

**APPENDIX B – ANALYTICAL PROCEDURES FOR DETERMINING ROAD VALUE
AND RISK
ARAPAHO/ROOSEVELT NATIONAL FORESTS AND PAWNEE NATIONAL GRASSLAND
FOREST LEVEL ROADS ANALYSIS**

To begin the analysis process all geographic information system (GIS) and Forest Service INFRA database for roads were used to produce a preliminary inventory of the maintenance level 3, 4, and 5 roads. With this initial inventory displays both on maps and on spreadsheets (road-by-road segments), the most knowledgeable people about the Arapaho and Roosevelt National Forests and Pawnee National Grassland (ARP) road system, the Ranger District personnel, were huddled for a 1 to 2 day meeting at each of the district offices to do the initial evaluation of each road segment. Various criteria were developed (much more than finally reported in this analysis), a multitude of notes were taken, and errors in the database were corrected during these extensive meetings.

The interdisciplinary team (IDT) then reviewed this District data. Some of the IDT members (e.g., recreation, range) were able to utilize the District valuations without much additional analysis. Other IDT members needed to do much more extensive analysis using the ARP's spatial geographic information systems data to develop a final value or risk rating for each road segment.

The following analytical descriptions are those additional process the IDT members developed for their criteria's final evaluation to either a High or Low rating.

Value Assessment

HAZARDOUS FUELS AND TIMBER RESOURCES

During the District meetings the District specialists determined the value ratings of roads for access to lands suited and available for timber production given local knowledge and historical use. At that time they also determined the value of roads for access to lands for fuels profile modification and fire protection. The value of individual 3-, 4-, and 5-level roads on the Arapaho and Roosevelt National Forests and Pawnee National Grassland were evaluated using the ARP Forest Plan Database and Fire_Hazard coverage developed for the National Fire Plan. All this data resides within our Geographic Information System (GIS). This Arcview GIS coverage is stored in:

Office/rap/gis/forest/arcview/lands and the project name is tmsuit_firehaz.apr.

Value Ratings for Suited Lands

The District personnel rated the Forest Service roads for access to lands with suited and available timber on a scale of 0-2 based on whether or not the road itself had historical access to suitable

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lands (2) or a potentially suited and available lands (1). If the road was neither, it was assigned a ranking of 0.

0 = low value (suited and available for timber production lands)

1 = moderate value (not historically accessed but identified as suited and available for timber production lands)

2 = high value (historically accessed and identified as suited and available for timber production lands)

Further analysis required that those identified at the Ranger District be classified as either low or high. For the moderate ratings the method of designating a moderate either a high or low was determined by the likelihood of timber harvest in the area in the next 20-year period. This was done with local knowledge and evaluating GIS information.

Value Ratings for Fuels and Fire Protection

District personnel rated the Forest Service roads for access to lands with potential for high fire hazard value on a scale of 0-2 based on whether the road accessed lands with a high fire hazard rating (2) or a moderate rating (1). If the road was neither, it was assigned a ranking of 0.

0 = low value (low fire hazard)

1 = moderate value (moderate fire hazard)

2 = high value (high fire hazard)

Further analysis required that those identified at the Ranger District be classified as either low or high. For the moderate ratings the method of designating a moderate either a high or low was determined by the risk of fire starts in the area and the values at risk. This was done with local knowledge and evaluating GIS information.

Risk Assessment

WILDLIFE and RARE PLANTS

Ten criteria, listed below, were used to analyze road segments using GIS. These criteria are consistent with important species and key habitats identified in the 1997 Revised Forest Plan. All ten criteria are used for the Forests. Criteria 1, 2 and 7 were used for the Grassland.

Forest road segments are rated as high concern if a score of 2 occurs for any of the criteria 1, 3 or 4. Also, if the segment has a 'sum of scores' of 6 or higher for all criteria it rated high concern. The remaining segments were rated low concern.

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Grassland road segments are rated as high concern if a score of 2 occurred for criterion 1, or if the ‘sum of scores’ is 3 or higher for all criteria. The remaining segments were rated low concern.

1) Threatened, Endangered or Sensitive Species (TES) – used Colorado Natural Heritage Program data for locations of federal endangered, threatened or proposed and FS sensitive species occurrences (animal and plant)

- 2 --- segment \leq 300 feet from rare species points or polygons
- 1 --- segment $>$ 300 feet and \leq ½ mile from rare species points or polygons
- 0 --- segment $>$ ½ mile from rare species points or polygons

2) Rare Plants and Communities -- used Colorado Natural Heritage Program data for locations of occurrences that are not already in TES (see above). That is, the remainder of occurrences after TES has been considered (above).

