FE 257. GIS and Forest Engineering Applications

Week 8

Week 8

- Last week:
  - Chapter 9: Joining and Linking Spatial and Nonspatial databases
  - Chapter 13: Raster GIS database analysis
- Questions?
- Next week- read:
  - Chapter 17: Certification and Licensing of GIS users

Week 8 Topics

- Grading and Final project
  - Schedule
- Chapter 10: Updating GIS Databases
- Chapter 12: Synthesis of Techniques Applied to Advanced Topics
- GIS Lab 8
  - More work with raster data
    - Watershed delineation

Grading

- 200 points total
- You can check the FE 257 WWW site to get your current grade
- 100 points for weekly assignments
  - Includes abstract for project
  - Keep all your graded assignments
- 50 points for term project
  - 50 points for 3-5 page write-up
- 50 points for exams
  - 2 exams (40 points)
  - 1 lab final (10 points)

Term Project

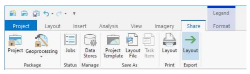
- Report due last day of classes at 5 PM
- Result should include a spatial summary or comparison drawn from a forestry or natural resource context
- Take it to Snell Hall 210A
  - There will be a box for projects

Term Project Guidelines

- Three to five double-spaced, typed pages
- Cover page (not included in 3-5 page count)
- Five sections:
  - Introduction: What you intend to do
  - Methods: How you did it, quality of your data
  - Results: What you discovered
  - Conclusion:
    - Primary results and why it matters
    - Problems and/or successes
  - Minimum of two 8.5 * 11 inch maps (location & results)
    - In addition to the 3-5 typed pages
- Please don't put in plastic or other cover!

Getting a layout figure into Word or PowerPoint

- Go to the Share tab
  - Choose Layout Export
  - Choose the EMF (encapsulated Windows metafile format) or another compatible format
  - Write the *.emf file to your work directory
  - Go to the insert menu in Word or PowerPoint and choose the Picture, From File option
  - Select your *.emf file and it will be imported into your document



Word, PowerPoint, and ArcGIS

- You may have to crop the *.emf within Word or PowerPoint to get exactly what you want
- ALWAYS look at your product at least once before a PowerPoint presentation
- The guideline: One (1) PowerPoint slide per minute of presentation

Next week

- Lab final
  - During your lab time
  - Two hours to complete
  - Open book

Geographic Information Systems

Applications in Natural Resource Management

Chapter 10
Updating GIS databases

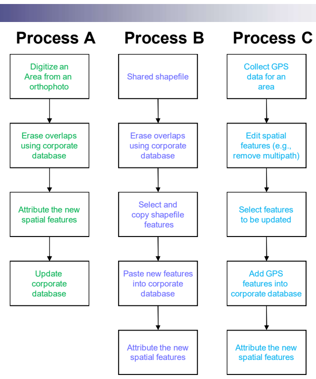
Michael G. Wing & Pete Bettinger

Chapter 10 Objectives

- Why GIS databases need to be periodically updated and maintained
- What issues might be associated with an update process
- What GIS processes could be used to physically update a database

GIS databases are rarely static

- Particularly in forestry and natural resources
  - Vegetation change due to time, disturbances, and management activities
  - Roads and trails are built and are sometimes obliterated
  - Stream conditions and structure changes
- GIS databases should be updated periodically to reflect changes that occur in resources over time
- Either the spatial locations, the attributes of the locations, or both will require updating
- The question is how often and thoroughly a database should be updated



Three examples of update processes related to a land acquisition.

GIS database updates

- Many organizations have developed processes and protocols to guide database updates
- The **update interval** is the ____________________
  - May range from hours to years
  - Will depend on organizational resources and database analysis goals

Organizational resources and goals

- Updates require investments of time and personnel
- If the goal of a forest management company is to generate revenue for stockholders
  - timber resources should be updated more frequently than other resources, such as hiking trails
  - updating resources such as roads, streams, and culverts may or may not be important
- In addition to determining the update interval, organizations will also need to determine what features are involved

Table 10.2. Inputs and process that can be used to assist a GIS database update.

