GIS on TAP:

Transportation Analysis Process on the Hiawatha National Forest

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Where we are
What is TAP?

- Transportation Analysis Process
- Part of the Forest Service Transportation Management Rule (2005)
Requires Forests to:
- Identify *minimum road system* for safe/efficient travel and for administration, utilization and protection of National Forest System lands.
- Incorporate science-based roads analysis
- Identify National Forest System roads that are no longer needed to meet resource mgmt objectives
Roads on the West Zone
Roads on the West Zone

3938 non-Private Roads in the West Zone
Transportation Analysis Process

- Defined in the Travel Mgmt Rule
- Resource specialists in the Regional Office defined 30 questions to be answered in the analysis (for the 14 Eastern Region Forests & 1 Prairie)
- Standardizes the criteria within the Region
How we would do this

- 30 resource area risk/benefit questions would be answered for each road segment.
- These answers would be in a score form, 0-5.
- Segment scores are averaged for risk questions and benefit questions (SummaryRisk, SummaryBenefit)
- Summary scores are categorized into High/Med/Low risk and High/Med/Low benefit
The 30 Questions

- Grouped by Resource Area
- Mix of Risk/Benefit questions
- Addressed Access, Wildfire Hazard, Invasive Species, Heritage/Cultural, Wildlife, Recreation, Watershed, Soils, Forest Health/Veg Mgmt
The Questions – benefit examples

- **AC₁** – Does the road provide access to private or non-FS land?
- **AC₃** – Does the road provide access to FS Admin site or developed recreation site or trail?
- **WFH₁** – Does the road provide access to or within a unique fuel/fire hazard situation?
- **VSF₁** – Does the road provide access for future silviculture/restoration on suitable lands?
The Questions – risk examples

- **IS₁** - Does the road segment have non-native plant populations found within 100ft?
- **HC₂** - Are cultural resources (Archaeology sites) located within 100ft of the road?
- **SOIL₂** – Does the road cross poorly/somewhat poorly / very poorly-drained soils?
- **WAB₃** – Does the road have a stream crossing characterized as a barrier to aquatic passage?
The Analyses

Some were fairly simple proximity or intersection processes.

- Is the road within 100ft of a stream or water body?
- Does the road cross unstable soil types?
- Is the road part of an existing fuel break or control line for prescribed burning?
The Analyses

- Others were more interesting...
  - Does the road provide access to a unique fuel/fire hazard situation?
  - Does the road segment occur within 100ft of an inventoried Invasive Species infestation AND is within one mile of an ecologically significant area, such as a Wilderness, Research Natural Area, and known rare plant communities?
The Scores

• Results of analyses are scored, 5 = high to 0 = low/none for road segment in each question.
• Average Risk and Avg Benefit score calculated for each road segment.
• Categorized Risk and Benefit scores to High/Medium/Low
### The Scores

| SummaryBenefit | SummaryRisk | RiskCategory | BenefitCategory | AC1 | AC2 | AC3 | AC4 | HC1 | HC2 | HC3 | IS1 | IS2 |
|----------------|-------------|--------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 2.142857       | 0.777778    | MEDIUM       | MEDIUM          | 0   | 0   | 0   | 0   | 2   | 0   | 0   | 0   | 0   |     |
| 1.428571       | 0.666667    | MEDIUM       | LOW             | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   |     |
| 2.142857       | 1.111111    | HIGH         | MEDIUM          | 5   | 0   | 5   | 0   | 5   | 0   | 0   | 0   | 0   |     |
| 0.714286       | 0.333333    | LOW          | LOW             | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |     |     |
| 0.714286       | 1.666667    | HIGH         | LOW             | 0   | 0   | 0   | 0   | 5   | 0   | 0   | 0   |     |     |
| 2.857143       | 0.666667    | MEDIUM       | MEDIUM          | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
| 1.428571       | 0.666667    | MEDIUM       | LOW             | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
| 2.142857       | 0.666667    | MEDIUM       | LOW             | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
| 1.428571       | 0.666667    | MEDIUM       | LOW             | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
| 2.142857       | 0.666667    | MEDIUM       | MEDIUM          | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
| 2.142857       | 0.666667    | MEDIUM       | MEDIUM          | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
| 0.714286       | 0.666667    | MEDIUM       | MEDIUM          | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
| 2.857143       | 0.666667    | MEDIUM       | MEDIUM          | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 5   |     |
The Results

- End product is a data set you can use to identify roads by risk/benefit category.
- This will allow us to prioritize high risk/low benefit road segments for further review in Travel Management.
- Dataset can also be used in future project-level planning.
The Results
The Challenges

- Gathering data... Some is readily available, some not... Are you collecting data you need?
- Learning new tools (Network Analyst)
- Solving spatial problems (well, this can be the fun part, too)
The Fun Stuff

- Learning the new tools!
- Solving spatial problems!
- Long meetings going over minor policy details! (OK, maybe not. And this didn’t happen, anyway.)
Several questions required analyzing if a road segment would be used in accessing a feature (parcel, rec site, timber stand...)

This would be potentially painful to do by hand, depending on the number of locations to check.

Use Network Analyst extension to facilitate this.
Network Analyst

- Requires a Network Dataset
- Can solve several types of analyses: Shortest Route, Service Area, Closest Facility, Location-Allocation, others...
- Building this dataset can take some time, depending on detail needed (turn rules, one-way segments...) and is beyond this discussion.
Access Question asked if the road provided access to Private/non-FS land.

- For the TAP analyses, we used Closest Facility.
- We needed to identify ‘destination’ points on non-FS lands, and solve for routes to each point from our ‘start’ points (FS office locations)
Network Analyst in TAP

- Clip roads by Private Ownership lands to get Roads on Private.
Network Analysis in TAP

- Generate Centroids of these line segments to get destination points on Private.
Network Analyst in TAP

Start a new Closest Facility analysis, Load the Private points into the ‘Incidents’ class, Load your start points into ‘Facilities’, and Solve...
Network Analyst in TAP

- Route solutions are generated.
Ok. Geek Time.

- The tool I love most now is the Tabulate Intersection tool.
- Makes calculating percent-of-coverage WAY easy.
- Works on Polygons, Lines, and Points
Summary

Computes the intersection between two feature classes and cross-tabulates the area, length, or count of the intersecting features.

Illustration

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Tabulate Intersection: Area within 100ft of Road that has been surveyed for Heritage Resources
Lessons?

- Start early – things always take longer than you initially thought...
- Data will be the lynch pin. Do you have it? Can we find a substitute? Is there enough? Is it clean enough?
- Be creative. If problem-solving isn’t rewarding, you’re in the wrong line of work...
Questions?

Thanks!

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