- 2 --- segment \leq 300 feet from rare species points or polygons
- 1 --- segment $>$ 300 feet and \leq ½ mile from rare species points or polygons
- 0 --- segment $>$ ½ mile from rare species points or polygons at

3) Preble’s Meadow Jumping Mouse Habitat -- area within 300 feet (each side) of perennial streams at or below 7600 in feet elevation within the Arapaho and Roosevelt National Forests (not the Pawnee National Grassland).

- 2 --- segment \leq 300 feet from mouse habitat
- 0 --- segment $>$ 300 feet from mouse habitat

4) Lynx Habitat and Linkage Areas – used latest lynx habitat map and linkage areas that are defined by Regional Forest Service standards

- 2 --- segment intersects linkage areas
- 1 --- segment intersects lynx habitat (denning, forage, other and unsuitable types)
- 0 --- segment not in habitat or linkage areas

5) Old Growth (OG) – used the Forest-wide old growth forest inventory that was mapped in GIS for the 1997 Revised Forest Plan

- 2 --- segment \leq 100 feet from existing OG
- 1 --- segment \leq 100 feet from will---be OG
- 0 --- segment $>$ 100 feet from existing or will-be OG

6) Interior Forest – used Forest Plan GIS maps

- 2 --- segment \leq 500 feet from interior forest on both sides from segment
- 1 --- segment \leq 500 feet from interior forest on one side from segment
- 0 --- segment $>$ 500 feet from interior forest

7) Habitat Effectiveness – used Forest Plan GIS maps

- 2 --- segment is in mapped effective habitat (i.e., a road closed to public travel)
- 0 --- segment is in mapped non-effective habitat

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8) Calving, Kidding or Lambing Areas – used Colorado Division of Wildlife Resource Information data

- 2 --- segment \leq ½ mile from reproduction areas
- 1 --- segment $>$ ½ mile and \leq 1 mile from reproduction areas
- 0 --- segment $>$ 1 mile from reproduction areas

9) Migration Routes/Road Crossings – used Colorado Division of Wildlife Resource Information data

- 2 --- segment intersects with identified wildlife crossing or migration route
- 0 --- segment without intersection from identified wildlife crossing or migration route

10) Riparian Habitat – used polygons defined for Arapaho and Roosevelt National Forests

- 2 --- segment intersects riparian
- 1 --- segment \leq 150 feet from riparian
- 0 --- segment not in riparian

CULTURAL RESOURCES

The cultural resource risk of individual 3-, 4-, and 5-level roads on the ARP were evaluated using the ARP cultural resource GIS atlas. This atlas is a database of locations of cultural resources that have been identified and evaluated for their eligibility to the National Register of Historic Places. This database does not include *all* cultural resources on the ARP, since only a small percentage of the forests and grassland have been inventoried.

The risk posed to cultural resources by Forest Service roads was quantified according to proximity to NRHP-eligible sites. A 1981 study by Nickens et al. demonstrated that archaeological sites that are located within ¼ mile of a road have an increased chance of being damaged by “pothunters.” Most looters will not travel a greater distance than ¼ mile carrying excavation equipment.

Risk was ranked according to the following criteria:

- 0 = no known risk (no eligible sites located within ¼ mile of the road)
- 1 = low risk (unevaluated sites located within ¼ mile of the road)
- 2 = moderate risk (one or more NRHP-eligible or listed sites located within ¼ mile of the road)
- 3 = high risk (ARP employees have reported sites looted near the road)

These categories were later consolidated into two categories as follows:

L = low risk (no known eligible or unevaluated sites located within ¼ mile of the road)

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H = high risk (one or more unevaluated or NRHP-eligible sites located within ¼ mile of the road)

Again, roads ranked L should not be considered “low risk,” but “unknown risk,” since this group includes roads in areas that have not been surveyed for cultural resources. A very small percentage of the Arapaho and Roosevelt National Forests and Pawnee National Grassland have been surveyed for cultural resources.

WATERSHED CONDITION

A two-pronged approach was developed for assessing the effects of roads on water, soil and aquatic resources. The first was to assess the inherent sensitivity of sixth-code (5,000 to 40,000 acre) watersheds on the Forests and Grasslands to roads, and the second was to rate the risk that individual maintenance level 3, 4, and 5 roads pose to watershed and aquatic resources.