Input:	
Digital photographs	
Hand-drawn maps	GPS features
Tabular databases	Field notes
A person's memory	GIS features developed by field personnel
GIS processes:	
Digitize	Scan
Join	Update
Link	Copy / paste
Import	Attributing
Querying & verification	Overlay

Annual Update Example

- Example: A forest management company in Florida has decided to update its forest stand inventory annually- why?
  - This stand inventory is perhaps the most important
  - Most corporations require an annual estimate of the value and volume of corporate holdings for tax and planning purposes
  - Given the relatively short rotation that is typical of industrial forests in the south, a longer update interval may not be sufficient
  - A shorter update interval will lead to increased costs and may add confusion among field foresters if databases change too often

Continual Update Example

- In Washington state, all forest management plans must be submitted to the Department of Natural Resources (DNR) for review and approval
  - A map must accompany the plan
  - Must show the relation of the proposed activities relative to the landscape and any surrounding stream systems
  - The DNR provides a statewide streams database for mapping purposes

Updating a streams database

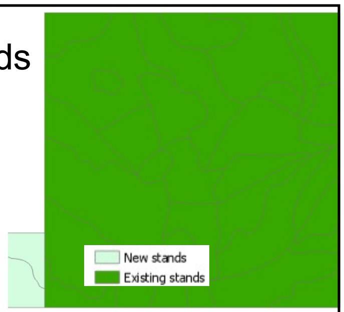
- The DNR streams database is continuously updated as new information becomes available
- A land owner that surveys a stream and notes changes from the DNR streams database can submit a change request
- The DNR has a review protocol for change requests
  - Requests are either denied or approved
  - Approved requests will be used to update the streams database
- Although several months or more may elapse in the reporting, review, and update process, this is considered a continual update since ______________________

Updating existing GIS databases with new landscape features

- Example 1: A land purchase results in the addition of two stands into an existing GIS database
- Example 2: Incorporating a new trail into a GIS database
- Both examples assume:
  - The new features were either digitized or measured with a GPS or other equipment and are available in a GIS database
  - The new features are initially stored separately from the existing resource database

Two new stands

- The owners of the Daniel Picket have purchased 80 acres (30.4 ha) adjacent to current land holdings



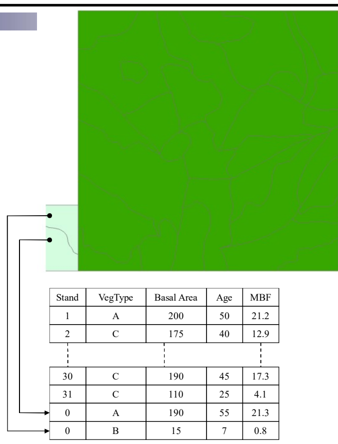
Stand	Acres	Vegetation type	Basal area	Age	MBF
1	42.6	A	190	55	21.3
2	37.4	B	15	7	0.8

Three options for updating

- Digitize the shape of the two stands into the existing stands database
  - Will require a manual entry of attribute data
- Use a merge process to combine the newly digitized stands into the existing stands database
  - Must ensure a perfect fit between the common edges of the new stands and existing stands databases
- Use the new stands layer and update command (ArcGIS Tool)
  - Best chance of a good fit between databases

Update Results

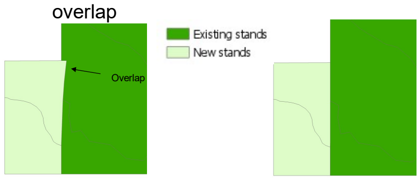
Figure 10.5. Daniel Pickett forest stands and land purchase area after updating the stands database using the land purchase GIS database.



Stand	VegType	Basal Area	Age	MBF
1	A	200	50	21.2
2	C	175	40	12.9
30	C	190	45	17.3
31	C	110	25	4.1
0	A	190	55	21.3
0	B	15	7	0.8

Ensuring a perfect fit: options

- Use snapping techniques while digitizing to force the new features to fit the existing
- Use GIS tools
  - Edit the new stands polygons so that they overlap the existing database, then
  - Use the existing stands layer to erase the overlap

