Appendix A

Slope Stability Assessment

Sharps Creek Landslide Inventory and Slope Stability Assessment

The landslide history of Sharps Creek was developed using a series of 1:24000 air photographs to identify observable landslide features (primarily debris slides) in a time sequence. Due to the mixed ownership, the photo record includes Umpqua Forest coverage as well as Eugene BLM photos. Three flight years were evaluated to develop an understanding of the historical landslide occurrence, relative to disturbance in Sharps Creek. The 1946 photos were used for historic perspective on the National Forest, however 1950 photos were the earliest available for the BLM. The period of early management activity was observed using the 1966 flight for the forest and 1968 for the BLM. The third series included 1988 forest coverage and 1990 photos for the BLM.

While it is well accepted that landslide analysis using air photos without field verification has limited applicability, it does provide a broad scale understanding of the frequency and magnitude of landslides, particularly shallow rapid ones. During the interpretation phase, an attempt was made to identify the type or associated disturbance with each feature. Each landslide was assigned an attribute, either natural, timber or road, based on proximal location to observable characteristics.

In addition to the development of a comprehensive landslide layer in a GIS format, an attempt was made to incorporate a modeling approach to predict potential mass wasting hazards. In cooperation with the Eugene District of the BLM, in particular Barry Williams, we utilized a cohesionless, infinite slope stability model developed by Montgomery and Deitrich (1994) to portray areas subject to mass wasting potential. This was the first application of the model on Western Cascade geomorphic terrain, specifically on the Umpqua National Forest.

The application of the model was tested using two data sets of digital elevation data, 30 meter and 10 meter intervals. From an initial review of these products, relative to the air photo landslide product, it appears that the resolution of the 30 meter DED's more accurately represents the relationship of landslide features to high potential instability. One explanation of the limitations of the model may be the ability to accurately manuscript landslide features in a digital manner. Unfortunately, the inability to run the model or to generate reports without the assistance of the BLM and their UNIX system, limits the applicability of the model.

Recent conversations with Dr. Dietrich indicate that an updated version of the model will be available by the end of 1999 and may be useful for project planning and future forest planning analysis.

As a result of this evaluation, this information should be used with a number of caveats:

- It is strictly for natural occurring shallow landslides, not deep seated failures.
- All areas have topographically identical risk of landsliding.
- At any given time, only a small proportion of the landslide sites will show evidence of landsliding at any one time.
- Model failure typically occurs when the digital elevation data does not accurately indicate topography.
- Management related failures may occur in sites classified as low potential.

Reference:
Montgomery, D.R. and W.E. Dietrich. 1994. A physically based model for the topographic control of shallow landsliding. Water Resources Research 30: 1153-71.

Appendix B

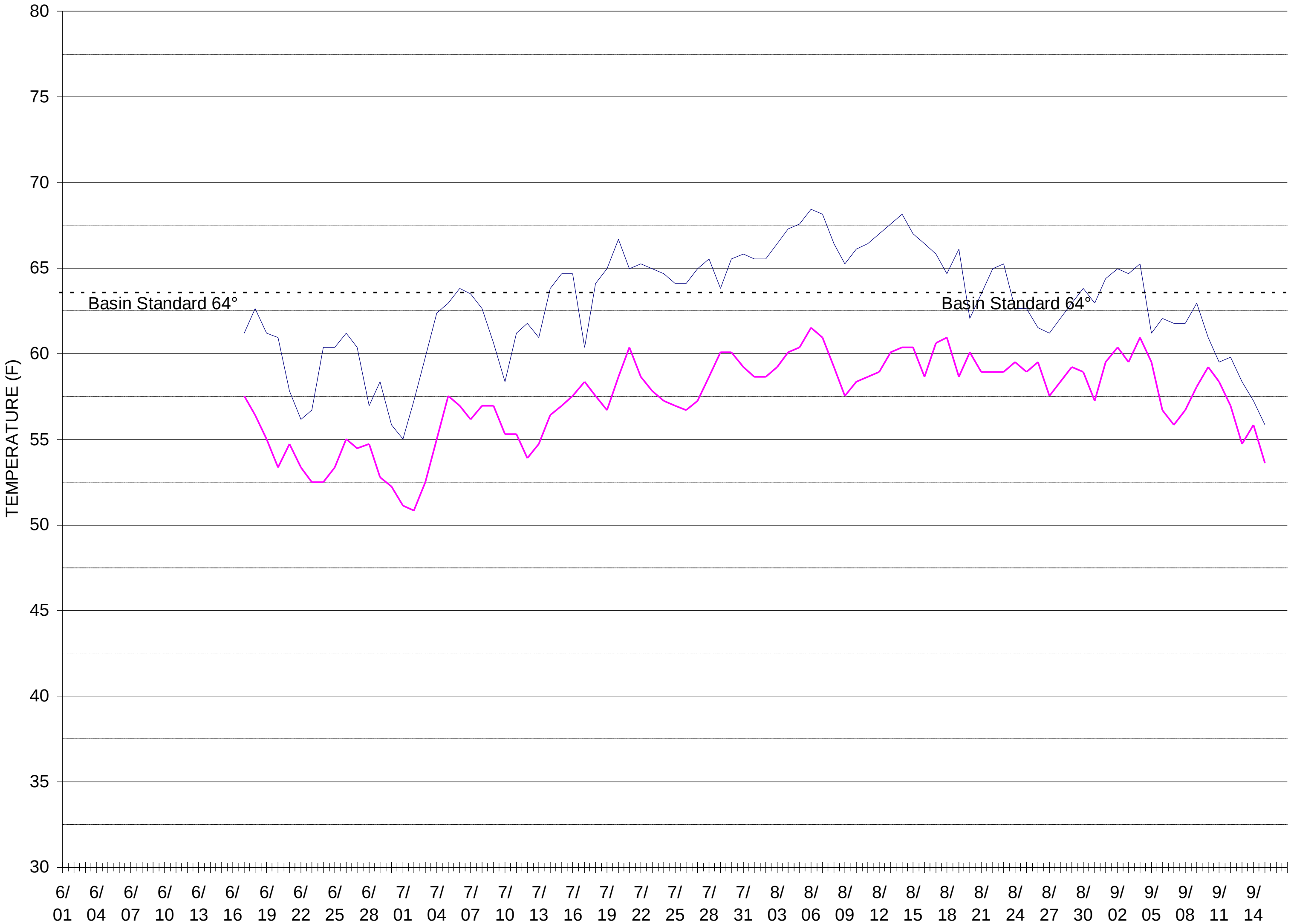
Hydrology
and
Water Quality

Summer 1996 Sharps Creek Streamflows

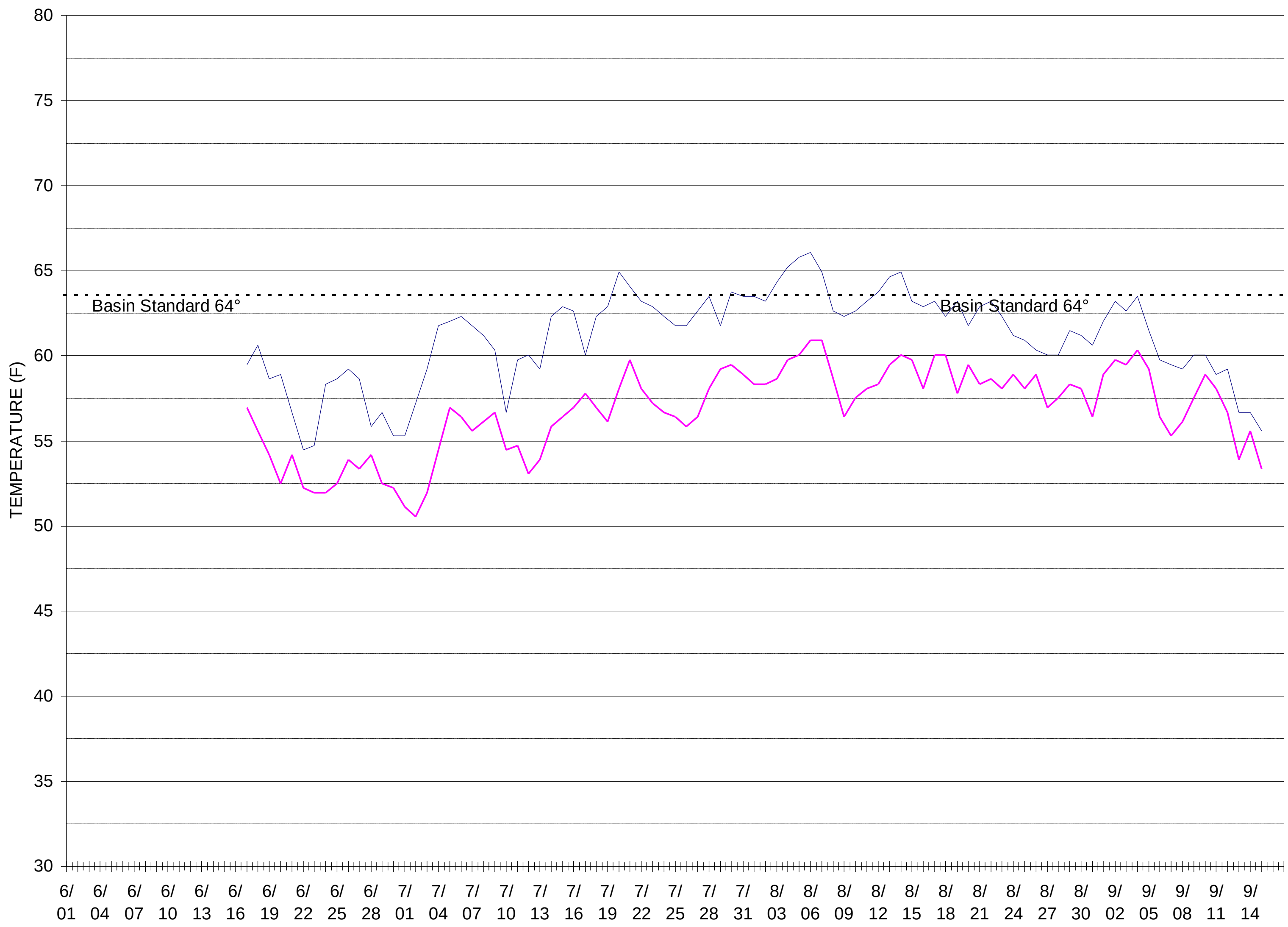
measurements 9/10/96 to 10/1/97 two summers

Stream Name	Stream Name	Stream Name	Stream Name	Date	cfs	mi2	cfs/mi2	Row cfs	%Row 9-10-96	cfs 9-10-96	cfs/mi2 9-10-96
										final estimates	
Sharps @ mouth				9/26/97	13.8	66.44	0.21	52	2.74	5.04	0.08
Sharps @ Staples Bridge (flow est same as 9-30--96)				10/1/97	11.9	47.3	0.25	47	2.47	4.81	0.10
	Walker Cr			9/26/97	1.33	5	0.27	52	2.74	0.49	0.10
	White Cr			9/25/96	0.07	1.23	0.05	28	1.47	0.04	0.04
Sharps abv White				10/1/96	5.67	30.43	0.19	23	1.21	4.68	0.15
	Sharps abv Martin est			10/1/96	4.08	12.73	0.32	23	1.21	3.37	0.26
		Sailors Gulch		9/25/96	0.10	0.67	0.15	28	1.47	0.07	0.10
		Fairview Cr		10/1/96	1.64	5.65	0.29	23	1.21	1.35	0.24
			Walton Cr	10/1/96	0.35	1.22	0.28	23	1.21	0.29	0.23
			Cinge Cr	10/1/96	0.83	1.63	0.51	23	1.21	0.68	0.42
		Bohemia Cr		10/3/96	0.80	2.3	0.35	23	1.21	0.66	0.29
			Glenwood Cr	10/3/96	0.42	1	0.42	23	1.21	0.34	0.34
	Martin abv Sharps (calculated)			9/10/96	1.59	17.7	0.09	19	1.00	1.59	0.09
	Martin abv Sharps (measured)			9/29/97	3.78	17.7	0.21	50	2.63	1.44	0.08
		Quartz cr		9/11/96	0.26	4.45	0.06	19	1.00	0.26	0.06
		Puddin Rock		9/20/96	0.08	1.46	0.05	42	2.21	0.04	0.02
		Cedar Cr		9/19/96	0.267	1.34	0.20	47	2.47	0.11	0.08
		China Cr		9/17/96	0.30	2.46	0.12	144	7.58	0.04	0.02
			Saddle Camp	9/23/96	0.30	1.2	0.25	31	1.63	0.18	0.15