Because this analysis included all 2-wheel drive roads, quantitative data on each road was not available and a site visit to each road was not done. A series of matrices were developed that used existing assessments and information sources and could be used to develop a rating for each road and watershed. Factors that were considered in the matrices were derived from existing sources and from GIS. They included:

- Watershed condition class from the 1997 Revised Forest Plan revision watershed assessment for sixth-code watersheds
- Watersheds identified as containing high value fisheries from the Inland West Watershed Initiative (IWWI)
- Sensitive and granitic soils identified in the Forest soil survey. Sensitive soils were selected by the Forest soil scientist and included wetland and riparian soils and highly erosive soils
- Proximity of streams to roads, stream crossings by roads, and road density
- Road impacts or problems identified by staff on the Ranger Districts
- The Forest GIS allowed us to look at spatial relationships of watersheds, soils, streams, and roads.

A total of eight matrices were developed. The first two matrices assessed the inherent sensitivity of sixth-code watersheds to watershed impacts and the value of aquatic resources in the watersheds. The following four matrices rate the watershed impacts of all roads within a watershed (not only level 3, 4, and 5 roads). The final two matrices assess the impacts of individual level 3, 4, and 5 roads and assign a high or low risk rating to the road. An annotated spreadsheet showing the matrices is attached.

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Forest-Wide RAP - Level 3, 4, and 5 Roads

This spreadsheet, documents the process calculated in the following spreadsheets to determine the Watershed Road Rating

Matrices

Notes:

The first six matrices all consider the effects of roads on 6th-code watersheds

Matrix 1

		Watershed Condition Class		
		I	II	III
High Value	Y	H	H	H
Fisheries	N	L	M	H

High Value Fisheries: High Value or TES fisheries (from IWWI)

Matrix 2

		Sensitive Soils		
		H	M	L
Granitics	H	E	H	M
	M	H	H	L
	L	H	M	L

% soils within a watershed that are sensitive or granitic
H>35%, M16-35% , L<16%

Matrix 3

		Road Proximity		
		H	M	L
# of Road	H	E	H	H
	M	H	H	M
Crossings	L	H	H	L

Roads were considered proximate if they were within 150 ft. of a perennial or intermittent stream.

<u>Road Proximity</u>		<u># of Crossings</u>	
H	>55%	H	>0.6%
M	30-55%	M	0.3%-0.6%
L	<30%	L	<0.3%

Matrix 4 - Road Effects

		Proximity X Crossing			
		E	H	M	L
Road	H	E	H	H	M

Road Density (mi./sq. mi.)

H >3.7

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Density	M	E	H	M	L	M	1.7-3.7
	L	E	H	M	L	L	<1.7

Matrix 5 - Watershed Sensitivity

Watershed Condition x Fish

		H	M	L
Sensitive	E	E	H	M
	H	E	H	M
Granitics	M	H	M	L
	L	H	M	L

Matrix 6 (1) - Watershed Risk

Watershed Sensitivity

		E	H	M	L
Road	E	E	E	H	M
	H	E	H	H	M
Effects	M	H	H	M	L
	L	M	M	L	L

Matrix 6 (2) - Watershed Risk

The original matrix 6, identified as (1) contained both E and H ratings. However, matrix 8, the road rating matrix was not sensitive to the difference between E & H, so E was dropped the matrix was replaced with (2), shown below

Watershed Sensitivity

		E	H	M	L
Road	E	H	H	H	M
	H	H	H	H	M
Effects	M	H	H	M	L
	L	M	M	L	L

Matrix 7 - Road Contribution

		Y	N
District ID'd problem?			
Road Crossings?			
Road Proximity to Stream?			
Road in TES watershed?			
Sensitive, granitic or wet soils?			

- Info from district RAP meetings
- Greater than one crossing per mile, if more than one crossing?
- Greater than 35% of road along stream(s)?
- is the road in a watershed that contains aquatic TES species?
- Is the percent of the road length constructed on sensitive or granitic soils greater than the district median for 3,4, & 5 roads

Matrix 8 - Road Rating by Watershed

Watershed Risk

H M L

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Road	5		H	H	H
Contribution	4		H	H	H
	3		H	H	L
(# of "y"	2		L	L	L
answers)	1		L	L	L
	0		L	L	L

*The "E" column (extreme) was eliminated because the matrix result from "E" and "H" ratings were the same.