Willamette National Forest Pilot Road Analysis

Appendix F

Fire and Fuels Process Paper

October 1998

Background

The Willamette National Forest observes a moderate to high fire activity load during each fire season. Normally, fire seasons on the Forest occur from June 20 to October 15, each year (1). Fire occurrence for the Forest from 1970 through 1994 (25 years) indicates the Forest average fire loaded is 0.453 lightning fires per ten thousand acres and 0.42 human caused fires per ten thousand acres, annually (2). Current Federal Wildland Fire Policy states: *fires are to be suppressed at minimum cost, considering firefighter and public safety, benefits, and values to be protected, consistent with resource objectives* (3).

Roads are an important factor, both positively and negatively, in the nature of wildland fire and fuel management on the Willamette National Forest. Roads networks provide a positive benefit by allowing travel access to and from forested areas for fire suppression and fuel management activities . They provide access to and from water sources, lookouts, helispots and other fire resources. Within the Forest roaded areas, suppression response time is reduced increasing efficiency and effectiveness of firefighter suppressing both human and natural fires. Roads also provide barriers or fire breaks for fire suppression and fuels activities. From a safety standpoint, roads provide anchor points for line construction, escape routes, and in some cases safety zone for both wildland fire and prescribed fire personnel. In some cases wildland fire strategies have been developed around road networks (4).

Contrary to the positive benefits forest roads and other forms of transportation systems provide for firefighters, they also they also have negative aspects. These effects are increases in risk of ignitions of human caused fires. Human caused fires along roadways throughout most the Forest have a random distribution. However, there are geographical, public high uses, areas which have higher frequencies of fires. In some cases, data analyzed indicates, these areas have significantly higher human caused fire frequencies. The majority of these areas were identified along major State of Oregon highway corridors and a railroad transportation systems within the Willamette National Forest boundary.

Disturbances of forested areas by fire can change ecosystems and interacts with geomorphic processes. The geomorphic processes from the fire and road construction to harvest fire-killed timber can have an important effect on the overall rate of erosion (5).

Process Description and Documentation

1. How do roads provide for or affect protection in terms of efficiency, effectiveness and safety?

Fire Suppression (Efficiency, effectiveness, and safety)

Historically, road systems have provided for an efficient transportation route for an appropriate fire suppression response on the Forest. Roads have normally been associated with strategies and tactics that were the most cost-effective commensurate with objectives for management areas in which the fires occur (6).

The level of fire suppression efficiency was measured for the Forest by an analytical process known as the National Fire Management Analysis System (NFMAS) in 1994. NFMAS

objectively measured the net value change between the fire protection program, fire related cost, and resource losses on the Forest. This process identified the most efficient organizational needs for fire protection and proposed the most efficient funding level for the Forest fire protection organization.

Efficiency of transportation by emergency and other vehicles on Forest road systems played a key role in the NFMAS process. Vehicles were utilized, as the primary mode of transportation, in 87% to 90% of representative fires analyzed. The primary reason for the high utilization of vehicles was due to the high road density on the Forest.

Within NFMAS, fire management analysis zones were identified based on access and travel management within ranger districts boundaries and whether or not the area is designated as wilderness. Within the Forest, three nonwilderness zones were identified for each ranger district based on the primary type of initial suppression actions historically taken on wildland fires (1). The percentages of the initial suppression responses are shown below in *Table 1.* The "roaded-engine/hand" are initial attack forces going to the fire being transported in a vehicle or engine. The "remote hand" initial attack forces require walk in time, in addition to the vehicle travel time on existing Forest road systems.