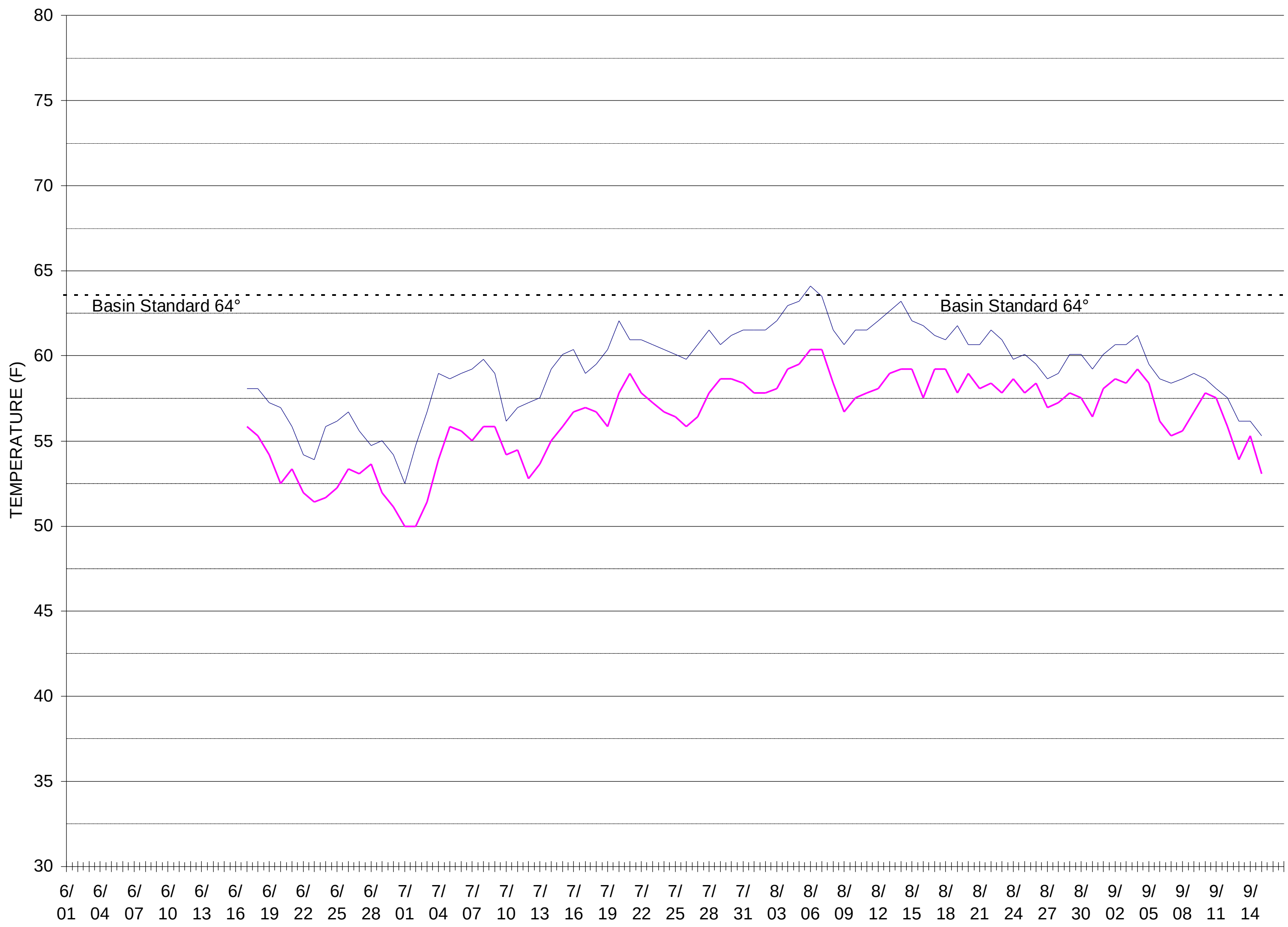
Sharps below Walker Creek

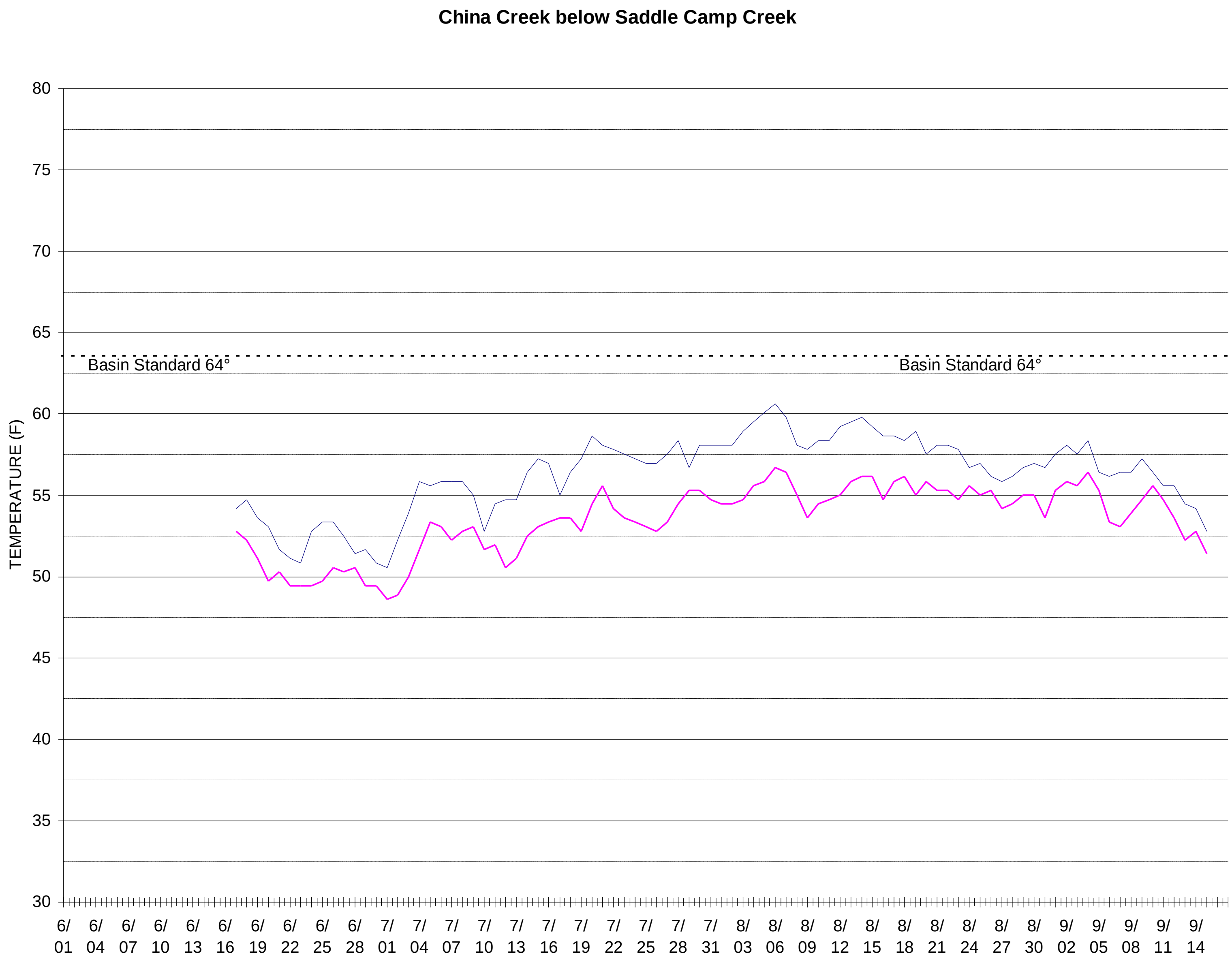


Martin at the mouth



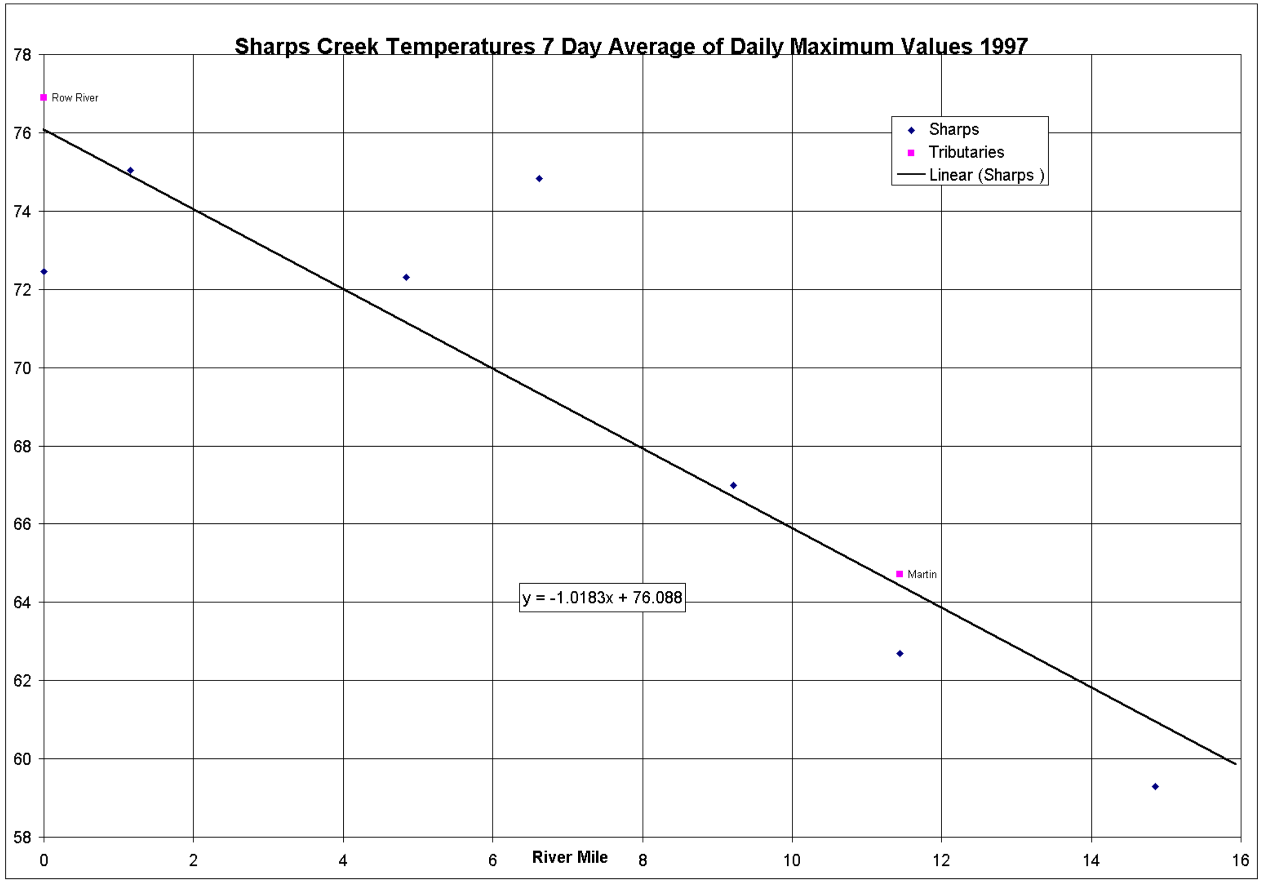
Sharps above Martin

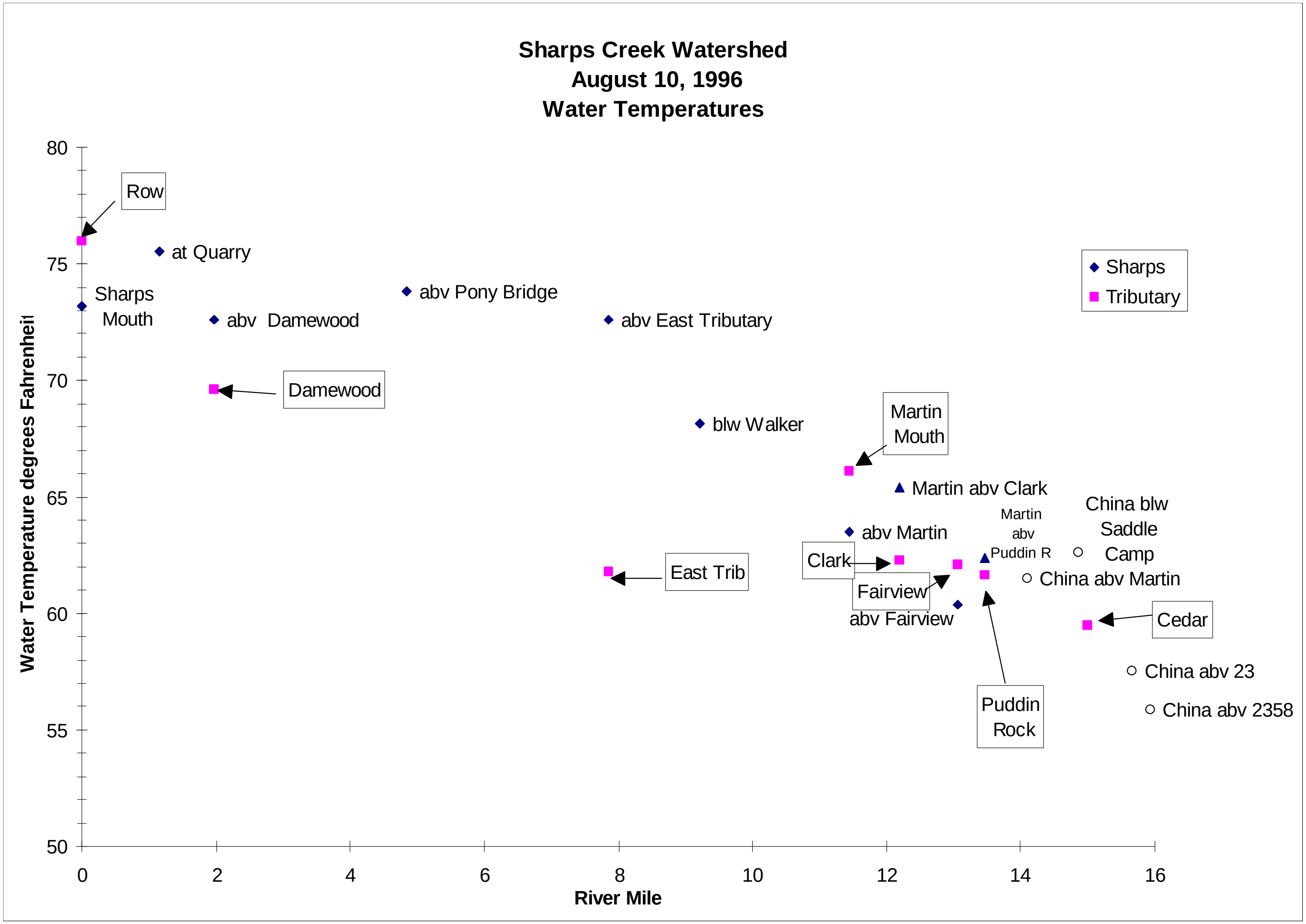



China Creek below Saddle Camp Creek
TEMPERATURE (F)
80
75
70
65
60
55
50
45
40
35
30
Basin Standard 64°
Basin Standard 64°
6/ 01
6/ 04
6/ 07
6/ 10
6/ 13
6/ 16
6/ 19
6/ 22
6/ 25
6/ 28
7/ 01
7/ 04
7/ 07
7/ 10
7/ 13
7/ 16
7/ 19
7/ 22
7/ 25
7/ 28
7/ 31
8/ 03
8/ 06
8/ 09
8/ 12
8/ 15
8/ 18
8/ 21
8/ 24
8/ 27
8/ 30
9/ 02
9/ 05
9/ 08
9/ 11
9/ 14

River Mile	Sharps	Tributaries	Sharps	Tributaries
0.00	72.45	76.90	at Mouth	Row abv Sharps
1.16	75.04		at Quarry ref	
1.97				
4.84	72.30		abv Pony Br	
6.62	74.83		abv Staples Creek at Bridge	
9.22	66.99		blw WalkerX	
11.44	62.69	64.72	abv Marti	Martin Cr mouth
13.06				
15.50				
15.94			China 2358	
15.66			China 23	
14.86	59.30		China blw SC	
14.10				
15.00				
13.47				
12.19				

1997 7-Day Average Maximum Temperatures August 1-8, 1997 Measured Stream Temperaures




Sharps Creek Watershed
August 10, 1996
Water Temperatures
Water Temperature degrees Fahrenheit
River Mile
80
75
70
65
60
55
50
0
2
4
6
8
10
12
14
16
Row
at Quarry
Sharps
Mouth
abv Damewood
Damewood
abv Pony Bridge
abv East Tributary
blw Walker
East Trib
Martin
Mouth
Martin abv Clark
abv Martin
Clark
Fairview
abv Fairview
Martin
abv
Puddin R
Puddin
Rock
China blw
Saddle
Camp
China abv Martin
Cedar
China abv 23
China abv 2358
Sharps
Tributary

October 3, 1997

Jim Wieman
District Ranger
Cottage Grove Ranger District
Umpqua National Forest

Dear Jim,

On September 29, 1997 I looked at a bedrock reach of Layng Creek about ½ mile downstream from the Layng Creek municipal water intake and Rujada Campground, about 100 feet downstream from a concrete bridge where you described algae growing on the stream bottom. Debra Gray, hydrologic technician, and I used a Hydrolab multiprobe water quality meter to measure water temperature, dissolved oxygen (and percent oxygen saturation), pH, and specific conductivity. These parameters might be affected by algae, or indicate the sensitivity of water quality to the oxygen and carbon dioxide production and use by algae.

My observations were that this reach has moderate amounts of a brown, cottony attached algae (periphyton), and longer, green filamentous algae. There was also some green moss on the rocks. Compared to upstream and downstream, there was more algae in this open, bedrock reach below the bridge. This amount of algae is common throughout the Forest on unshaded streams. This letter explains why I think the evidence so far indicates minor effects on Layng Creek water quality and no effect on Cottage Grove's water supply.

Location	September 29, 1997 time	Temp deg C	Dissolved Oxygen mg/liter	D.O % sat	Sp Cond msiemens	pH units
Flag 200' bel bridge	1500	13.02	10.32	103.4	67.7	7.52
100' bel bridge	1515	13.05	10.50	104.5	67.8	7.50
100' bel repeat	1515	13.07	10.39	104.1	67.8	7.50
Under bridge	1525	13.03	10.25	103.2	67.7	7.48

Our measurements of water quality do not show significant effects of algae (see table). Since algae use carbon dioxide during the afternoon in photosynthesis, carbonic acid goes down and pH alkalinity can go up. The opposite is true in the morning, when algae use up oxygen with respiration. The result is swings of pH from 7 in the morning to 8 or higher in the afternoon. We did not find high pH (it was about 7.5) on a sunny day. It is possible that water quality was affected by algae in the middle of summer, when more sun was available. However, based on experience on other streams with weak ionic strength like

Layng Creek, low flow conditions in September are likely to produce high afternoon pH when algae is excessive.