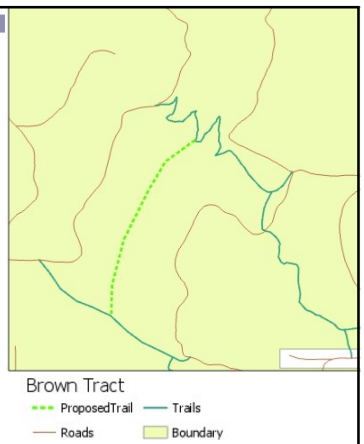


Updating a trails database

- The existing trail system for the Brown Tract was digitized several years ago from hardcopy maps
- Over time, people will tend to develop new trails on their own
  - These are know as unauthorized trails

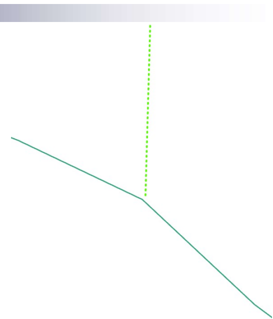
A new trail

- An unauthorized trails has emerged as a candidate for inclusion into the existing trail system
- The new trail's location is captured by a GPS and entered into a proposed trails GIS database



Integrating the new trail

- Check that the lines meet at intersections
  - Snapping tools may help in this process
- Some attribute work may need to be done manually



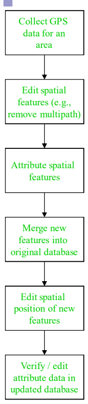
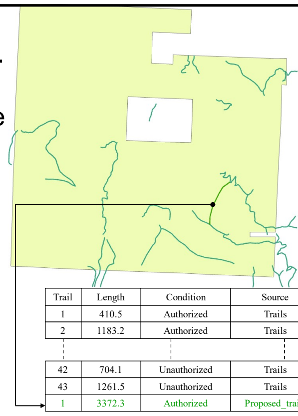


Figure 10.12. Updated trail system of the Brown Tract.



Trail	Length	Condition	Source
1	410.5	Authorized	Trails
2	1183.2	Authorized	Trails
42	704.1	Unauthorized	Trails
43	1261.5	Unauthorized	Trails
1	3372.3	Authorized	Proposed_trails

Updating a GIS database by modifying existing landscape features and attributes

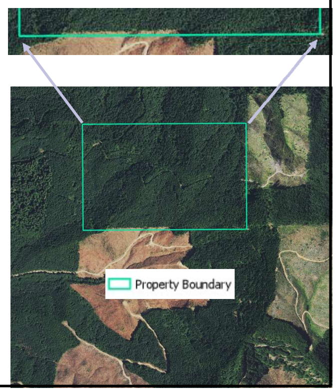
- This implies that we physically alter existing databases rather than previous examples where we created a separate database to capture changes
- Some danger in damaging the existing database
  - Make a copy
- May be difficult to detect and correct any mistakes unless processing steps have been carefully documented
- An examples: using a digital orthophotograph quadrangle (DOQ) to update position

Digital Orthophotograph Quadrangles (DOQs)

- Given that the projection of a DOQ exactly matches that of your existing databases, you can use DOQs to judge database accuracy in representing resources
- If the DOQ and is of sufficient quality, you can use it to create update information
  - You can digitize point, line, and polygon features directly from the DOQ
- DOQs are very common
  - Oregon Imagery Explorer
    - https://imagery.oregonexplorer.info/

Boundary Issue

- Property boundary being displayed on OSIP DOQ
- Reveals that either the boundary database has an error or that a harvesting operation was incorrectly located



Uncertain boundary can be adjusted

- Use the DOQ as a guide to adjust the vertices along the boundary database to match the DOQ line
- If precision and accuracy are an issue, you may want to capture the boundary location through a property boundary survey
  - Total station or survey GPS measurements
- Updates to the boundary database may impact other databases

Geographic Information Systems

Applications in Natural Resource Management

Chapter 12

Synthesis of Techniques Applied to Advanced Topics

Michael G. Wing & Pete Bettinger

Chapter 12

- Builds on the tools and techniques that were introduced in chapters 5-11
- Wraps them into three applied problem examples
  - Land classification
  - Recreation Opportunity Spectrum
  - Habitat suitability model with a road edge effect
- Demonstrates how techniques from previous chapters can be used in applied settings