Table 8. Forest Suppression Response Method

Forest Area-NonWilderness	Primary Suppression Response Method	Percent of Fires
Detroit / Sweet Home RD's	Roaded - Engine/Road - Hand	89%
	Remote - Hand	11%
Blue River / McKenzie RD's	Roaded - Engine/Road – Hand	90%
	Remote - Hand	10%
Middle Fork RD	Roaded - Engine/Road - Hand	87%
	Remote - Hand	13%

Based on the scope of the Forest Road Analysis, data, and time frames available to identified site specific changes in the road systems, quantifiable to changes to fire protection efficiency and effectiveness will not be analyzed in this process paper. The Forest Fire Managers are planning to calibrate NFMAS by March of 1999. The scope of this analysis should address travel management as a key issue or theme. If travel management is identified as an issue, base on current and future road closures, primary suppression response methods will be adjusted in the analysis. These adjustments, if made, will adjust the frequency of the distribution of the representative fires in the analysis. The change in frequency of the distribution will change the acres represented in the "roaded-engine/road-hand" and apply those acres to the "remote-hand". To apply this process road closures, future road closures and acres those road closures represent will need to be identified within the Forest's 3 non wilderness Fire Management Analysis Zones (FMAZ). This process will allow for frequency distribution changes to be utilized and will provide a detailed look at the net-value change for fires in areas where road closures occur.

The example in *Table 2* illustrates the estimated adjustment to the acreage on the Forest given a 2% frequency change in the NFMAS calibrations for suppression methods for firefighters traveling to fires. Again, this is just an example to reflect a change on Forest if road system being closed were to change suppression from "roaded-engine/road-hand to "remote-hand" in approximately 38,000 acres.

Table 9. *(Example)* Effect of Acreage Change with a 2% Change in NFMAS Frequency for Initial Attack Transportation Method

Suppression Method	**Current Acres (Forest wide)**	**Acres Change @ 2% Freq. Change in NFMAS (approx. 38,000 acres**
Roaded - Engine/Road - Hand	1,180,000	1,142,000
Remote - Hand	118,600	156,600

The example in *Table 3* illustrates the change of expected burned acres and cost plus the net-value change if a 2% frequency change (38,000 acres) was made in the NFMAS analysis on Forest.

Table 10. *(Example)* NFMAS Cost Plus Net-value Change and Burned Acres @ 2% Frequency Change

(Acres and dollar amounts are set at -30% Most Efficient Level and expressed in 1993 dollar values)

	Acreage change	**Expected Burned Acres**	**Cost + NVC** (1000 Dollars)
Current NFMAS Theme	0	1014	$8,902
NFMAS Theme @ -2%	38,000	1274	$9,645
Difference	38,000	+260	+$743

Safety in relation to road systems and travel management on Forest, along with all other safety considerations, will be the highest priority for firefighters and publics. When considering fire responses to wildland fires, fire managers along with firefighters need to identify tactics and strategies that do not compromise safety of firefighters. Issues such as road surface type and condition, road clearances, visibility of roadways on corners, maintenance levels, and traffic levels are just a few of the safety or possible safety issues emergency vehicle drivers deal with when responding to wildland fires. The scope to this analysis at a Forest level was too broad to deal with site specific and random information that requires on site data needs. In addition, the data sets are not currently available, and the time frame for this analysis was too restrictive to identify all the fire suppression safety issues as they relate to roads systems on a Forest scale. We would suggest that future analysis occur at the watershed level through water shed planning, NFMAS, and wildland fire situation analysis to answer questions relating to firefighter safety and access management travel.

When road maintenance issues are identified during fire suppression, corrective actions are taken. Many of these issues are as simple as brushing out narrow roads, grading roads, or doing other maintenance work to make road systems safe for travel by firefighter. When safety issues dealing with access and travel management on Forest cannot be mitigated, other forms of suppression transportation or methods of suppression actions will be utilized, by fire managers.