You relayed the information that Cottage Grove Public Works employees from the Layng Creek water treatment facility had found an oxygen demand in the water below the concrete bridge. Biochemical oxygen demand (BOD) is a measure of the organic and inorganic matter in water that will use oxygen to decompose, thus using oxygen from the water or expressing a "demand" for oxygen. An oxygen demand might show that algae are dying and using oxygen in the process. That would be compatible with our finding that enough algae was present to saturate the water with oxygen in the afternoon, but suggest that enough has died off since summer so that effects on pH aren't extreme.

Note that the location of this stream reach (and algae) is below the intake for the City of Cottage Grove, and apparently above the point where occasional back-flushing, if any, from the plant might affect water quality. For these reasons, the stream and drinking water quality are unaffected by the algae, or by the plant operations.

Sorry that this isn't a simple topic, but my brief assessment is that more algae probably existed here on Layng Creek in midsummer (and some effect on pH and dissolved oxygen), but that this is occurring on many other streams on and off the National Forest. We have found much more severe effects of algae on water quality on other streams (pH of 9 on Little River and Jackson Creek in the Umpqua basin), and suspect that past removal of wood and shade from streams is a likely cause. Nitrogen enrichment from fertilizer use and timber harvest may contribute to algae in streams susceptible to these effects.

Mikeal Jones
Hydrologist
Umpqua National Forest

Enclosure

Water Quality Measurements of Row River Tributaries, September 29,1997

Location	September 29, 1997 time	Temp deg C	Dissolved Oxygen mg/liter	D.O % sat	Sp Cond msiemens	pH units
Martin Cr @ mouth	1230 open	10.99	9.85	94.3	61.4	6.76 (7.6*)
Martin Cr Repeat	1230 open	11.05	9.71	93.2	61.5	6.95
Sharps Cr abvMartin	1340 shaded	11.80	10.00	97.4	66.1	7.08
Sharps Cr Staples br	1410 open	16.20	10.42	112.0	65.0	7.92
Brice Cr @ mouth	1430 shaded	15.61	9.23	97.7	54.8	7.05 (7.5*)
Layng Cr below Rujada	1515 open	13.05	10.5	104.5	67.8	7.50
Sharps Cr @ mouth	1545 open	15.03	9.94	103.9	66.4	7.54 (7.9*)

*pH values measured by portable pH pocket tester

Drainage Densities

Drainage	Numbe	Acres	Miles/ SqMile	Fish Bearing	NonFish Bearing	Total Streams	Stream Density	Class III	Class IV	Miles of Road	Road Density
SHARPS		724.4	1.13	0.8	5	5.8	5.1			4.5	4.0
REVIER		1144.3	1.79	2.4	9	11.4	6.4			10.4	5.8
Totals for Lower Sharps North		**1868.7**	**2.92**	**3.20**	**14.00**	**17.20**	**5.9**			**14.9**	**5.1**
BOULDER		2140.6	3.34	4.2	22.3	26.5	7.9			25.2	7.5
DAMEWOOD		1337.0	2.09	3.5	9.9	13.4	6.4			15.5	7.4
TABLE		1431.7	2.24	2.7	14.4	17.1	7.6			15.1	6.8
GRASSHOPPER		1949.7	3.05	4.5	14.8	19.3	6.3			16.3	5.4
Totals for Lower Sharps South		**6859.0**	**10.7**	**14.9**	**61.4**	**76.3**	**7.1**			**72.1**	**6.7**
PONY		1575.7	2.46	2.2	9.8	12	4.9			12.8	5.2
STRAIGHT		2041.3	3.19	3	18.8	21.8	6.8			21.5	6.7
LICK	31	1572.6	2.46	3	11.6	14.6	5.9			9.2	3.7
BUCK		2515.8	3.93	2.8	24.9	27.7	7.0			25.3	6.4
ADAMS	03A	2422.9	3.79	4.2	21.6	25.8	6.8			12.1	3.2
WALKER	03V	3402.2	5.32	5.5	34.6	40.1	7.5			24.5	4.6
CLARK	03W	3340.5	5.22	5.8	27.4	33.2	6.4			13	2.5
Totals for All BLM & Private		**30589.0**	**47.80**	**56.3**	**271.5**	**327.8**	**6.9**			**262.6**	**5.5**
WHITE	03B	789.8	1.23	0.6	8	8.6	7.0	1.4	6.6	2.7	2.2
LOWER SHARPS	03G	914.2	1.43	2.2	7.5	9.7	6.8	0.8	6.7	2.4	1.7
MID SHARPS	03J	895.7	1.40	1.3	7.8	9.1	6.5	2	5.8	2.4	1.7
SAILOR'S GULCH	03I	431.2	0.67	0.2	4.2	4.4	6.5	1.4	2.8	1.2	1.8
UPPER SHARPS	03L	819.1	1.28	0	6.6	6.6	5.2	1.7	4.9	1.3	1.0
GLENWOOD	03K	1470.0	2.30	0.4	10.3	10.7	4.7	4.7	5.6	6.8	3.0
Totals for FS Sharps		**5320.0**	**8.31**	**4.7**	**44.4**	**49.1**	**5.9**	**12**	**32.4**	**16.8**	**2.0**
LOWER FAIRVIEW	03F	339.8	0.53	1.2	2.2	3.4	6.4	0	2.2	0.1	0.2
WALTON	03C	779.7	1.22	0.5	6.6	7.1	5.8	1.5	5.1	0.8	0.7
CINGE	03D	1045.1	1.63	0.6	11.2	11.8	7.2	3.2	8	0	0.0
UPPER FAIRVIEW	03E	1451.7	2.27	0.6	12.5	13.1	5.8	3.6	8.9	3.7	1.6
Totals for Fairview		**3616.3**	**5.65**	**2.9**	**32.5**	**35.4**	**6.3**	**8.3**	**24.2**	**4.6**	**0.8**
LOWER MARTIN	03H	556.0	0.87	0.7	3.8	4.5	5.2	0	3.8	3.1	3.6
PUDDIN ROCK	03M	932.8	1.46	0.4	9.9	10.3	7.1	1.7	8.2	4.8	3.3
MID MARTIN	03O	539.6	0.84	1.2	5.2	6.4	7.6	0	5.2	2.3	2.7
CEDAR	03P	858.0	1.34	0.3	7.9	8.2	6.1	1.4	6.5		0.0
UPPER MARTIN	03Q	681.7	1.07	0.7	4.8	5.5	5.2	1.2	3.6	0.5	0.5
CHINA	03S	806.9	1.26	1.3	8.2	9.5	7.5	1.4	6.8	4.5	3.6
SADDLE CAMP	03R	764.9	1.20	0.3	7.7	8	6.7	2	5.7	3.5	2.9
Totals for Martin		**5139.9**	**8.0**	**4.9**	**47.5**	**52.4**	**6.5**	**7.7**	**39.8**	**18.7**	**2.3**
LOWER QUARTZ	03N	773.0	1.21	1.3	9	10.3	8.5	1.3	7.7	3.7	3.1
WEST FORK QUARTZ	03U	922.5	1.44	0.7	13.5	14.2	9.9	2.2	11.3	4.5	3.1
UPPER QUARTZ	03T	1153.4	1.80	1.3	15.6	16.9	9.4	2.1	13.5	4.9	2.7
Totals for Quartz		**2848.9**	**4.45**	**3.30**	**38.10**	**41.40**	**9.3**	**5.60**	**32.50**	**13.10**	**2.9**
Sharps Creek Total		**47514.1**	**74.24**	**72.10**	**434.00**	**506.10**	**6.8**			**315.80**	**4.3**
FS Total		**16925.1**	**26.4**	**15.8**	**162.5**	**178.3**	**6.7**	**33.6**	**128.9**	**53.2**	**2.0**

Appendix C

Fire and Fuels Management Analysis

Sharps Creek Watershed

Fire and Fuels Management Analysis

February 1998

Abstract:

The purpose of this analysis is to document past and current fire and fuels management activities, and to discuss the effects of these activities on various structures and processes in the watershed. Where possible, recommendations will be made as to potential restoration opportunities and management strategies which may enhance current conditions. Areas that have the potential for further research or study will also be identified.

Introduction

In order to define a reference time period, we assessed the information available to us for the Sharps Creek watershed. Based on preliminary fire history data, various historical records and tree origin dates, the reference period was determined to be 1936. For the purpose of this paper, current conditions will account for the period of 1937 - 1997. Reference conditions will account for the time prior to 1936.

Due to the limited data available, some portions of this analysis are not as detailed as they may have otherwise been. These areas will be identified and may need to be expanded on when site specific project analyses are done.

The Watershed Analysis Guide and Sharps Creek Issues and Key Questions were reviewed to determine what should be addressed in this paper. Questions were grouped to fit the six step process, and objectives were written for each step. The following are the objectives to be met in this paper.

Objectives

- Identify issues and key questions to be addressed in this paper.
- Describe the existing fuels condition; describe any significant effects of fire/fuels activities on the structure/processes of the watershed; describe the current role of disturbance on the existing fuel condition.
- Identify historic uses and activities relative to fire; discuss how fire may have affected the development of the landscape pattern (as defined by fire regimes, fuels distribution, type, magnitude and intensities of known fire episodes) during reference (historic) times; discuss the historic role of fire and it's range of variability.
- Analyze the range of effects of fuels and fire activities over time, including changes in fuels distribution, disturbance regimes and the associated range of variability, as a result of Euro-American influences. Analyze the likelihood and potential impact of a large scale, high severity fire occurring in the Sharps Creek watershed. Discuss whether and how fire suppression and management activities have affected the ability

of the system to maintain reference conditions, and what the implications are of the changes or trends on future fire intensities.

- Identify and recommend fire/fuels management strategies and opportunities to enhance, maintain, restore or manage: fuels distribution, historic stand conditions, wildlife, silviculture, or other resource concerns. Identify priority areas for prescribed fire use.

Step One - Characterization

Fuel Models

The watershed is comprised of five fire behavior (FBO) fuel models. The FBO fuel models consider primarily the 0-3 inch size classes, and are the standard models used to estimate fire behavior. These fuel models are representative of both current and reference times, though their distribution over the landscape has differed.

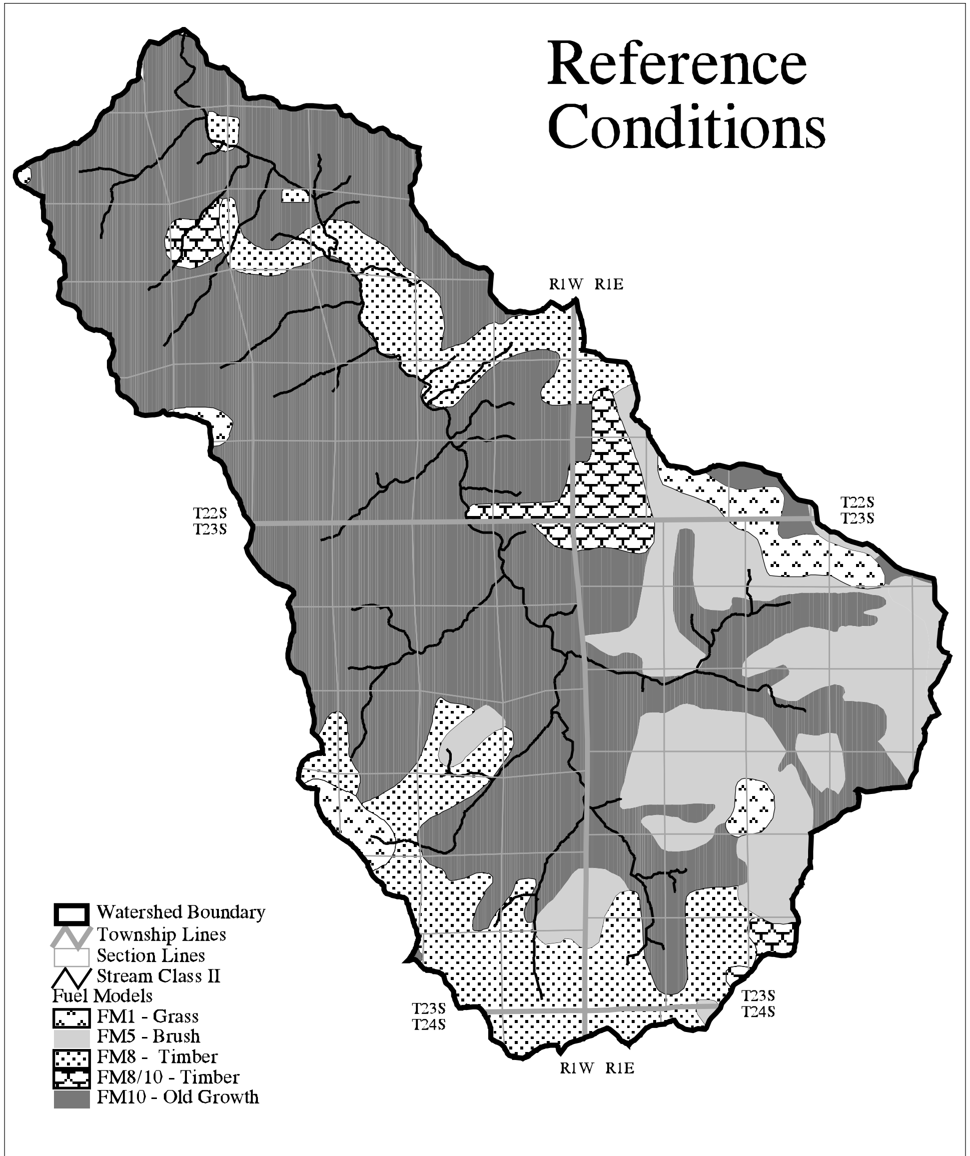
Current Fuel Models

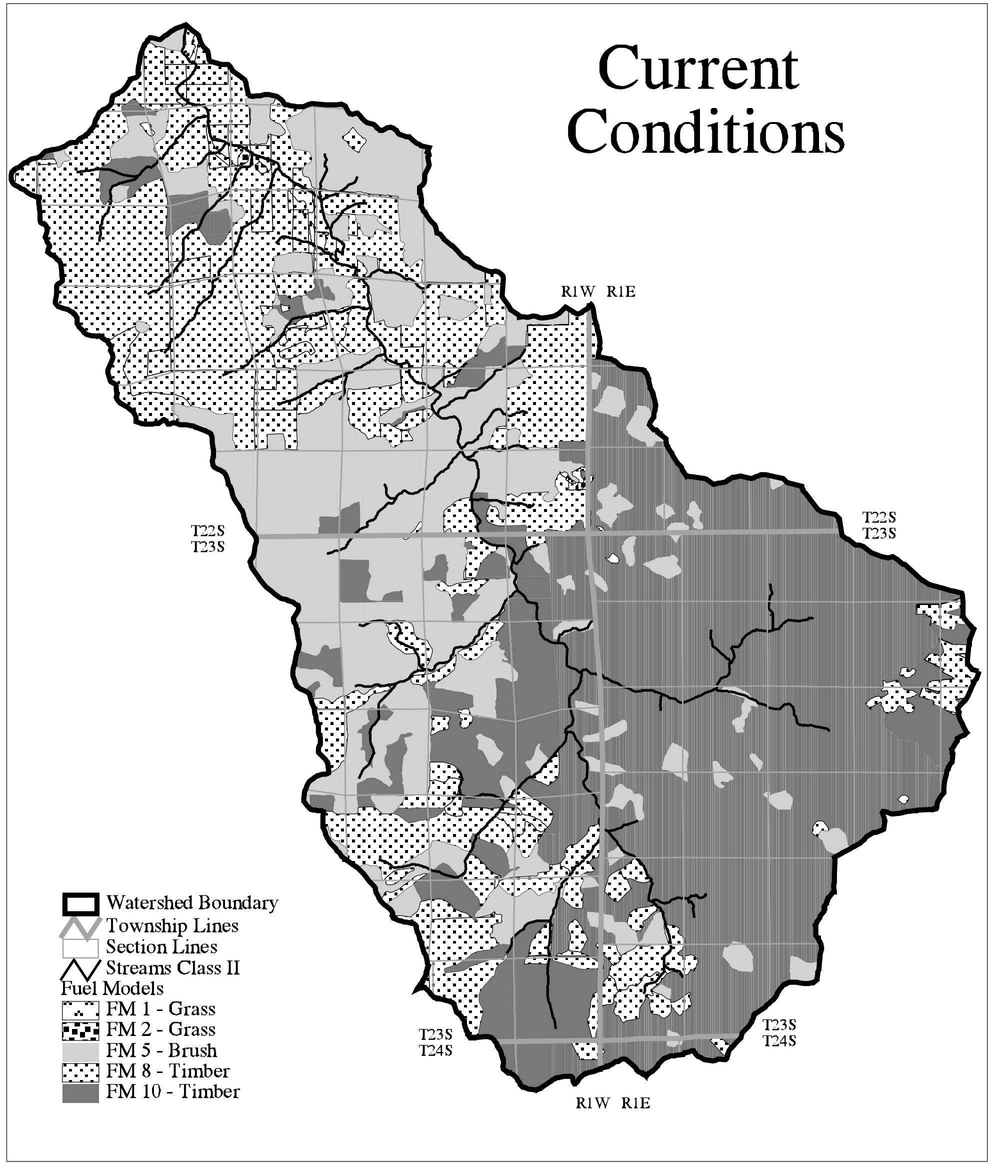
Fuel Model	Acres			Total Acres	Percent of Watershed
	BLM	Pvt.	USFS		
1	28.55	114.27	15.85	158.67	0.90
2	0.00	29.38	2.18	31.56	0.10
5	2,142.71	7,095.59	1,333.64	10,571.94	25.00
8	4,144.50	7,236.36	1,643.08	13,023.94	30.00
10	2,699.44	1,251.78	14,752.22	18,703.44	44.00
Totals	9,015.20	15,727.38	17,746.97	42,489.55	100.00

Reference Fuel Models

Fuel Model	Acres	Percent of Watershed
1	1,499.18	3.00
2	0.00	0.00
5	6,403.76	15.00
8	6,912.91	16.00
8/10	1,562.17	4.00
10	26,111.53	62.00
Totals	42,489.55	100.00

Sharps Creek Watershed
Fuel Models





Fuel Model 1: The meadow areas within the watershed are represented by Fuel Model One. In this grass fuel model, fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one third of the area.

