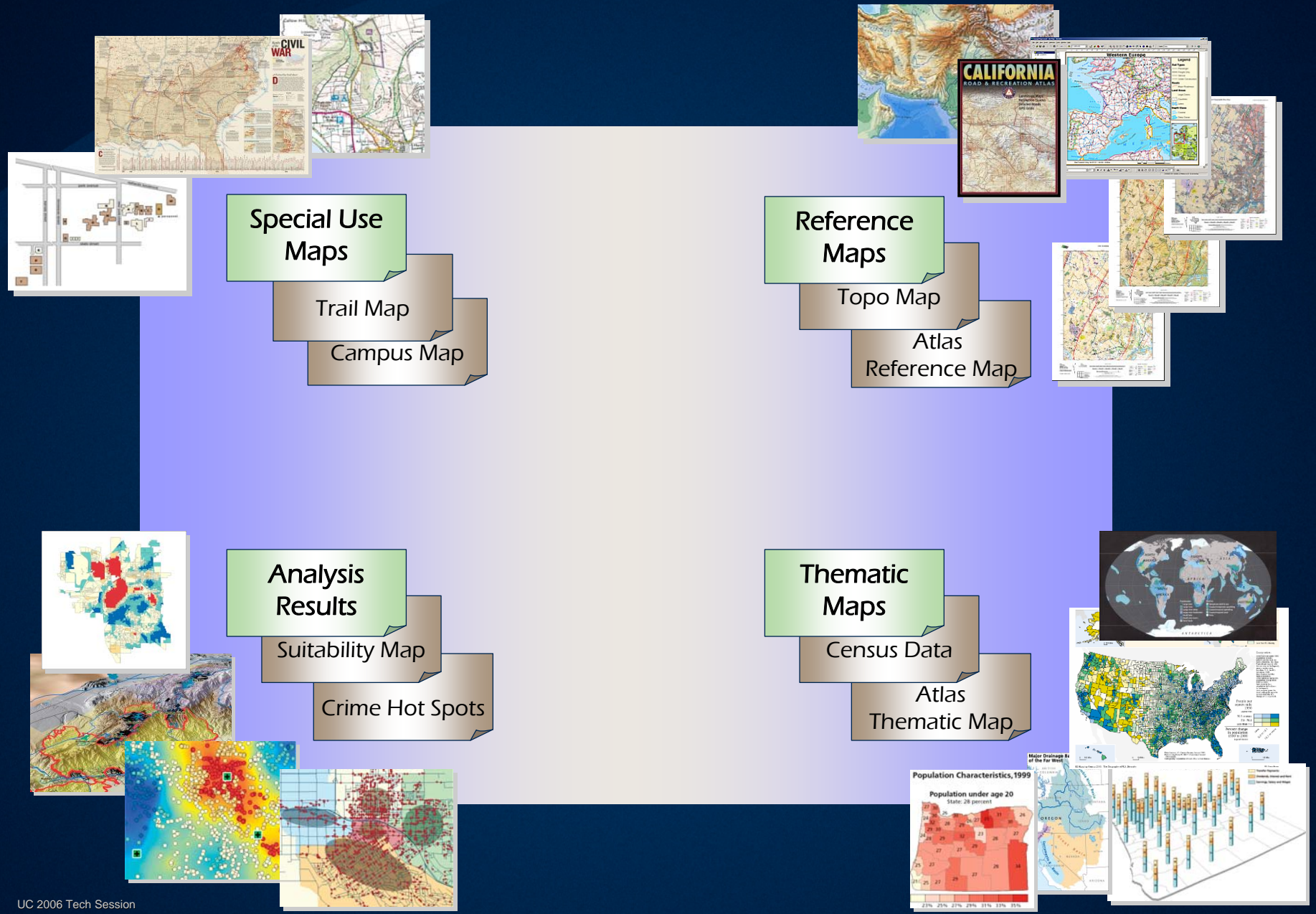Turn **OFF** cell phones and paging devices

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What kind of maps do you make?