Land classification

- Land classifications have many purposes in forestry and natural resource management
  - ______________________________
  - Framework for assessing management opportunities
  - Provide policy direction and implementation
    - Knowing what resources are available and where
- Land classifications are generally based on land characteristics that can be seen and measured
- Most natural resource organizations establish their management plans within a land classification framework

Land classifications for membership

- Land classifications may also be a requirement for stewardship programs
- The American Forest & Paper Association (industrial forest organizations mainly) requires that members comply with the Sustainable Forestry Initiative (SFI)

Oregon State Forest Land Classification System

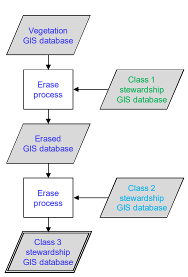
- Three main categories organized into an order of precedence
  - General stewardship
    - Most silvicultural and operational activities allowed
  - Focused stewardship
    - A limited set of management activities allowed
    - Can't be reclassified as general
  - Special stewardship
    - Very few forest management activities allowed
    - Can't be reclassified as focused or general
- Categories can't overlap spatially
  - This implies that GIS database development should start with the most restrictive category (Special stewardship) and work toward the most general
    - May need a series of query, buffer, clip, and erase operations to get to the final land class

Land classification: Brown Tract

- Class 1: (reserved) areas will contain meadows, research areas, rock pits, and oak woodlands.
- Class 2 (limited management) will be those areas of land that are within 50 m of streams, 100 m of hiking trails, 100 m of homes, and 300 m from any owl nest locations.
- Class 3 (general management) areas are assumed to contain land that remains after class 1 and class 2 management areas have been delineated.

Classification procedure

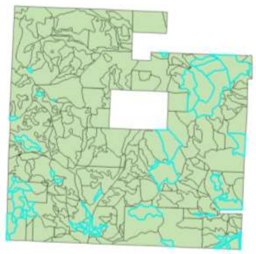
- The spatial rules for Class 1 and 2 could be applied to create GIS databases of associated areas
- A Class 3 GIS database could be created by erasing Class 1 and 2 areas from the Brown Tract



See Figure 12.2 for a flow chart of GIS processes that would support the creation of Class 1 and 2 areas

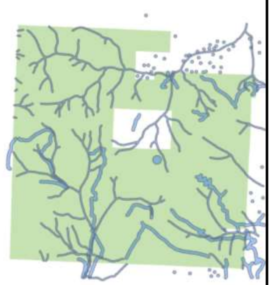
Land classification (Class 1)

- Class 1: (reserved) areas will contain meadows, research areas, rock pits, and oak woodlands.



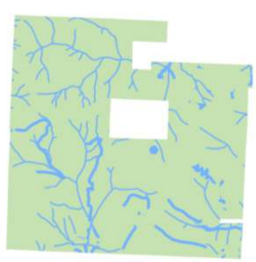
Land classification (Class 2)

- Class 2 (limited management)
- Areas within:
  - 50 m of streams
  - 100 m of hiking trails
  - 100 m of homes
  - 300 m from any owl nest locations



Land classification (Class 2)

- Class 2 (limited management)
  - after combining buffers and removing Class 1



Land classification (All Classes)

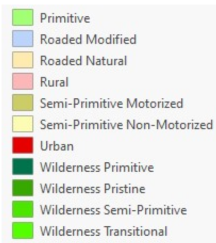
Recreation Opportunity Spectrum

- Developed by the USDA Forest Service (Clark and Stankey 1979) as a tool for:
  - ______________________________
  - for integrating these activities with other land uses
- The ROS is used to describe and identify recreational settings
  - Describes the likelihood of recreational opportunities along a spectrum which is divided into several categories that combine aspects of location and remoteness
  - An opportunity is an area that may yield certain experiences

Rules for evaluating ROS space

Primitive (P)	Areas of land greater than 1.5 miles from a road.
Semi-primitive, non-motorized (SPNM)	Areas of land which are greater than 0.25 miles from a road, have forest stands ≥ 50 years of age, and are ≥ 202.3 hectares (500 acres) in aggregate size.
Semi-primitive, motorized (SPM)	Areas of land which are greater than 0.25 miles from a *paved* road, have forest stands ≥ 50 years of age, and are ≥ 202.3 hectares (500 acres) in aggregate size.
Roaded natural (RN)	Areas of land with stand ages ≥ 50 years, and ≥ 16.2 hectares (40 acres) in aggregate size.
Roaded, managed (RM)	Areas that do not fit into any of the other classes.