Fuel Model 2: Open shrub lands, and open stands that include clumps of fuels that generate higher fire intensities, represent this fuel model. Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead down stem wood from the open shrub or timber overstory, contribute to the fire intensity.

Fuel Model 5: Young reproduction, prior to canopy closure, is fairly well represented by Fuel Model Five. Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area.

Fuel Model 8: Portions of the timbered areas are represented by Fuel Model Eight, and the remainder by Fuel Model 10. In Fuel Model Eight, slow burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose high fire hazards.

Fuel Model 10: Fires burn in the surface and ground fuels with greater fire intensity in Fuel Model ten than in fuel model eight. Dead down fuels include greater quantities of 3 inch or larger limb wood resulting from over-maturity or natural events that create a large load of dead material on the forest floor.

Fire Regimes and Range of Variability

Fire Regimes by Forest Type

Approximately 75% of the Sharps Creek watershed is a western hemlock (Tsuga heterophylla) forest. The remainder is composed of a variety of other Pacific Northwest forest types; the Pacific silver fir (Abies amabilis) forest, approx. 5%; the white fir (Abies concolor) forest, approx. 5%; and the Douglas-fir (Pseudotsuga menzieseii) forest, approx. 15%. The silver and white fir forests are primarily high elevation sites in the eastern-most portion of the watershed. The Douglas-fir is intermixed with the western hemlock throughout the watershed.

Western Hemlock

Agee characterizes the western hemlock forest by saying that the dominance of Douglas-fir in the zone at the time of European settlement was largely due to disturbance, primarily by fire, for many centuries before such settlement. He further states that over the western hemlock zone, there is considerable variability in the age of stands that burn, as well as in fire frequency, intensity, and extent, which creates a variety of post-fire effects. He cites

Morrison and Swanson's work (1990), that suggested a higher fire frequency in the drier western hemlock forests, and a natural fire rotation of 95-145 years over the last five centuries. He also cites Teensma's work (H. J. Andrews 1987), in which Teensma calculated a mean fire return interval for stand replacement fires of 130-150 years. Agee's description of the western hemlock forest represents those portions of the Sharps Creek watershed fairly well.

Pacific Silver Fir

Agee describes the fire regime for Pacific silver forests as characterized by infrequent fires of high severity, with lower elevation and drier forests possibly having fire return intervals of 100-300 years. He goes on to state that fires in these forests usually occur under unusual conditions of summer drought and east wind and tend to be of high intensity, killing most or all of the trees on the site. The fire return interval for the western hemlock/silver fir transition zone in the central Oregon Cascades is 149 years, according to Morrison and Swanson, 1990. In the central western Cascades, Morrison and Swanson found pre-1800 fires in this forest type to be predominately stand-replacing, but between 1800 and 1900 only about 25% of the area burned was of high severity, with 32% of moderate severity and 43% of low severity. This description of the Pacific silver fir forest seems to fit this watershed as well.

White Fir and Douglas-fir

According to Agee, the most complex set of forest types in the Pacific Northwest includes those called mixed-conifer or mixed-evergreen forests. He identifies four types, including the white fir and Douglas-fir.

He writes that the Abies concolor forests of the Pacific Northwest are a northern extension of more widespread forest in the Sierra Nevada to the south, and that the zone is not widespread in the Pacific Northwest. Agee theorizes that in an environment as prone to burn as the drier Abies concolor forests, human ignitions may only have substituted for inevitable lightning fires. Fire history of white fir areas in the Crater Lake National Park and Siskiyou National Forest was studied, and the average fire-return intervals ranged from 9-42 years in lower elevations to 43-61 years in higher elevation white fir/Douglas-fir communities, and up to 64 years in white fir/herb communities, which reflects a lengthening of the fire-return interval with increasing elevation. The intensity of these historical fires was usually low, because the frequent fires removed understory ladder fuels and consumed the forest floor. Fires occurring after an extended fire-free period would likely have been more intense and were probably the norm in the higher elevation stands with larger proportions of white fir. Abies concolor forests have a gradient of stand development patterns associated with the fire regime gradient…three white fir communities occur with increasing elevation; a dry Douglas-fir/white fir type, a mesic Douglas-fir/white fir type, and a white fire/herb type. As fire return intervals lengthen, likely due to cooler, wetter climate, there is a tendency to have higher proportions of white fir in the overstory. This description appears to fit the stands in the higher elevations of the watershed.

Sharps Creek Fire Regime

A fire regime is a generalized description of the role fire plays in an ecosystem, and is described using combinations of frequency and intensity. The moderate severity fire regime has the most complex mix of low, moderate, and high severity fires; it is this regime that characterizes the Sharps Creek watershed. Agee's description of a moderate severity regime states that fires are infrequent (25-100 years); they are partial stand replacement fires, including significant areas of high and low severity; that fires occur in areas with typically long summer dry periods and will last weeks to months. Periods of intense fire behavior are mixed with periods of moderate and low intensity fire behavior; variable weather is associated with variable fire effects. The overall effect is a patchiness over the landscape as a whole, and individual stands will often consist of two or more age classes. Stands in the higher elevations of the watershed, with the exception of riparian areas and some north facing aspects, tended to burn in a high intensity, stand replacing manner in 100-150 year intervals. Stands in the lower elevations tended to burn at lower intensities, with variable fire effects, and at similar intervals.

Step Two - Issues/Key Questions

Fire/Disturbance

Core Questions

- What are the current conditions and trends of the disturbance processes in the watershed?

  (Addressed in chapter 3)

- What are the historical disturbance processes within the watershed? Where do they occur?

  (Addressed in chapter 4)

- What are the natural and human causes of changes between historical and current disturbance conditions in the watershed?
- What are the influences and relationships between disturbance processes and other ecosystem processes?

  (Addressed in chapter 5)

Issue

- The role of fire as a maintenance function has changed.

Causal Mechanism

- Lack of landscape scale fire due in part to the advent of fire suppression.

Result

- Fire regime is nearing the upper end of its natural range of variability.
- Change in the distribution and make up of fuels.

Key Questions

- How has the role of fire as a regime maintenance function changed over time, and what has been the effect on vegetation?
- What are opportunities to replicate fire's role in the watershed?

Other Questions

- What effects might current fuels conditions have on the development of late successional conditions in the late successional reserve (LSR)?

Steps 3 and 4 - Fire Uses and Activities

Current Condition

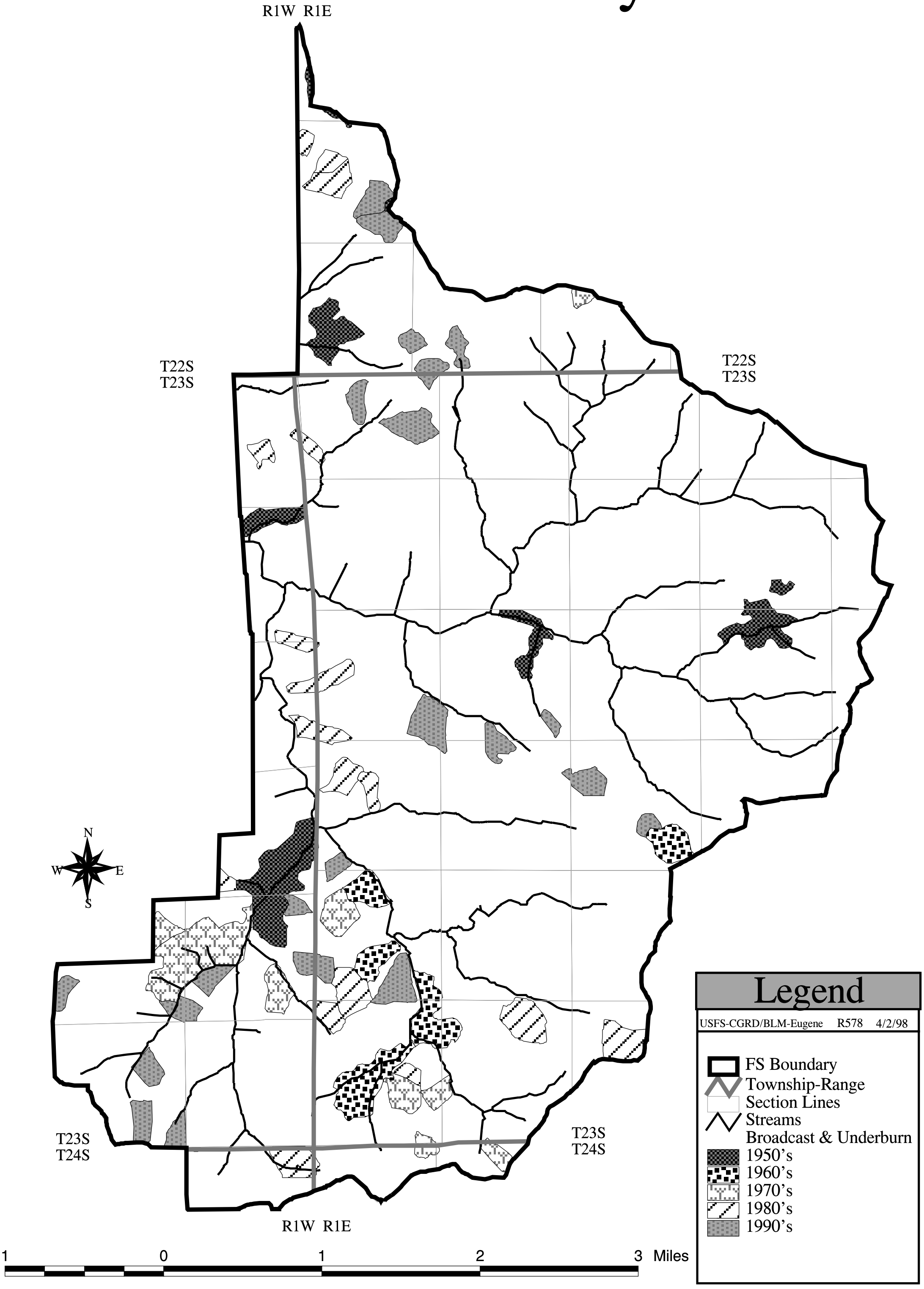
Fuels Management Activities

Organized forest fire protection began soon after the disastrous fires of 1902. By 1904, evidence suggests that fuels reduction activities (esp. slash burning) occurred in areas where miners were exploring.

Logging activity began in the lower (Bureau of Land Management (BLM) and private) parts of the watershed in the late 1920's, and in the upper (Forest Service(FS)) parts in the late 1940's. Slash burning has been a standard practice on harvested lands in the Sharps Creek watershed.

The fuels activity map and table below displays the numbers of acres treated by either broadcast burn or under burn on FS lands, and the percent of the FS land they represent. Similar data for BLM and private lands were not available for this report. Piling and burning was not evaluated because this treatment method does not usually consume enough fuels to change the fuel model or create a significant difference in fire behavior.

Sharps Creek Watershed
Fuels Activity



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Creator: ArcView Version 2.1
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Table 1. Fuels Treatment Activity in Sharps Creek (USFS land only)

Time Period	Acres Treated	Percent of Watershed
1950-1969	848.4	.05
1970-1989	467.9	.03
1990-1998	93.9	.01

(ac total)

Reference Condition

Native Americans

Use of the Sharps Creek watershed prior to Euro-American settlement is thought to have been for seasonal hunting and gathering by local Indian tribes. Camas bulbs, tarweed pods, huckleberries, hazelnuts, and bracken were among those harvested to supply food; they used over 50 plants.

Their diet also included insects and larvae, salmon, eels, and mammals. This diet indicates their hunts and harvests required seasonal migrations. History records indicate the Kalpuyans hunted and gathered in the Bohemia area during the late spring, summer, and early fall.

Indians also traveled the ridges as trade routes between the Willamette Valley, the Umpqua area, and eastern Oregon to obtain obsidian to make tools and weapons. Other Indians traveled through from the east side of the Cascades to the coast.

According to records (circa 1826), the Indians repeatedly burned prairie and forests for game hunting and brush clearance. This kept the forest from growing fully except near rivers and along some valley bottoms. The landscape was open grassland on the valley floor and light, open forests on most hills around the area. This use of fire had kept the valley's flora in a fire-maintained climax state for hundreds of years. These activities have modified landscapes in many subtle ways that have often been interpreted as "natural" by the early explorers, trappers, and settlers.

Though settlers did not start appearing in the Cottage Grove area until 1848 and major settlement did not occur prior to 1851, free trappers and companies such as the Hudson Bay Company traveled through the area as early as the late 1700's and early 1800's. In 1782-1783, a smallpox epidemic killed an estimated 50% of the Kalapuyan Indian population. In 1833 members of the Hudson Bay Company returning from California fell ill with a fever (malaria) and died; this illness was communicated to the Indian population, and as much as 2/3 of the native population of the Willamette Valley is thought to have died. After 1834 diseases such as dysentery, measles, tuberculosis, and venereal disease took a toll on the remaining Kalapuyans. Still, hundreds of Kalapuyan Indians survived, though many moved west or were relocated to reservations. The last known Indian burning in this area was prior to 1846.

An article from the Cottage Grove Sentinel (April 25, 1919) talks about the activities of the Kalpuyans, apparently related to them by the Indians remaining in the area. They said that *"before the white men came…they kept underbrush cleared from level lands and hills by controlled grass burning. This, they felt, produced better grass growth, better deer hunting, easier traveling, protection from fires in fall, and better visibility…the white man came and permitted undergrowth to take much of the land."*

Euro-American Settlers

Accounts of local residents who inhabited the area around the turn of the century tell of how large areas of forested land were cut down and burned; in some instances the timber wasn't logged, but left to be burned with the rest of the "trash". The land was then seeded for grasses upon which sheep would later graze. When asked in a 1975 interview what he remembers about the country around the Cottage Grove area, Frank Baker reported that it was much more open under the timber than it is now.