Special Use Maps

Trail Map

Campus Map

Reference Maps

Topo Map

Atlas
Reference Map

Analysis Results

Suitability Map

Crime Hot Spots

Thematic Maps

Census Data

Atlas
Thematic Map

Agenda for This Seminar

- 1:30-1:50   Introduction (5 min)
                Part 1: Describing what we mean by "informed data capture or creation" (15 min)
- 1:50-2:05   Exercise 1
- 2:05-2:30   Part 2: Introducing specific examples (elevation, vegetation, physiography)
- 2:30-2:45   Exercise 2
- 2:45-3:00   Part 3: Describing what we mean by QA/QC (15 min)
- 3:00-3:30   Break
- 3:30-4:00   Part 3a: Introducing specific examples (cultural, boundaries, hydrography)
- 4:00-4:15   Exercise 3
- 4:15-4:30   Part 3b: Introducing specific examples (transportation, text)
- 4:30-4:45   Exercise 4
- 4:45-5:00   Wrap up and conclusions

Pre-conference seminar materials

- Resources from this seminar
  - Handouts for slides
  - Exercises
  - Example maps
  - Web for downloads
    - Lectures
    - Exercises with step-by-step instructions
    - Example map – Crater Lake
    - Example database – Crater Lake
    - Calculate statements
    - Expressions
    - Style

Focus of this workshop

- Focus is on tailoring a GIS database so that it can be used for high quality map production
- Requires that you know what kinds of products you will make from the database
  - That is, the product specifications – which means, the maps!
    - Type – reference, thematic, analysis results, special purpose
    - Scale – actually a finite range of scales
    - Purpose – audience, medium, objectives

Two themes run through everything we talk about today

- Informed data capture (what it is and why it is important
  - Definition: capturing and compiling (modeling) your data with a specific product type, scale, and purpose (or set of them) in mind
  - NOTE: a single data capture may not suffice for all layers for all product types, at all scales, for all purposes!!
  - Parts 1 and 2
- Quality in your data → quality in your products (QA/QC)
  - Parts 3, 3a, 3b

Part 1

Describing what we mean by "informed data capture or creation" and "QA/QC"

What we will talk about in this seminar

- High quality maps are more efficiently/effectively produced from high quality data
- How to enforce quality in your cartographic database
- How to be critical about your data whether you capture it yourself or you get it from someone else

Two relevant concepts that we will talk about:

1. Informed data capture or creation
   - For features and attributes
2. Quality Assurance / Quality Control - QA/QC
   - Quality assurance – how to enforce quality in your database and products
   - Quality control – how to check if there are errors despite your quality assurance measures
   - QA/QC for single layers or among layers

Informed data capture or creation – general concepts

- Requires that you know the geography
  - E.g., the geography of Crater Lake National Park
- Requires that you know the domain of knowledge
  - E.g., hydrography, elevation, physiography, land ownership, etc.
- Know what you plan to make with the data – what types of maps

- If you want it on the map you have to have it captured in your data!!!
  - Refers to both the symbols and the labels

Crater L[ake]

Crater Lake vegetation

Crater Lake National Park Map
Tom Patterson, NPS

Informed data capture or creation

- Sometimes relates to geometry, sometimes to attributes
- Geometry
  - Capture centerlines at the same time you capture edges of features (e.g., rivers or roads)
  - Reshape features that are or should be coincident (e.g., rivers and boundaries, rivers and DEMs)
- Attributes
  - Appropriate attributes for display (e.g., prominence, size, avoid overlapping symbols)
  - Appropriate attributes for labeling (e.g., LabelString, ShowYN)

Exercise 1

- 1:50-2:05

- The objectives of this exercise are to become acquainted with your colleagues and to begin thinking about how mapping is done with GIS by first considering your own workplace.
- Work in small groups
- Introduce yourselves to each other
- Discuss how mapping and GIS are integrated in your workplace
- To what extent is mapping planned in advance?
  – By whom?
  – Who signs off on it?

Part 2

Introducing specific examples – Elevation, vegetation, physiography

Elevation

- Hillshading (same for bathymetry)
  - Creating a default hillshade
  - Creating a Swiss hillshade
  - Displaying the Swiss hillshade
  - Changing the color ramp
  - Setting the resampling method
  - Setting the stretch type
  - Creating a MDOW hillshade
  - Flattening the rasters
- Survey points
  - Digitizing the features
  - Adding a field for the type of point for symbolization
 - Labeling elevations with text formatting tags

Vegetation

- Bump mapping
  - Creating the bump map
  - Symbolizing the bump map

Physiography

- Named physiographic features (same for named marine water bodies)
    - using 3 sources to determine whether the feature should be included and where the feature is
    - delineating or digitizing features
    - populating the name and other fields
    - calculating the label string field with all capital letters
    - adding fields for shape type and feature size so they can be used top create different label classes