Applying ROS to the Siuslaw NF



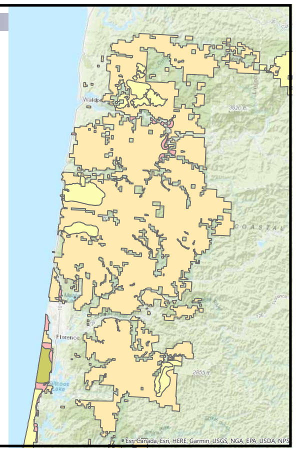
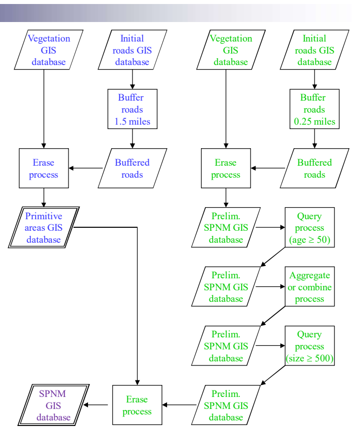


Figure 12.5. Hierarchy of intermediate and final GIS databases created in the development of the primitive and semi-primitive portions of a recreation opportunity spectrum map.



Habitat suitability model with a road edge effect

- Habitat suitability models provide managers with a glimpse into the potential of a landscape to support habitat for specific wildlife species
- These models generally take the geometric mean of two or more variables that represent or influence the occurrence and abundance of a particular wildlife species
- While some debate exists as to their usefulness and accuracy, habitat suitability models do allow managers to examine the relative quality of one area versus another with respect to a particular species

Vole habitat suitability index (HSI)

- HSI = *f* (basal area, age, distance from roads)
- HSI calculation = (basal area score * stand age score * distance from road score) $^{1/3}$
- Values must be assigned to each variable based on research, professional advice, field data, or other means

HSI values

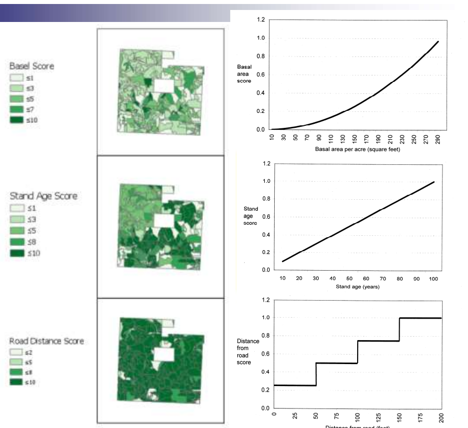


Figure 12.10. Hierarchy of intermediate and final GIS databases created in the development of an analysis of a potential wildlife habitat suitability (HSI) areas for a vole on the Brown tract.

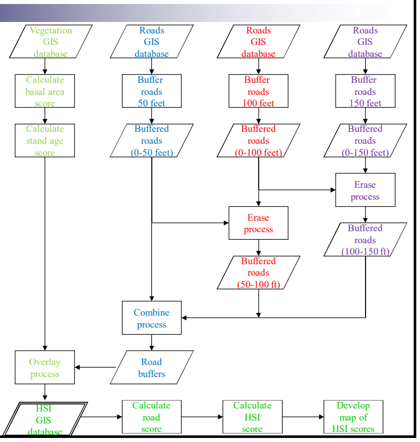
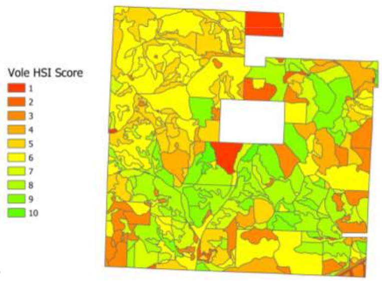


Figure 12.9. Habitat suitability scores for a vole on the Brown tract.



- 1 Poor habitat
- 10 Optimal habitat