In the late 1850's, prospectors began exploring the present day Bohemia Mining District. Buildings, mills, roads and trails were built in the Sharps Creek watershed through the 1800's. Though there were isolated incidents of set fires, it is unlikely that miners regularly set uncontrolled fires to clear their lands. Instead, areas of trees were cut, and slash burned. In 1899 however, two men building the White Swan Trail started a fire that burned 240 acres.

In July 1904 Ranger Carl Henry Young noted in his journal that he "*burned brush on cutting area*[s]", most of which were probably on mining claims or associated with them.

Young also wrote of the fires he had discovered adjacent to the Sharps Creek watershed, as well as to distant smoke columns he observed. These fires were probably related to land clearing activity.

Fire History, Occurrence, and Intensity Levels

Current Condition

Fire Occurrence

In this section, fire intensities and sizes classes are discussed. To better understand how these are defined, please refer to the table in the Fire Intensity Levels section (following this one) for clarification.

Sixty-eight years of recent lightning and human caused fire occurrence (1930-1997) were analyzed to determine fire frequency, intensity, and extent. Data was gathered from Forest Service fire records, and does not include fires that may have occurred outside the Forest Service boundary. Overall fire occurrence, regardless of cause, is 0.6 fires per year in the Sharps Creek watershed. Lightning and human caused fires are discussed separately below.

Over the last 68 years, 30 lightning fires have occurred in the Sharps Creek Watershed. These fires represent 17% of all the lightning fires that have occurred on the Ranger District. The average lightning occurrence for the Watershed is 0.4 fires per year. Twenty six of these fires (87%) were size class A (1/4 acre in size or less), due to either the fuel conditions or suppression activities. Four lightning fires (13%) were size class B (1/4-9 acres).

In the 1930's two of the size class B fires (1/4-9 acres) burned on the southwest aspects of Cat Mountain, on the upper third of the slope. The third occurred in the 1950's east of Saylor's Gulch, mid-slope below Puddin Rock. The fourth occurred in the 1940's near present day Mineral Campground.

The size class B fires tend to be clustered in two areas. The first is the lower to middle third of the north facing slope between Mineral Campground and Puddin Rock (Sharps Creek drainage). On this north slope, the primary contribution to larger acreage fires would likely be fuels buildup over time due to infrequent fire, and the steep topography of the area. The second area is the southwest slope of Cat Mountain. Exposure to prevailing winds (SW), the southerly aspect, and drier fuels would account for the greater likelihood of larger fires occurring there.

The remaining small (class A) fires burned in isolated areas of heavier fuels, or crept around in surface fuels. These, too, tend to be clustered not only in the areas described above, but also on the south and westerly slopes in the vicinity of Glenwood Creek, within the Saylor's Gulch drainage, and along the length of the Calapooya Divide, Puddin Rock, and Adams Mountain-to-Cat Mountain ridge lines. Isolated fires occurred in the Fairview Roadless area, and in the White, Quartz and Clark Creek areas.

Human caused fire occurrence was analyzed for the same time period. Prior to 1930, there are few records of human caused fire in the Sharps Creek watershed. The exception is the 240 acre fire in 1899 along the White Swan trail.

In the last 68 years, there have been 11 human caused fires in the watershed, which accounts for 17% of all the District's human caused fires. A human caused fire occurs at a frequency of approximately one fire every six years (0.16 fires per year) in the watershed. Of these 11 fires, 37% (4 fires) were caused by debris burning; another 27% (3 fires) were abandoned campfires. One fire (9%) was smoker caused; 18% (2 fires) were due to equipment use. One fire (9%) was due to miscellaneous causes.

Six of the human caused fires (55%) were size class A fires; three (27%) were size class B fires. Two (18%) were size class C fires. All human caused fires, with one exception, occurred in the same general location as the majority of the lightning fires, which is between the Puddin Rock Creek and the Sharps Creek drainages, and along the Adams Mountain-to-Fairview Mountain ridge line.

The size class A fires are primarily scattered along the Sharps Creek drainage from the Glenwood area downstream to road 23. Of the larger fires, debris burning fires occurred in 1972 in the Star Mine area (4 acres, size class B); one in the Marten Creek area (7 acres, size class B); and one in the Puddin Rock Creek area (26 acres, size class C). A forty acre (size class C) fire occurred in 1985 due to equipment use. A one acre (size class B) fire occurred near Marten Spring in 1972 as a result of debris burning. The largest was the 240 acre (size class D) fire that occurred in 1899; this fire was located on the west slopes of Bohemia Mountain, southeast of the Glenwood area.

Though fires were scattered throughout the watershed, the clusters that occurred between Puddin Rock Creek and Sharps Creek, the confluence of Bohemia and Glenwood Creeks to Bohemia Mountain then north to Fairview Mountain, and the Cat Mountain area, indicate these areas are more susceptible to ignition starts and fire spread. Exposure to weather, drier fuels or build up of fuels over time, and steep topography are all factors in these areas. Of these areas, the slopes between Puddin Rock Creek and Hardscrabble Road (from road 23 at the bottom to the Calapooya Divide at the top) are of particular concern.

Fire Intensity Levels

Fire intensity data was incomplete for 1930-1969; fire intensity levels (FIL) for 1970-1997 showed majority of fires to be FIL 3 or less. The exceptions are two fires (5 and 15 acres) in 1996 that burned at fire intensity level four. Fires in 1930-1969 are assumed to have displayed similar FIL's. Fire size classes of known FIL's were used to assign FIL's to the earlier fires.

Table 2. Fire Intensity Levels

Fire Intensity Level (FIL)	Flame Length (Ft)	Fire Report Designation	Assumed Fire Size Class	Size Class Acreage
Low	0 - 2	FIL 1	A/B	0-1/4 ac.
	2 - 4	FIL 2	B	1/4-9 ac.
Moderate	4 - 6	FIL 3	C	10-99 ac.
	6 - 8	FIL 4	D	100-299 ac.
High	9 - 12	FIL 5	E	300-999 ac.
	12+	FIL 6	F/G	1000+ ac.

We can assume the size class A fires displayed low fire intensity levels (0-2 foot flame lengths), with occasional exceptions when the fire burned in isolated pockets of heavier fuels or torched a snag. The size class B and C fires could be characterized as partial stand replacing, as they would have burned at moderate intensities and killed isolated or patches of trees. Fuels would have either built up over time or been dry enough to contribute to higher intensity fire in the areas these larger fires are clustered. The 240 acre fire in 1899 most likely exhibited fire intensity levels of 4 or 5; this was a higher intensity, stand replacing fire.

Reference Condition

Fire Occurrence

Fire history data was collected on Forest Service lands within the Sharps Creek watershed, but due to a series of stand replacing fires in the 1800's, much of the fire scar evidence in the area was destroyed. The BLM and private portions of the watershed are not well represented due to lack of data. Tree origin data and adjacent watershed analyses were used to develop a picture of the fire history in the Forest Service portion of the watershed. Aerial photos were used to aid in determining historical occurrence in the roadless areas.

Findings of Fire History Study

Adams Mountain/White Creek area

These areas are multi-aged stands with remnant old growth from the late 1400's to mid 1500's. A majority of these stands have origins in the mid to late 1700's, with understory from both the early and late 1800's.

Puddin Rock area

The stand sampled indicates this is more of a single aged stand with very scattered old growth from the mid 1500's to the early 1600's. A small portion of the stand originates in the early 1800's, with the majority originating in the late 1800's.

Quartz Creek area

This is more of a single aged stand with very scattered old growth from the early 1600's and early 1700's. The majority of the stand originates in the late 1800's.

Saddle Camp area

In samples taken in this stand, no remnant old growth were found. This is a young stand, with trees originating in the early and late 1800's.

Clark Creek area

This is a multi-aged stand with trees from the early 1600's and early 1700's, with an understory stand from the early and late 1800's.

Fire Intensities

According to this data, it appears high intensity fires passed through the area in the late 1500's, the late 1600's, and the early 1800's. These fires burned in a lower intensity in the northern portion of the watershed, leaving multi-aged stands, and in a higher intensity in the southern portion, leaving remnant old growth in the riparian areas and on northern aspects. It is estimated that stand replacement events would have occurred approximately every 100-150 years, in which a significant portion of the Sharps Creek watershed would experience fire so severe that it would set the forested stands back to an early successional stage. Low to moderate intensity fires occurred between the major fire episodes in the southern portion as well, but the effects aren't as obvious as those that occurred in the northern portion. Because adequate fire scar evidence was not available, the natural fire rotation could not be calculated for the watershed.

Air Quality

Current Condition

Adjacent to the Umpqua National Forest, the Crater Lake National Park and the Diamond Peak Wilderness are Class I areas, as defined by the Clean Air Act. The remaining areas, including the wildernesses within the Forest, are Class II areas. We are required to comply with the provisions of this act as well as standards set by the Environmental Protection Agency and the Oregon State Smoke Management Plan. These policies are designed to improve air quality. One objective is to prevent smoke from being carried to or accumulating in designated areas or other areas sensitive to smoke. The northern boundary of the Sharps Creek Watershed is approximately 11 miles southeast of the southern-most edge of the Willamette Valley Designated Area (DA).

The Willamette DA includes the town of Cottage Grove and the Dorena Reservoir area. Several miles to the northeast is the Oakridge Special Protection Zone (SPZ). This zone requires us to adhere to possible additional restrictions to prescribed burning between November 15th and February 15th of each year.

Within the Oregon State Implementation Plan for Visibility Protection (SIP), a general prohibition on prescribed burning applies to Lane County during the July 1st to September 15th period of each year. The goal of this strategy is to reduce substantially impaired visibility within select Class I lands. The Class I areas nearest the watershed are 17 or more miles away and include the Diamond Peak Wilderness to the southeast, and the Three Sisters Wilderness to the northeast.

Particulate matter (PM-10) has been identified as an air pollutant. Particulate matter emissions are produced from activities such as prescribed fire and events such as wildfire. The PM-10 health standard established by the EPA is aimed at respirable sized particulate matter that penetrates deep into the lungs. This particulate matter is that which is 10 micrometers and smaller in size.

Residual smoke from prescribed fire is a related concern, as larger volumes of this smoke may drift downwind and into communities within the designated areas. Generally, prescribed fire residual smoke has not been an issue to down canyon communities. In most cases winds are from a northwesterly direction during the day, so carry smoke to the southeast; at night down canyon winds are normally light, and smoke settles in the adjacent valleys.

Reference Condition

Prior to Euro-American settlement it is evident that fire was a common occurrence, regardless of ignition source. With the combination of Indian and settler burning in the Willamette Valley and Calapooya Mountain foothills in the spring and fall months, the lightning fires in the summer months, and with possible human ignited fires in select areas of the watershed for grazing, game, or gathering purposes at various times of the year, we can assume that smoke was present at varying densities throughout much of the year. Air quality ranged from a light haze from distant fires to a dense layer over areas in which fires were large, intense and of extended duration. Smoldering fuels probably contributed much of the emissions, given the nature of the fires that occurred in the watershed.

Residual smoke from fires within the watershed can be assumed to have drifted into the Oakridge and Umpqua Valley areas with the predominant northwesterly winds. Localized drainages would have accumulated smoke during the evenings and early mornings, and been lofted somewhat with the lifting of the inversions typical at certain times of year.

East wind conditions would have carried smoke into the Disston valley and possibly down into the Cottage Grove area (the southern end of the Willamette Valley). Smoke in this area may have accumulated during evening hours and occasionally during daytime, as it tends to be prone to inversion conditions.

Water Sources

There are 3 known water sources within the Forest Service portion of the Sharps Creek watershed. A map and detailed information regarding sizes and capacities are available from Fire Management upon request. Any proposed restoration/changes to the existing water sources should be coordinated with fire management to assure these minimum needs are met.

Minimum requirements for water sources within the watershed are as follows:

- Refill rate of 300 gallons per minute during periods of low flow;
- 100,000 gallon capacity per water source;
- Flow and storage rate of 20-25,000 gallons per hour;
- High in elevation;
- Evenly distributed across the landscape;
- Accessible by engines.

Role of Fire on the Fuel Condition

Current Condition

The primary role of fire since the early 1900's has been that of a management tool to reduce the fuels hazard and associated risk of fire starts. The fuel conditions under which the burns were carried out were unnatural (extensive clearcutting), but the resulting human created mosaic of various burn intensities may in some way mimic the overall effects of fires that occurred in reference times. Since the late 1800’s, the role of natural fire has been minimal in the watershed. Regardless of ignition source, stand or partial stand replacement fires have been a rare occurrence in the watershed since 1899. The fires since 1900 have burned only small concentrations of fuels, individual snags or trees, and occasional patches of timbered stands. The largest on Forest Service land were 26 and 40 acres in 1972 and 1985, respectively. One fire occurred in the northern portion of the watershed in the 1970’s that was fairly extensive, but information on cause, fire intensity, and total acres are not available.

Reference Condition

In reference times, repeated fires appear to have sustained much of the lower (northern) and riparian areas of the watershed in a mid-successional to old growth condition. The exceptions are the eastern portion. of the Sharps Creek drainage, and other higher elevation areas. These sites appear to have been maintained in non-forest or early successional states, only occasionally reaching some semblance of maturity before being set back by fire.

It has been approximately 100 years (within the estimated fire return interval of 100-150 years for stand replacement events) since a partial to stand replacement fire has occurred.

Many isolated lower intensity fires have burned through these older stands, reducing litter, smaller understory, and pockets of concentrated fuels. Minimal partial stand replacement and torching events have occurred since the last major fire in the late 1800's. It is likely that some of the fires that have been suppressed over the last 100 years had the potential for sustained crown fire, or at least partial stand replacement, given past weather extremes and fuels conditions.

The types of fuel models in reference times were similar to what we see today. The difference is in the distribution and amount of each fuel model over the landscape. Rather than the patchy distribution seen today due primarily to logging activities in the roaded areas, fuel models in reference times were maintained over larger, contiguous areas. Fire was a random event in terms of location, intensity and extent, and created and maintained a mosaic that is not evident today. The exceptions are the riparian areas of the major tributaries to Sharps Creek, which are probably similar today to what was seen in reference times.

Fire was probably used within the watershed for hunting, at gathering sites for berries and other plants, in high elevation meadows for game or grazing, and to some extent for clearing brush and slash in and around mining claims. The roles fire played would be to set back or kill brush that impeded big game movement or reduced visibility and ease of travel, to maintain gathering and grazing sites, and later in the 1800's, to dispose of slash. Fires set for these reasons would have been mostly low intensity (2-4 feet flame lengths), and with few exceptions would have been ground fires. If Indians maintained select areas as has been suggested in various writings, fire was probably set every year to five years, depending on site needs. The miners' use of fire created isolated, low to moderate intensity fires, with very little overall effects on the area as a whole.

Significant Effects of Fire/Fuels Activities on Watershed Structure or Processes

Current Condition

Slash burning has had the most obvious effect on the watershed since 1936. At least 1410 acres have been broadcast or under burned on Forest Service lands, representing 9% of that portion of the watershed. Of the 24,725 acres of non-Forest Service lands, we can estimate 75% (10, 632 acres) of it has been previously harvested and burned at some point, which would raise the total percent of the watershed burned to (43% + 9% =52%.) Early slash burns were done at various times of the year, and had a wide variety of effects. Burns occasionally exceeded cutting unit boundaries, stressing or killing nearby live trees. For the most part this occurred a limited distance from the unit's edge.

To some extent the earlier slash burns were of greater impact than some parts of the watershed would have experienced had timber not been harvested. Effects on soils were in some cases moderate to severe. Residual snags and coarse woody debris were minimal to non-existent after harvest and slash burning in some areas that would have historically continued to provide these materials.

In the last 15 years or so, burns on federal lands have been carried out under spring burning conditions. Effects on stands and fuels have, for the most part, more closely resembled the moderate to lighter intensities typical of past ground fires in this watershed.

As discussed above, none of fires since 1936 had produced significant partial stand replacement effects. Effects of these smaller, low to moderate intensity fires were not significant to the watershed's structure or processes, but did have localized effects on soils and overstory survival. Had these fires not been suppressed, they may have continued to grow in size and intensity to some extent.