Exercise 2
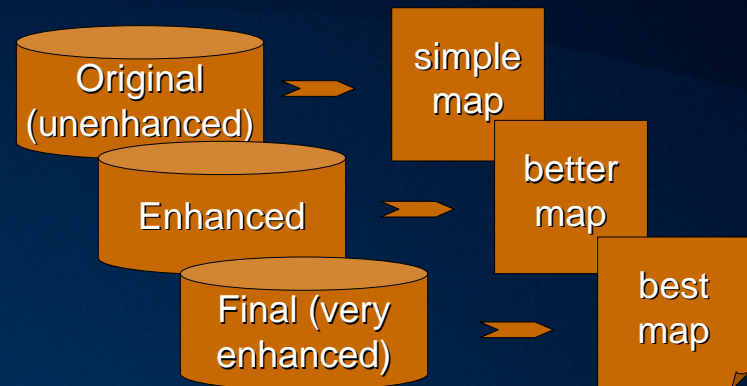
- 2:25-2:40

- The objective of this exercise is to acquaint you with how the database looks and what results you can get on your maps with the database at various stages of enrichment for mapping.
- In small groups, determine the following:
  - Which cartographic effects can you achieve with a database in its original form? (very simplistic database – both tables and features)
  - In an enhanced form?
  - In its final form?

- *For this exercise, you have the themes and feature classes, the attribute tables, the maps, the styles, and the domains. These resources are for three different maps at three levels of enrichment. One is the data as it came from the source and its resulting map, another is the database under development and its map, and the third is the final map and database. All small groups have the same resources. You will share your results at the end of this exercise.*

Part 3

Introducing specific examples – Cultural, boundaries, hydrography

Quality in your data → quality in your products

- "Quality Assurance / Quality Control" or "QA/QC"
- Quality Assurance
  - How you enforce quality in your database, whether you captured it or got it from someone else
  - Examples – use domains, set valid values
- Quality Control
  - How yu fin d erro5rs in yor datebass desplite y our QA practicEs
  - Examples – geometry mismatches
- Requires that you know your product specifications!
- Can be within or among layers
  - Data cleaning or data scrubbing for single layers
  - Layer integration among layers

Within a layer – QA/QC using tables

- Cleaning tables
  - Sort
  - Summarize
  - Visually check the data
  - Fix erroneous values
  - Add missing values

- Domains enforce consistency
  - Allow only valid values
  - Use them to Match to Symbols in a Style
- Use the map to fix the tables and visa versa
- Clean tables are required for queries and expressions (definition queries, SQL queries, label expressions)

Within a layer – QA/QC of the geographic features

- Check against a reliable source
  - Known dataset
  - Other maps
  - Satellite image
  - Aerial photo
- Check against other layers
  - Buildings to roads
  - Roads to rivers
  - Rivers to DEMs
  - Etc…

Among Layers – QA/QC

- Examples
  - Relationships between points and lines
    - Rotate point symbols to a line feature
    - Add an attribute for the angle rotation
    - Examples – building to a road, springs to a stream
  - Relationships between points, lines and polygons
    - Features located in complexes
  - Highway intersections
    - Merge/join – so symbols transition smoothly into one another
    - Symbol level drawing to indicate overpasses and underpasses
  - Coincident boundaries
    - Break and code lines according to line symbol that will be used
  - Offset line from another feature
    - Streams, roads

Layer integration examples

- Give a couple of examples
- Then show them a map and ask them what needs to be done to take care of layer integration problems and what you would need to do in the database to achieve the effects they suggest

Break

- 3:00-3:30

Half way through this workshop

- Focus is still on maintaining a GIS database that can be used for high quality map production
- Still requires that you know what kinds of maps you will make from the database
  - That is, meets the product specifications – type, scale, purpose

Cultural

- Cultural points
  - using a domain to set symbology
  - using a definition query to stop some features from showing
  - adding an attribute to indicate that the feature is in a complex
- Cultural polygons
  - using Unicode values to label features with symbols
  - using text formatting tags in the label expressions

Boundaries

- Ownership
  - adding missing feature data
  - adding missing attribute data
  - changing polys to lines and cleaning them up
  - using ShowYN to set symbology
- Area outside study area
  - setting the symbology
- Park boundary
  - using buffers to create the boundary
  - setting the symbology
- Overlapping boundaries
  - converting polygons to lines
  - adding an attribute to designate line type
  - using a domain to set symbology

Hydrography

- Named water bodies
  - digitizing the features
  - labeling the features with different label classes
- Hydro points
  - using a domain to set symbology
  - adding fields for labeling
  - changing the rotation of symbols for springs and falls
  - adding a field to not label some features
- Streams
  - using a domain to set symbology
  - fixing errors in the original data

Exercise 3

- 3:50-4:05

- The objective of this exercise is to understand how QA/QC, both within layers and among layers, can be accomplished with GIS data for mapping.