Access for Fuels Treatment and Management

It is anticipated, future fuel management and prescribed burning on the Forest will decline at the activity fuel project level and may increase on a ecological landscape scale. Activity fuel treatment projects funded by trust fund accounts on the Forest have been decreasing since the early 1990's (7). In 1996-97 a forest-wide Fire Management Plan was developed to identify the role of prescribed burning, within LSR's, at an ecological landscape level. In addition, a wilderness prescribed natural fire plan was developed for three of the wilderness areas on the Forest. It's anticipated that roads and road networks leading to and from activity fuel areas will not change significantly in the near future. This is based on the activities and access needs normally associated within watershed planning areas. In the future, if management ignited fires (MIF) are used to meet wildland fire objectives at an ecological scale, road systems maybe be utilized to provide for effective barriers during the ignition and holding stages of the prescribed burn. At this time, however, this program is still in the planning stage with no site specific prescribed burns planned that can be analyzed in regards to road access. Again, these are issues that are best analyzed and managed at the watershed level and not at a forest level. In regards to safety, fuel management would be address the same as in subsection "A. Fire suppression" portion of this process paper. Safety is recognized as the number one priority for local fire managers dealing with access travel management to and from activities, and needs addressed at a site specific or within each watershed level.

Access to Fire Resources

Fire resources are defined as lookouts, helibases, developed water sources, developed incident base camp locations, radio hill top sites, preattack fire breaks, helispots, and other related areas on the Forest. These resources were developed to support fire activities and safe factors relating to fire detection, fire prevention, Forest communications, and suppression of wildland fires.

An analysis of these resources was not done in relation to access and travel management, due to the nature and of the scope of this analysis.

Helispot, preattack fire breaks, and developed water sources need to be review at the watershed level scale and not at a Forest scale analysis. Road access to permanent lookouts and radio hill top sites or trail heads leading to those facilities need to be retained and maintained due to investments in the facilities, personnel safety factors, and communications network they provide for the Forest. At this time the only developed incident base camp within the Forest is the Hills Creek Dam site, located five miles southeast of Oakridge, Oregon. This site is located on Corp of Engineer lands under special use agreement with the Forest (see *Table 4*, below).

Table 11. Fire resources located on Forest

Type of Resource	Number of Resources on Forest
Lookouts (permanent)	4
Lookouts (other)	3
Radio Base Hill Tops	11
Heliports (not on FS lands)	2
Developed Water Sources	281
Helispots	79

2. How do roads increase the risk of fire occurrence?

Public Access in Relation to Fire Occurrence

Public access to National Forests is an important issue. Undoubtedly, the high density of roads on the Forest have contributed to a higher frequency of human ignitions in some areas (4). Also it can be assumed that public high uses areas have higher then average human ignitions. The randomness of each fire occurrence makes it very difficult to analyze.

Historical fire occurrence data on the Forest was assessed to determine if there was any correlation in human fire occurrence on the Forest to road density and high public uses areas. The historical fire occurrence data set was utilized to assess the fires that occurred on the Willamette National Forest between the years of 1970 and 1994. Also reviewed at the Forest scale were the spacial relationships between high intensity fuels models, dry southern aspects, areas where slope was greater then 50%, and human fire occurrences across the Forest.

Table 5 shows the number of human caused fires for standard road densities identified on the Forest. The statistical information is from fires occurring between 1970 though 1994.

Table 12. Human Caused Fire by Road Density

Road Density Mile/Milė	#'s of Human Caused Fire/ Road Density
0	270
0-2	244
2-4	618
4-6	485
6-8	69
>8	12

The road density assessment does not indicate a correlation in road mile density and human caused fires on the Forest. The frequency and distribution of human caused fires may be related to factors other then road densities. At this point more analysis is needed.

Greater access to such areas as dispersed campsites, backcountry camping and hunting may contribute to the higher incidence of human-caused fires – up to a point. Areas with the highest road densities are generally highly industrialized and therefore are less appealing to recreationists and hunters as camping sites.

The assessment at this time doesn't verify the need to alter, close, or change road systems based on just human caused fire occurrence.