Reference Condition

Fire played a major role in structure and process in reference times. The type and amount of vegetative species were influenced by the extent, intensities, and recurrence of past fires. As previously discussed, fire created and maintained a mosaic landscape pattern which changed through the centuries. The fire episodes indicate repeated and large areas of stand replacement, as well as significant areas of partial stand replacement. Very little of the watershed had been left unburned for more than a 150 year period, at least since the 1400’s.

In those areas that had recurrent stand replacement, fires would have initially burned at intensities that consumed coarse woody debris (material greater than one inch in diameter) as well as some larger down logs in various stages of decay. Fire would have burned within riparian areas with relative ease, primarily those higher in elevation and somewhat exposed to prevailing winds. After these fires, fuels would slowly accumulate as fire killed trees and brush fell to the forest floor; trees and brush would eventually re-establish themselves; after a period of time, another stand replacing fire would sweep through the area, and the process would repeat itself. Effects of subsequent fires would depend on the length of time between fires, and the rates at which vegetation could re-establish and fuels could build.

Areas of partial stand replacement were dispersed throughout the watershed. Within these areas, isolated incidents of stand replacement occurred as fire encountered concentrations of heavy fuels, or where weather and topographical features affected fire behavior. Partial stand replacement fires would have burned through the undergrowth and ground fuels at lower intensities, occasionally burning into the overstory and torching individual and clumps of trees. This kind of fire creates a diverse mosaic, leaving not only openings in the canopy, but unburned patches of ground throughout the burn area. This kind of fire is less likely to burn intensely in riparian or other moist areas. Subsequent fires moving through these areas would burn the previously unburned fuels, and some of the fuels that had accumulated since the earlier burn.

It is not possible to assess the impact human set fires may have had on the watershed. With the knowledge that local Indians may have used the area for hunting and gathering purposes, and that both local and out-of-area Indians used the major ridges as travel/trade routes, we can make the assumption that at some point they used fire for clearing some of the areas they used. Depending on the time of year they would have done this, fire effects would have ranged from negligible to a major low-moderate intensity fire. It is possible that some of the fire episodes discussed in this paper were human caused; however, as Indian use of fire is considered a natural part of the process in reference times, the effects of human influence in reference times is not an issue.

Step Five - Interpretation

Fire/Disturbance

Key Questions for Vegetation and Natural Fire Regimes

The question of how the role of fire as a regime maintenance function has changed over time, and what its effect on vegetation has been, will be addressed in this section. The second question regarding opportunities to replicate fire's role in the watershed will be addressed in chapter six - recommendations.

Changes in Fuel Model Distribution

In reference times, there were approximately 1500 acres of open, grassy areas; today there are only 190 acres of meadow (about 10% of what was there historically, little of which is in the higher elevations that once had much larger areas of open meadow).

Where there was once approx. 6400 acres of brush/establishment, mostly in the upper elevations of the watershed, today those areas are primarily timbered. The older, denser stands in these areas include both transitional and old growth. As they continue to age, fuels will build and the areas will become more susceptible to intense fire behavior. The conditions these stands are in now, and the heavier fuel conditions that will eventually prevail, may well be typical of the area as it reaches the stand replacement stage of the fire cycle.

Conversely, in the lower elevations 10,600 acres of land that was once mature or old growth timber are now in various stages of brush, establishment, or young timber. Where these stands were more contiguous in reference times between stand replacement events, and in some areas maintained through intermediate lower intensity fires, we now find a patchy distribution of a greater variety of fuel types. Past and current harvest practices play the primary role in the makeup and distribution of the fuel models today. In the areas of mixed ownership, the noncontiguous and dynamic nature of the fuel models will likely continue.

Changes in Fire Intensity Levels - Impact of Settlement, Fire Suppression Policy, and Management Activities

Fire was a common occurrence and played a major role in the watershed in reference times. The settlers did not have a significant influence on the watershed's fire history in the last half of the 1800's. The establishment of the forest reserves, and subsequent protection measures in the early 1900's, played a more significant role.

Fire suppression policies were developed to protect the forest reserves after the devastating fires of 1902. Severe fires occurred in almost every county west of the Cascades. Fires found in the watershed were extinguished, often before they attained any size or intensity. With few exceptions, most lightning and human caused fires were extinguished at less than one acre. Today full suppression (control) is still the primary action taken; occasionally limited suppression (contain) is used; rarely is nothing more than monitoring a low risk fire (confine) done. A full suppression fire policy has had a significant effect on the role fire plays in maintaining fuel types and their distribution in some portions of the watershed, where in other areas the effects of fire suppression are secondary to the effects of harvest practices.

Slash burning has also had a significant effect on the watershed. Since 1951, over 1410 acres of the Forest Service portion of the Sharps Creek watershed has been either broadcast or underburned. Past harvest/burn/replant practices have created a patchwork mosaic of land. In many places these burns were possibly more severe than the area had been subject to previously, while in other places the opposite was probably true, particularly on mixed ownership lands where no burning was done after harvesting. Prior to the mid-80's slash burns often took place in the summer and fall months when fuels were at their driest. These burns were generally more intense, and had greater negative effects in regards to soils and coarse woody debris. Since spring burning began, overall intensities and negative effects have lessened.

Current Condition

Fires are smaller in size, regardless of ignition source, due to both suppression activities and past fire episodes in the watershed. Larger fires tend to occur between Puddin Rock and Sharps Creek, and in the upper Sharps Creek drainage, where the topography is bowl shaped. Fuels on the north slopes of Sharps Creek build up due to the moister nature of the north facing, steep topography. Given certain weather conditions and dry fuels, fires in this area have the potential to burn to larger sizes. The fuels on the south and westerly slopes are generally drier, and are more exposed to prevailing winds. Fires starting in these areas are more intense and have potential to grow because of these factors.

Reference Condition

With the exception of the two areas mentioned above, fire intensities were widely distributed in reference times. Areas of low to moderate intensity were intermixed with areas of moderate to high. Due to the fire history of the watershed, a more open forest was maintained in most areas. The last major moderate to high intensity fires occurred in the 1890’s. In terms of intensity, we are approaching the stand replacement fire return interval of 100-150 years for the watershed.

Changes in Fire Regime and Range of Variability

The optimal conditions for interpreting natural disturbance regimes are a long, pre-European settlement record with a high frequency, low severity disturbance regime, which permits sampling numerous events per site with dendrochronologic methods. Some areas of the watershed met this criteria; exceptions were areas that are roadless or experienced repetitive stand replacement fire events.

Current Condition

Fires appear to have been a frequent occurrence within the watershed, with a broad range of sizes and intensity. When the fires grew in size, overall intensities tended to be moderate. Had suppression policies not been in place, it is very likely many of the smaller fires would have become larger, with higher intensities. The advent of fire suppression, however, has minimized the role of natural fire, particularly those of low to moderate intensity.

Reference Condition

Again, fires were a frequent occurrence in the watershed. A wide range of fire intensities occurred, resulting in a complex, dynamic mosaic of forest composition and stand age structure. Throughout the centuries, the overall fire regime has been maintained. The mosaic burns of the past appear to have affected vegetative types, distribution, and sustained old growth. Miner influence on the watershed was negligible; they rarely set large areas on fire, and mainly used fire in a "cut and burn" style.

Changes in Air Quality

In the past, air quality was often poor. Regardless of ignition source, fires would have burned longer and more intensely, resulting in increased consumption and resulting emissions. Down canyon and down wind effects would have varied, depending on weather conditions. Smoke in the Willamette Valley and Willamette River drainages would have been a common occurrence in the summer months, and inversions would have contributed to prolonged poor air quality in the valleys. Wood burning for heat in the winter months would also have contributed to poor air quality; inversions are most common in the area at this time of year and sole reliance of wood for heat resulted in high emissions on a daily basis for several months of the year.

In the early to mid-1900's through the 1950's, air quality began to improve somewhat. Indian ignited fires were no longer a regular occurrence, and settler fires slowly decreased as land was cleared for homes and pasture land. Logging was starting to pick up in the forest, however, and slash burning smoke filled the air, mostly in the summer and fall months. It was during this time period that fire suppression policies were in full swing, and most fires of other origins were suppressed before intensities were such that significant emissions were produced. Wood burning in the winter months was still a major contributor to poorer air quality, though that was beginning to change with the development of other sources of heat.

In the 1960's and 1970's logging activities increased with a corresponding increase in slash burning emissions. In the 1980's logging decreased somewhat, but slash burning was still the accepted and preferred disposal method. Most of these burns were still carried out in summer and fall, but a trend toward spring burning had begun. Until the mid-60's there was little concern about air quality and residual smoke impacts to people.

With the passage of the Clean Air Act in 1967 and amendments in the 1970's, regulations were put into effect which restricted activities that contributed to air quality degradation. By the mid 1980's prescribed burning techniques were being implemented which further reduced negative impacts to air quality. Restrictions were in place which also reduced winter wood burning impacts.

In the 1990's we have only burned within the spring burning period. None of these burns impacted air quality outside the immediate vicinity of the burn. Through the techniques we employ and the regulations we adhere to we have minimized air quality impacts to downwind areas, and have not had a smoke intrusion due to prescribed burn activities for several years. Since pre-settlement times, air quality has gradually improved. Technology has advanced to the point that most smoke management and air quality concerns can be mitigated. An exception is the uncontrolled wildfire, which would impact air quality much more than prescribed burning does, even if management ignited prescribed fire (MIPF) were implemented.

Changes in the Role of Fire on the Fuel Condition

Fire has played a major role in creating, modifying, or maintaining fuels conditions within the watershed. Low intensity, partial stand replacement, and stand replacement fires served to keep the forest floor relatively clear of large build-ups of fuels. These fires also maintained a dynamic mosaic of fuel models over large areas of land. Stand replacement fires burned periodically, consuming most of the fuels that would have built up in the area over time due to disease, insects, weather events, or past fires.

The role fire played in relation to human manipulation was one of maintaining conditions for hunting, gathering, traveling, and grazing. Most of the time these fires would be of lower intensities, usually to clear out brush or burn off grasses. Exceptions probably occurred when higher intensity fires resulted, but for the most part human set fires maintained fuels conditions previously established.

In this century fire has played the role of fuels hazard reduction. Clearcuts and other harvest areas have been burned primarily to reduce wildfire risk, an objective that goes back to 1902. A secondary role has been to use fire as a silvicultural tool to clear slash for replanting. The outcome of slash burning in the watershed is similar to the outcome of fires in reference times, except that the distribution of fuels and mosaic effect on vegetation has not been maintained. Fire has not been allowed to burn after natural ignitions (prescribed natural fire), nor has it been re-introduced to the watershed purposefully (management ignited prescribed fire). Management activities and fire suppression have had the effect of encouraging fuels to build up in areas that have historically had low loadings, and have allowed burning in areas which had not experienced the moderate to intense slash burns that were characteristic of the 1940-1970’s.

The overall role of fire in the watershed has been minimal since the early 1900’s. As a companion to silvicultural practices, and for hazard reduction purposes, it has played a major role in preparing sites for planting and mitigating wildfire risk. While we have been mostly successful in preventing large fires from occurring, we have at the same time prevented many of the areas within the watershed from benefiting from the many effects of fire that may contribute to a healthier forest.

Changes in Effects of Fire on Watershed Structure or Processes

The effect of continued exclusion of fire will be forests with stands that are older on-the-average than historically, and which will function much differently ecologically. Due to both forest density and to the kinds of tree and other plant species that will emerge to replace the existing forest overstory, they will be forests which are more unstable than the ones they are replacing, i.e. more susceptible to catastrophic fire. There will be denser understory in what were once more open stands of trees, a higher potential for mortality from insect and disease epidemics, potential loss of seral tree, shrub, and herbaceous species important for natural diversity and wildlife habitat; and heavy fuel build-up leading to larger, more severe wildfire that can be expected to result in more significant impacts to water, soil, and air resources than. would have been typical in pre-European forests.

Fire played a major role in maintaining or modifying the watershed condition in reference times. Continued exclusion and suppression eliminates fire as an effective tool in maintaining and modifying structure and processes, and sets the stage for a major, destructive fire event at some point in the future. The watershed is still within its natural range of variability, and is due for a moderate intensity, partial stand or stand replacement fire to occur.

While slash burning plays a part in reducing hazard within an isolated area, it does not benefit surrounding areas; i.e. the landscape in the drainage or sub-watershed around it doesn't receive the treatment it may require to effectively mitigate the hazard over the total potential burn area. A clear-cut burned within an area susceptible to stand replacement fire, for example, may not be an effective control point to slow or stop a fire's spread.

Potential Effects of Future Activities

Should silvicultural and fuels management use of prescribed fire continue as it has in the past, the watershed will continue to receive limited prescribed fire in isolated pockets, to the neglect of the area as a whole. Eventually a large, stand replacing fire will occur which will probably have some level of severe effects on the watershed and on air quality.

Instituting management ignited prescribed fire may not immediately or effectively mitigate the risk of high intensity stand replacement fire, but over time may lessen the risk significantly. Application of fire to select areas may have the added benefit of restoring fire's maintenance role to portions of the watershed.

Natural fuels planning on the District, particularly in the Sharps Creek watershed, may bring to light areas that would benefit from recurrent management ignited prescribed fire. The recommendations in chapter six will address this potential in more detail.

A Late Successional Reserve (LSR) is situated within a portion of the watershed. Fuels in these stands have been building, and there is concern that potential effects of a wildfire occurring within the LSR may be severe. The general discussion of LSR's in the Record of Decision mentions fire as a natural process in retaining the forests in a natural condition. Further, it states that small scale disturbances by wildfire and other agents will be allowed to continue, and that use of prescribed fire in the LSR is allowed. In the discussion on management of disturbance risks, it states that reintroduction of fire may be necessary, and discusses underburning over a large area. As there is a moderate risk to the LSR, options to mitigate the risk will be discussed in the recommendations section.

Relationship to Standards and Guidelines - Fuels Management and Fire Suppression

The Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (Forest Plan) was reviewed to insure that any recommendations made would fall within its requirements. Prior to implementing any recommendations, local land management plans would also need to be reviewed.

Page C-35 of the Forest Plan discusses fuels treatments and fire suppression activities affecting riparian reserves. Any prescribed burning done within these areas must contribute to attaining Aquatic Conservation Strategy (ACS) objectives; strategies should be planned to avoid damage to long term function.

Wildfires and fire suppression activities carry an element of risk to riparian areas as well. A stand replacement fire in the watershed would impact riparian areas; severity would depend on the location of the fire start, and extent of fire spread. Trade-offs and consequences of not carrying out prescribed burning in select areas of the watershed should be evaluated in terms of fire and suppression effects in the event wildfire occurs in those areas.

Page C-40 of the Forest Plan discusses maintenance of coarse woody debris. This may be accomplished by maintaining areas that simulate the reference condition of a moderate severity regime by means of silviculture, prescribed fire, or utilization. This would require planning for management ignited prescribed fire, in conjunction with other methods, over a period of years.

Appendix VIII. of the Forest Plan contains the Fire Management Standards and Guidelines. Its content can be summarized as recognizing fire's role as part of ecosystem function, and that fire should either be used or suppressed in the context of achieving ecosystem management objectives at the landscape level.

Guidelines within this appendix include writing fire management plans that cover the use of prescribed fire for ecosystem management, fuels hazard reduction, and wildfire suppression. The overall goal would be a reduced risk of large scale, high intensity wildfire. This fire/fuels analysis is a first step in developing any future fire or fuels plans for areas within the watershed. (The remainder of Appendix B expands on the guidelines discussed above, and can be found on pages B-135 and B-136.) Natural fuels planning will be the next step in developing an interdisciplinary prescribed fire plan for the watershed.

From a fire/fuels standpoint, there are no obvious conflicts with any of the standards and guidelines. They allow for both prescribed natural and management ignited fire within the watershed, once approved plans are in place. Current suppression policies are adequate, as well, though the range of suppression strategies are often not utilized when looked at in terms of appropriate suppression response.