- In small groups, examine the database and the maps that were created from them and determine the errors on the maps and in the data.
    - What needs to be corrected?
    - How would you correct it?
    - What would the result be on the map?

- *For this exercise, you have the attribute tables and the nearly finished map, as well as the style and domains and the label classes and their properties. Look for 6-8 errors on these maps. All small groups have the same map. You will share your results at the end of this exercise.*

Part 3b

Introducing specific examples –
Transportation, text

Transportation

- Trails
  - dissolving the trails for dashed line symbol and labeling
  - using a domain to set the symbology
  - using an expression for labeling the Pacific Crest National Scenic Trail

- Roads
  - calculating the field for labeling with highway shields
  - setting up highway shield labels
  - using symbol level drawing

Text

- Annotation
  - using feature linked annotation
  - appending to an annotation group
  - saving annotation in a geodatabase
  - projecting the feature dataset with the annotation

- Graphic text
  - adding text and symbols to a focused data frame

Exercise 4

- 4:30-4:45

- The objective of this exercise is to consolidate what you have learned by examining different maps and determining the database requirements for the cartographic effects.
- In small groups, examine the cartographic effects that you see on the maps. Some of these have been created with GIS and some have not. Determine the database features and attributes that would be required in order to achieve the cartographic effects that you noted on the maps.
  - What data need to be included?
  - What format should it be in (point, line, polygon, combinations of these)?
  - How would you organize this in the database (what themes would you put the data into)?
  - What attributes would be needed?
  - How could you achieve the effects that involve relationships among layers?
  - What effects do you think could not be achieved with the GIS database (that is, they are simply graphic effects)?

- *For this exercise, we have a variety of maps for you to examine. Each small group has different maps. You will share your results at the end of this exercise.*

Wrap-up and conclusions

Parting words

- Have a plan -> start with a product in mind or in hand
  - Product type: reference, thematic, analysis results, special purpose
  - Product scale: (actually a short range of scales)
  - Product purpose: audience, medium, objectives
- This is more easily done if you have an equivalent or similar product
- Incorporate mapping into your current workflow
  - Informed data capture or creation / QA/QC / map production
- Work with cartographers / project manager / DBAs

- Remember – If you want it on the map you have to have it in your data!!!

Resources

- Resources from this seminar
  - Handouts for slides
  - Exercises
  - Example maps
  - Web for downloads
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    - Example map – Crater Lake
    - Example database – Crater Lake
    - Calculate statements
    - Expressions
    - Style

Resources

- Through the ESRI web site – Base map data model web page
  - Cartographic Data Model
  - Geoprocessing tools, models, scripts – also on Geoprocessing web page
  - Case studies
  - Best cartographic practices
  - Step-by-step instructions

- User community
  - Case studies / best cartographic practices
  - Geoprocessing tools, models, scripts
  - Models & schema

http://support.esri.com > Downloads > Data Models > Basemap

Other sessions

- For data modeling
  - Cartographic data model session
    - ArcGIS ArcMap: Designing GIS Databases to Support Mapping and Map Production
      - Wednesday 8/9/2006 – 08:30 AM - 09:45 AM
  - Other data model sessions – examples:
    - Address data model – for names management
    - ArcHydro data model – for understanding a data model and seeing how it can be used cartographically

- For map production
  - Cartography technical sessions
  - PLTS sessions – Production Line Tool Set

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Date Submitted: July 6, 2001
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Many of these same layers also appear in base maps for other purposes, like zoning maps that overlay onto satellite imagery or orthophotography. The intent of this model is to provide a clear approach for implementing, managing, and creating maps using these layers in a GIS database.

In particular, this work was done as a case study at ESRI using the Texas Natural Resources Information System's (TNRIS) data. The goal was to create a multi-purpose base map to demonstrate best practices for GIS design.

We invite user group members to participate in a series of instructional web casts. Please fill out the data model survey to give us feedback on what web casts you would like to see.