Human caused fires were also reviewed from a non statistical process by identifying areas on a GIS created map with human fire occurrences. Occurrence data was overlayed and reviewed with transportation systems on the Forest, high intensity fuel within the Forest, slopes greater then 50% slopes and southern aspects. Identified were the high-risk areas based on fuel model, slope, and aspect in relation to fire occurrences. Nine areas were identified with high human caused fire occurrences for the 25 year period. None of the high occurrence sites identified had significant amounts of high-risk areas associated in them. Three of the nine areas were identified to have very high occurrences of human caused fires. The first was the Lookout Point area northeast of Oakridge, Oregon. High human fire occurrence in this area was due to a high frequency of railroad fires in the early 1970's through the early 1980's. The Forest area surrounding the Oakridge area also had a high occurrence rate due to the high amount of recreational activities outside the Oakridge City limits and occurrences along the Oregon State Highway 58 corridor. The third area was in the Upper McKenzie river area. The Upper McKenzie area is a very high recreational area during the summer.

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3. How do roads affect the fire protection in the urban interface?

An assessment for road affects on Urban interface within the boundaries of the Willamette National Forest was not accomplished. This was due to short time frames of the process and quality of information available on a Forest scale. Assessment for affects on Urban interface will be recommend to be accomplish at local levels where public comments and information can be utilized to make site specific evaluations for each area of concern.

Interpretation

This assessment presents limited results due to time frames and process time. The nature of fire protection and assessment of fire protection of this scale is limited by well define information that can be utilized to identify cause and effect. Besides GIS data, studies and information sources on Forest and nationally are very limited when discussing fire management and road issues, however this is a good starting point. In this assessment there was not a determination on the values of roads in relation to fire protection and impacts to fire protection if road were closed. To assess values of roads in relation to fire protection and cost, quantifiable information, such as miles of road to close, site specific locations, and types of closures will need to be determined in advance of the analysis.

Future fire management issues dealing with road access will be a key issues on the Willamette National Forest this winter. The Washington National fire management group has request all National Forests in all Regions to calibrate NFMAS. The fire managers on the Forest have already identified that changes in road systems are forthcoming. Areas that were once accessible by roads four to five years ago are blocked or no longer in existence. Changes in current road access, availability of road access, or future access will need to be analyzed. This ultimately will influence strategies, tactics, burned acre area, and budgets on the Forest in the future.

Process Critique

Time of the year and process knowledge were key factors during the assessment. My lack of technical capabilities in GIS and not having good processing time was lacking thought the first month of the project. Lack of quality technical information relating to the effects of roads on fire management or fire on roads could not be secured. There seems to be very few reports addressing this issue. For a Forest scale assessment, background information would have been helpful. What little information I did find was helpful.

Competition for data through GIS seemed to be the one major problem. Time frames were short and not having maps and other data available in a timely manner was a key factors. Also, much of the fire data, on file, was not related to the issues of the analysis and did not really answer questions about access and travel management. The data that was relevant in some cases created more questions then answers, causing a need for more data.

Limited public involvement did not affect fire management input to the process, however, public involvement is an important factor in any Federal assessment and time will tell how critical not having public involvement in this process was.

Literature Cited, Key References, and Data Source

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USDA Forest Service, 1998. Willamette National Forest, Geographical Information System, fir data.

Appendix

GIS Data

Data Table:

1. Number of Human and Lightning Caused Fires By Road Density

Bar Chart:

2. Number of Human and Lightning Caused Fires for Each Road Density Category

Data Table:

3. Forestwide Road Density - Acres

Forest Map:

4. Human Caused Fire Cluster Count

Data Table:

5. Human Caused Fires per Fifth Field Watershed

Bar Chart:

6. Number of Human Caused Fires in Each Watershed

Data Table:

7. Results of Evaluating Overlap of Significant Hazard and Resource Concerns

Data Table:

8. Description and Count of Various Structures that Occur on Willamette National Forest Land

NFMA and F.BEHAVE Data

Data Tables:

9. Summary of Option - Theme 4
10. Summary of Option - Group 2%
11. Summary of Option - Group 4%
12. Summary of Option - Group 6%
13. Summary of Option - Group 8%
14. Summary of Option - Group 10%
15. Burn Subsystem, Fire1, Behave Run (3 pages)