Summary

The Augusta Creek Project yielded some general lessons about historic vegetation patterns that appear to be relative to the Sharps Creek watershed as well. Both areas have a similar fire return interval and fire regime. Three main points were made in the Augusta Project summary. First, that fire has been a significant and persistent component of the ecosystem, resetting stand conditions and influencing stand development. Second, that the resulting vegetative patterns have been highly variable in time, space, and structure. Lastly, that fire and vegetation patterns appear to be correlated with topographic features.

Though complex, there are opportunities to manage the landscape more closely along the patterns of natural disturbance, which might be used as a template for forest management. Ultimately, a focus on maintaining the ecosystem at something resembling reference conditions will require evaluating wildfire suppression methods and the potential use of prescribed fire, as well as addressing air quality concerns.

Step Six - Recommendations

Key Questions for Vegetation and Natural Fire Regimes

The question as to opportunities to replicate fire’s role in the watershed will be addressed in this section.

Fire as a Replication of the Ecological Process

Fire is an appropriate process in the preservation of old-growth forests. Fire is responsible for their creation and maintenance, as well as their destruction. As we cannot replace the effects of fire with only timber harvest or vegetation manipulations, fire must remain as an active function in the system. However, allowing fire to take its course isn’t a feasible option under current fire suppression policies in these land allocations. Instead of natural fire events, we can take advantage of prescribed fire lit under pre-determined conditions and limitations.

Potential Restorative and Enhancement Opportunities

Some of the timbered stands in the watershed have become denser in terms of fuel loading. The primary causes have been fire suppression, lack of landscape prescribed fire, and severe weather events. The overall fuels condition will continue to deteriorate, and stands will become more susceptible to fire. The role of fire as a maintenance function will change significantly throughout the watershed as fires continue to be fully suppressed.

If we maintain the status quo, continuing full fire suppression and doing little prescribed burning other than for silvicultural or hazard reduction purposes within timber sales, fuels will continue to build; the high fuel loadings will be maintained; eventually an intense, stand replacing event will occur.

Flame lengths in excess of eight feet are generally not affected by control technologies. Control is more successful when flame lengths are below eight feet. Factors that contribute to success include increased moisture, loss of fuel continuity, drop in wind velocity, and/or change in slope. As fuels continue to build in the forests, wildfires continue to become larger and more severe. When controlling the size of wildfires is mentioned, it is intended for wildfires burning within the limits of control technology. In addition, most large wildfires incur significant spotting. It can be very difficult to impossible for aerial retardant to be effectively delivered on the spot fires due to the smoke, intense heat, and strong turbulence. Fuel breaks and roads are usually ineffective in stopping or slowing the spread of a spotting wildfire.

Recommendations for restoration or enhancement include:

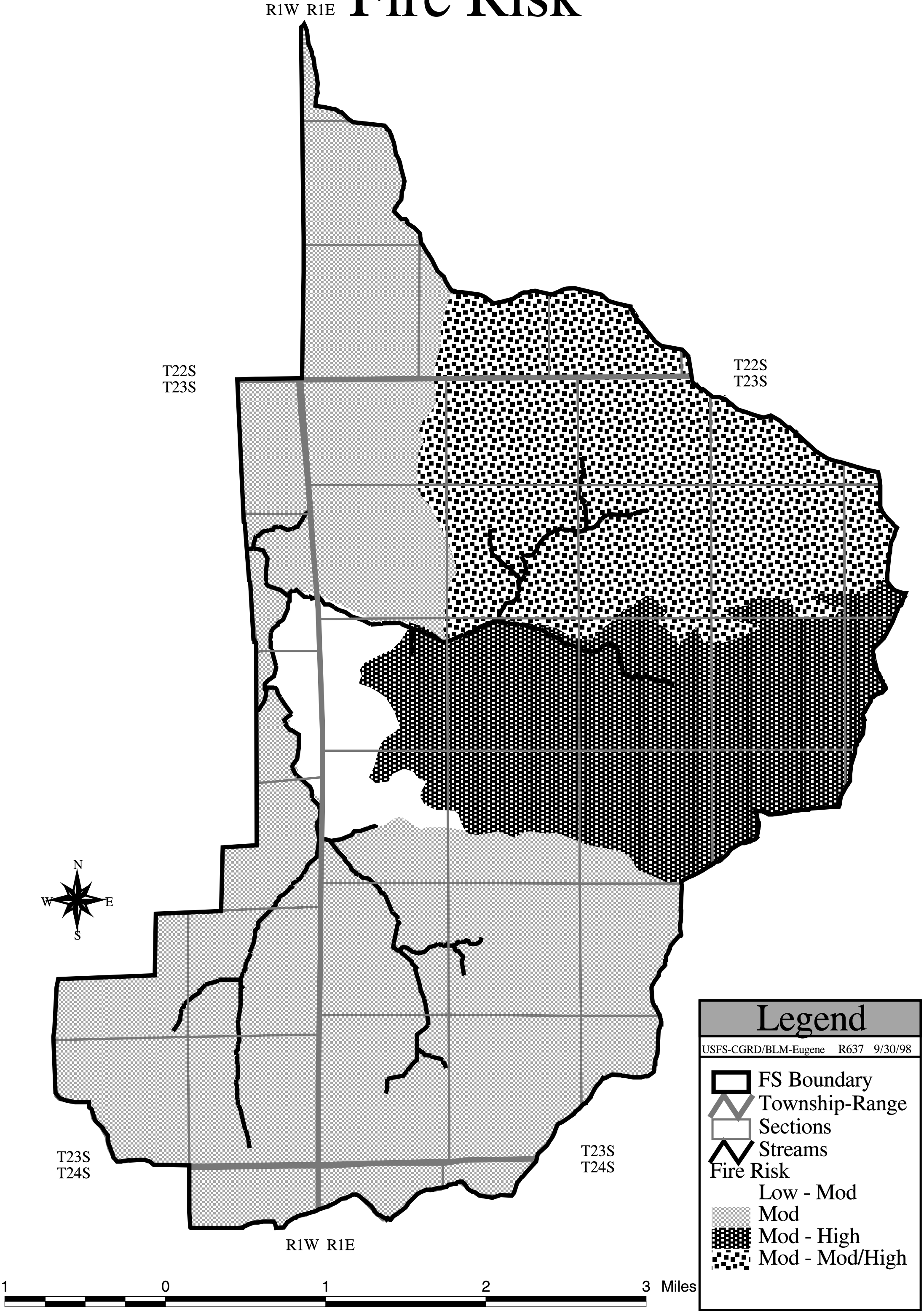
* Identify and evaluate opportunities for prescribed natural or management ignited fire in select areas to restore fire's role of maintenance. Priority areas would be:

- Matrix areas that have historically experienced moderate intensities, and recurrent partial stand replacing fires.
- Meadows and winter range habitat;
- Planning areas for which an analysis shows prescribed fire would be beneficial, either inside cutting unit boundaries or adjacent to them;
- Late Successional Reserve;
- Areas where significant amounts of trees have fallen due to extreme weather events.

Assess risk of using or excluding fire in these areas (See following Fire Risk Map). Include:

- Firefighter and public safety;
- Values at risk, to include mining structures;
- Potential fire behavior;
- Cost analysis;
- Air quality concerns;
- Fire effects;
- Road access or potential closures, especially in the LSR.

Sharps Creek Watershed
Fire Risk



LSR Assessment

The Draft LSR Assessment currently being done with the help of the Umpqua National Forest indicates the Desired Future Condition is that 65% of the LSR will be in a low to moderate risk category, as determined by fire behavior, fuel loadings, and fire occurrence. Prescribed fire planning for the Sharps Creek portion of the LSR should include a risk assessment to determine where it falls in relation to this figure.

Management Strategies

- Identify opportunities for partnership projects, (partners may include the Bureau of Land Management, the Bohemia Mine Owner's Association, Oregon State Department of Forestry, and the Umpqua's North Umpqua and Cottage Grove Ranger Districts);
- Begin natural fuels planning effort, using an interdisciplinary approach, to assess areas that would benefit from management ignited prescribed fire as described above;
- Prepare management ignited prescribed fire plans for areas within the watershed that would be high priority for application of fire;
- Identify opportunities for monitoring and evaluating prescribed fire applications and effects beyond what is currently required;
- Develop fire behavior predictions for use in Fire Situation Analyses (FSA's) and fire planning;
- Identify several prescription windows to maximize opportunities for a variety of landscape scale treatments;
- Model potential smoke management emissions given proposed projects (using PUFF plume trajectory modeling);
- Delineate proposed wildlife corridors and areas of concern for larger fires on Hazard Reduction Standards Risk Map and identify protection priority. As the landscape surrounding the proposed corridors develops, consider opportunities for prescribed fire within the corridors;
- Along the Sharps Creek and Puddin Rock corridors, increase fire prevention efforts to mitigate risk of human caused fire due to recreational and mining activities;
- Develop map of pre-determined risk (of significant spread) areas; identify and practice appropriate suppression response (confine, contain, control) based on mapped areas, weather, available fire management personnel, and fire behavior projections as available.

Areas Needing Further Study or Research

The Fairview and Puddin Rock areas need to be evaluated more thoroughly. Fire management personnel will survey representative areas to gather data such as visible fire scars, tree age samples, fuels and stand characteristics as funding and opportunities become available. The information collected will be used to validate assumptions made in this study as to the fire risks of these areas.

Areas identified as possibilities for prescribed natural or management ignited prescribed fire may require pre-burn preparation. Those areas requiring reduction of understory fuels as a pre-burn preparation could be expensive. An economic evaluation of potential costs and losses associated with this type of preparatory work would be necessary.

Significant Issues or Areas of Concern

In order to implement management ignited and prescribed natural fire programs, and to meet current management suppression policies, qualified personnel with good prescribed fire training and experience are needed. Skills need to be emphasized in the following areas:

- Fire and fuels planning for landscape scale projects
- Knowledge of fire effects
- Prescribed fire behavior analyst skills
- Complex prescribed fire manager, burn boss, and specialist skills

Should the District choose to plan and implement prescribed burning as suggested in this paper, training and skills of employees should be evaluated and enhanced as necessary.

Air quality has been gradually improving since the early 1900's. This trend should continue, and any prescribed burning would be planned to meet air quality standards and restrictions. With any larger scale prescribed fire project, an assessment of the public's concerns relative to potential smoke emissions would need to be addressed.

Other public concerns that would need to be addressed in any prescribed fire planning effort for the watershed would be not only the issue of using prescribed fire but also the risks and consequences of human use or lightning triggering a wildfire. At a minimum, human use of the watershed, especially in fire season, and the potential use of chemicals (i.e. retardant) during fire suppression activities would need to be addressed.

There are strong public expectations for protection and fire suppression programs. Through educational opportunities, people can be taught the role of fire and its effects. They will better understand the historical role fire has played in the watershed prior to our management activities. An increased public awareness of fire management issues may lead to more tolerance for prescribed fire after understanding some of the trade-offs and risks associated with wildfire.

Conclusions

Expanding a prescribed fire program seems to be a simple and biologically sound way to restore sustainable conditions. Fire regulates the biotic productivity and stability of fire adapted ecosystems in ways that cannot be fully emulated by chemical or mechanical means. In order to accomplish prescribed fire on a landscape scale, however, pre-burn vegetative/fuel management actions may be needed to incrementally reduce hazard prior to prescribed burning.

Some types of these pre-burn actions may be difficult to accomplish on landscape scales, but avoiding treatments may create serious consequences, such as:

- A change from relatively low damage, stand maintenance fires to more severe high damage, stand replacement fires;
- Conversion from fire resistant species to fire intolerant species having less resilience to fire disturbances;

- Less controllable and more costly wildfires;
- Increasing danger to firefighters;
- Increasing potential for higher particulate matter emissions as fuel loads and understory biomass increase.

In order to effectively assess the use of prescribed fire in various locations within the watershed, the prescribed fire planner should develop an operational risk assessment and mitigation strategy in support of proposed prescribed fire treatments. The assessment should include a determination of escape thresholds and identification of high risk factors that trigger or contribute to escaped prescribed fires. We recognize that a certain amount of risk is associated with the application of prescribed fire, and we must be able to accept some level of risk. However, unless those areas of high risk can be adequately mitigated, this process should become the basis for the go-no-go decision.

Ultimately, the objectives of periodic application of fire in portions of the watershed are to emulate fire's natural role, reduce risks, and make future wildfires more manageable.

Beverly A. Reed
AFMO- Fuels Specialist

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Appendix D

Vegetation
and
Soils

The following report was written for the Brice Creek Watershed Analysis by Ellen Goheen, Area Pathologist for Southern Oregon National Forests. The information is pertinent for the Sharps Creek Watershed as well.

Insect and Disease

In the Brice Creek Watershed, various insects and pathogens are causing scattered mortality of individual trees and groups of trees throughout the analysis area. Current watershed-wide mortality levels are generally low, however, local impacts are high and levels are expected to increase due to increased ground-disturbing activities and fire exclusion. Recent windthrow will influence Douglas-fir beetle populations in future years.

Insect and pathogen activity has probably increased since the turn of the century due to timber harvesting, the introduction of an exotic organism, and the exclusion of fire. Vegetation density is higher in some areas than that which would have been maintained by fire. Single-species, even-aged plantations of Douglas-fir provide more uniform conditions for introduction and spread. Road building and maintenance and soil compaction have increased tree stress.

Root Disease

Laminated root rot (Phellinus weirii) is the most prevalent root disease in the Brice Creek watershed analysis area. In natural stands, this root rot typically creates small openings (up to 2 acres) containing snags, stubs, down wood and shrubs. If susceptible conifers regenerate in these openings, probability is low that the trees will grow beyond sapling or pole size. If resistant conifers or hardwood trees fill in the openings, inoculum levels are reduced over time. Successional patterns of laminated root rot openings are tied to fire history and adaptation of different tree species to sites where root disease occurs.

Black stain (Leptographium wageneri) root disease affects sapling and pole-sized Douglas-fir within the Brice Creek Watershed. Black stain infection centers are most prevalent in areas where substantial tree damage or site disturbance has occurred, especially along roads and skid trails, where trees have been damaged by road maintenance equipment, in areas with a history of tractor logging and resultant soil compaction, and/or in areas that have been precommercially thinned.

Armillaria (Armillaria ostoyoe) root disease also occurs in plantations and in partially cut stands at higher elevations in the Watershed. It is often associated with site disturbance and individual tree stress. In the Brice Creek watershed analysis area, Douglas-fir less than 25 years old in plantations and true firs of all ages at higher elevations seem most susceptible.

White pine blister rust

Since its introduction into North America in 1910, white pine blister rust (caused by (Cronartium ribicola) has caused widespread mortality of western white pine and sugar pine throughout their range. Mortality in western white pine has been significant in seedling to pole-sized western white pine in Brice Creek and will continue. The fungus has also attacked older trees of both species; damage usually being confined to branch dieback and topkill and predisposition to attack by mountain pine beetle.

True fir dwarf mistletoe/canker fungi complex

At higher elevations in Brice Creek, particularly in the Holland Meadows area, white fir is experiencing branch dieback and decline due to true fir dwarf mistletoe (Arceuthobium abietinum) and a canker fungi, Cytospora species. Vigor loss resulting from this complex, in combination with high stocking, has made some trees susceptible to fir engraver beetles (Scolytus ventralis).

Douglas-fir Beetle

Douglas-fir beetle is one of the least aggressive of the Dendroctonus species and maintains endemic population levels by attacking stressed trees. Douglas-fir beetle is associated with standing mortality on the perimeters of root disease pockets and is highly associated with logging residues and windthrows. Patches of windthrow resulting from winter storms in 1995/1996 may be at risk for infection from Douglas-fir bark beetle.

Landunit Stratification

Characterization, Current and Reference Conditions, and Recommendations

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In order to facilitate understanding of vegetation types along moisture and temperature gradients, the Sharps Creek Watershed Analysis Area was stratified into six broadly-defined environments, called Landunits, that represent different moisture and temperature regimes. Sharps Creek Landunits were characterized and mapped using elevation, aspect and slope classes, those physiographic properties that most effect the distribution of soils and vegetation types in Sharps Creek and elsewhere in Oregon and Washington (Spies and Franklin, 1991).

The Sharps Creek Landunits characterize six physiographic environments that closely approximate the landunits of Sharps Creek. They are named for the moisture and temperature environments that they define:

Table 1. Sharps Creek Landunit Physiography

Landunit Name	Landunit Physiography		
	Elevation (feet)	Aspect (azimuth)	Slope (%)
Cool	>= 4000	SE to NW	< 60
	>3200	NW to SE	< 60
Cool,/Dry/Steep (C_D_S)	>= 4000	SE to NW	>= 60
Warm/Dry/Gentle (W_D_G)	<4000	SE to NW	< 60
Warm/Dry/Steep (W_D_S)	< 4000	SE to NW	>= 60
Warm/Moist/Gentle (W_M_S)	< 4000	NW to SE	< 30
Warm/Moist/Steep (W_M_S)	< 4000	NW to SE	>= 30

The purpose of these Landunits is to provide a clearly-defined, easily understood framework for describing potential vegetation and disturbance processes on a watershed scale. This Landunit framework may also provide insight into the historic pattern of vegetation types and seral stages, the distribution of snags and large woody material, differences in site productivity and other ecological properties of the landscape.

Analyses of central Oregon Cascades vegetation types along moisture and temperature gradients have demonstrated relationships between plant associations and site moisture/temperature classifications (Zobel et al, 1976). The Warm Landunits in Sharps Creek are separated into Warm/Moist and Warm/Dry Landunits based on north and south aspect categories. Within north-facing moist and south-facing dry Landunits, different soil moisture environments are separated based on slopes classes.

Timber stand exam data and the Lane County, Oregon Soil Survey data were used to identify elevation bands where the transition from warm to cool environments occurs in Sharps Creek. On north aspects in Sharps Creek, soil survey mapping shows that the 3200-foot contour defines the transition from warm to cool vegetation environments. On south aspects, plant association data from stand exams indicates that the 4000-foot contour defines the transition to a cool environment.

Cool Landunits

In the Sharps Creek Watershed Analysis Area, cool landunits occur above 3200 feet on north aspects (northwest to southeast azimuths) and above 4000 feet on south aspects (southeast to northwest azimuths). At these higher elevations, cool temperatures become more of a factor and soil moisture deficits less a factor affecting vegetation. The presence of cool western hemlock plant associations and absence of warm hemlock associations at timber stand exam points was used as an indicator of this cool environment on north aspects in upper Sharps Creek (see Figure xx). On South aspects, the Douglas fir forest dominates the cool environment. The transition to this cooler environment on south aspects was indicated by the absence of the Douglas fir/Salal/Swordfern plant association above 4000 feet.

Warm Landunits

The Warm Landunits occur primarily in the western hemlock and Douglas fir vegetation zones, where soil moisture is the principle site factor affecting vegetation. The Warm Landunits are separated in Warm/Moist and Warm/Dry based on aspect. Warm/Dry Landunits are located on south aspects, with the driest sites being those on slopes greater than 60% (Warm/Dry/Steep) where soils are often shallow and rocky.

The Warm/Dry Landunits are dominated by Douglas fir plant associations. In general, plant associations found in a Warm/Dry environments are less productive than other warm environments because they have lower levels of soil moisture, organic matter and large woody material. Comparable Willamette National Forest Plant Associations have site indices for Douglas fir that range from 107 (Tshe/Gash) to 87 (Psme/Hodi/Whmo) [King (1966), 50-year site indices for Douglas fir].

The Warm/Moist Landunits occur on north aspects, with the wettest sites being on slopes less than 30 percent (Warm/Moist/Gentle). The Warm/Moist environment is dominated by a group of moisture-loving western hemlock plant associations and the western redcedar plant series. The moist hemlock plant association group occupies the most productive sites that typically have deep soils with good drainage and lower slope positions. Within this group of moist western hemlock and redcedar associations, those with *Rhododendron* generally occupy less productive sites where moisture, fertility and/or temperature limits plant growth. On comparable Willamette National Forest western hemlock associations, Douglas-fir site indices range from 120 (Thse/Pomu) to 99 (Tshe/Rhma/Bene).

Plant Associations and Plant Association Groups

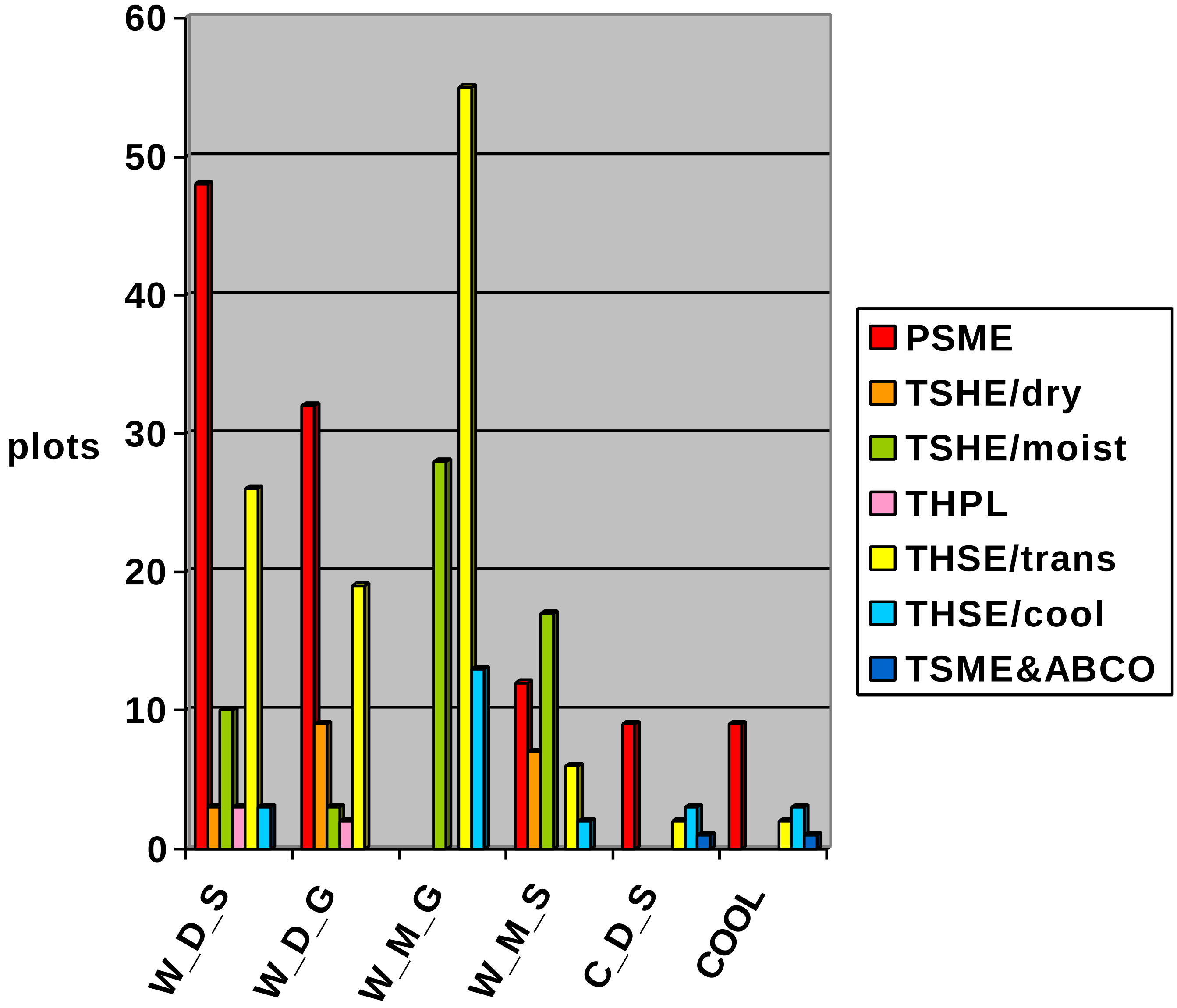
The most common plant associations found in the Sharps Creek WAA and the Plant Association Group (PAG) they are associated with are listed in Table 4. These PAG's were identified by timber stand exam data from upper Sharps Creek and lower Brice Creek.

The Plant Association Group distribution by Landunit reflects timber stand exam data from Upper Sharps Creek. The data for the warm/moist/gentle distribution is from timber stand exams in lower Brice Creek.

Table 2. Plant Association Group Distribution by Landunit

PAG (PAG code)	**Number of Plots by Landunit**					
	W_D_S	W_D_G	W_M_G	W_M_S	C_D_S	COOL
PSME (CD1)	48	32		12	9	9
TSHE/dry (CH2)	3	9		7		
TSHE/moist (CH1)	10	3	28	17		
THPL (CC1)	3	2				
TSHE/transitional (CH3)	26	19	55	6	2	2
TSHE/cool (CH4)	3		13	2	3	3
TSME (CM1) & **ABCO** (CW1)					1	1

PAG Distribution by Landunit



Disturbance Processes Affecting Vegetation

Three processes, fire, erosion and human use, most affect disturbance of vegetation. These three processes can be used to broadly characterize the pattern of vegetation in the Sharps Creek landscape. The three Landscape Areas in Sharps Creek reflect differences in landunit patterns, reference vegetation patterns, dominant erosion processes and differences in past management practices associated with the pattern of land ownership (a similar set of landscape areas based on landunit patterns were defined for Brice Creek):

Table 3. Sharps Creek Landscape Areas

Landscape Areas	Drainage Groups
Lower Sharps East	Adams, Lick, Lower Sharps East, Pony
Lower Sharps West	Buck, Lower Sharps West, Straight,
Upper Sharps	Adams, Clark, Fairview, Martin, Quartz, Upper Sharps, Walker

The objective for Landscape Areas is to define areas that represent broad-scale differences in vegetation pattern, stream characteristics and human use patterns.[1] These Landscape Areas can be the basis for developing a Desired Landscape Pattern that reflects;

- range and variability of historic vegetation patterns of different landscape areas
- riparian and stream channel morphology
- human use patterns, including effects of land ownership and management history

Different patterns of landunits define three Landscape Areas in Sharps Creek. The following discussion of vegetation and disturbance patterns combines Upper Sharps East and West into one landscape area called Upper Sharps.

Table 4. Distribution of Landunits in Sharps Creek Landscape Areas

Sharps Ck. Landscape Areas	Landunits (percent of area)					
	Warm/Dry/ Gentle	**Warm/Dry/ Steep**	**Warm/Moist/ Gentle**	**Warm/Moist/ Steep**	**Cool**	**Cool/Dry/ Steep**
Lower Sharps West	13	5	30	42	10	-
Lower Sharps East	83	10	4	3	-	-
Upper Sharps West	19	19	3	43	3	-
Upper Sharps East	26	23	1	21	24	5
Upper Sharps East and West	23	21	2	30	21	3

[1] USDA Forest Service, 1993. *Integrating Landscape and Watershed Planning for Ecosystem Management: The Augusta Project*. Cascade Center for Ecosystem Management. Willamette National Forest, Blue River, Oregon, 97413.

Fire

In moderate fire regimes, the pattern and patch sizes of vegetation stages over time is quite variable (Agee, 1990). The product of a moderate severity fire regime is a complex mosaic of vegetation that is initiated by a mix of fire effects and fire return intervals over the landscape. Differences in the effects of any one fire event reflect the variability in topography, site productivity and fire season climate on a landscape scale. The pattern of vegetation that burns also effects fire behavior, a vegetation "neighborhood" effect (Witherspoon and Skinner, 1995). Landscape Areas define landscape-scale differences in these variables and their effect on fire disturbance.

Lower Sharps West. The historic vegetation pattern is assumed to be a mature forest matrix with a complex pattern of early- and late-seral patches similar to the comparable area in lower Brice Creek. This pattern was the result of the moderating effect of gentle slopes on fire behavior combined with fuel buildup associated with productive warm/moist environments. The gently-sloping terrain and moist environment has the effect of lengthening the return-interval for stand replacement fire event. Longer fire-return intervals and low intensity fire effects that are characteristic of the warm/moist environments generate multi-aged stands. In contrast, heavy fuel build-up and layered forest canopies promote stand replacement fire effects under extreme fire conditions. Remnant old growth patches are most likely maintained in riparian areas and on gently-sloping northerly aspects.

Lower Sharps East. The reference vegetation for this landscape area is dominated by a matrix of mature, even-age forest with relatively few patches of early and late-seral forest compared to Lower Sharps West. The spread of fire on steeper slopes and southerly aspects (warm/dry/gentle & warm/dry/steep landunits) has the effect of shortening the fire-return interval for moderate severity fire effects. Between stand replacement fire events, fuel buildup is relatively low compared to Lower Sharps West due to increased frequency and extent of low intensity fire effects, a process that consumes ground fuels. Remnant patches of late-seral western redcedar and western hemlock forests are maintained in riparian zones.

Upper Sharps. The historic vegetation pattern in Upper Sharps landscape area is more complex than Lower Sharps areas. Steep slopes, alternating north/south aspects and warm/cool temperature environments effects a complex pattern of vegetation disturbance made by fire. The dominance of the Douglas -fir forest suggests frequent fires comparable to Lower Sharps East. Under severe fire conditions, the spread of fire on steep slopes that predominate in the area would create a mosaic of fire effects aligned with the landunit pattern. The high intensity fire effects of the 19th century fires has restricted remnant late-succession patches today to the lower slopes and narrow riparian zones. However, the reference percentage of late-seral is the highest of the three landscape areas because of the complex physiography.

Erosion

Lower Sharps West and East. Outside the Buck creek drainage, the dominant geomorphic feature in these Lower Sharps Landscape Areas is earthflow. The predominance of gentle slopes characteristic of earthflow terrain is reflected in a relatively low natural landslide rate, except along steep, incised channel sideslopes. In a warm environment, high site productivity and relatively large inputs of wood to stream channels provides structure and resilience to channel erosion. Relatively low channel gradients and oblique tributary junction angles are not conducive to debris flow process and associated channel scouring.

Upper Sharps. This landscape area as well as the Buck and Adams drainages have higher natural landslide rates than Lower Sharps areas, a reflection of the prevalence of steep slopes and weathered bedrock. Steep channel gradients combined with higher natural landslide rates produce more frequent debris flows and disturbance to riparian forests that are confined to narrow stream corridors confined by steep terrain.

Human Use

Management-related disturbance by landscape area reflects differences in the patterns of physiography and ownership. The gently-sloping landunits in **Lower Sharps** landscapes areas were roaded and timbered the earliest. As a result, today these areas have the highest road density and associated effects on stream channels including road-related stream channel extensions. Furthermore, the predominance of private land ownership in the **Lower Sharps West** has resulted in the simplification of the vegetation pattern, a pattern made more uniform and younger vegetation stages made more prevalent compared to the reference vegetation pattern. By comparison, **Lower Sharps East** has a mosaic of ownerships and slopes that have effected the more fragmented pattern of vegetation, roading and timber harvest that is present today.

Later road building and terrain more difficult to manage in Upper Sharps has resulted in a lower road density and a less fragmented vegetation pattern compared to Lower Sharps. Aside form the Walker Creek drainage, **Upper Sharps** is almost entirely in federal ownership.

Soil Resiliency

Soil resiliency is defined as, " the ability of a soil to readily recover from disturbance impacts, both human-caused and natural." In other words, resilient soils can maintain nutrients and structure while resisting erosion, fire and timber harvest effects, or other soil disturbance impacts. On the other hand, even the most resilient soils can be *sensitive* to disturbance due to soil properties that make them *susceptible* to erosion and loss of nutrients and structure as a result of disturbance processes. For example, clayey soils on gentle land surfaces have high resilience, yet they are "susceptible" to loss of structure as a result of compaction from equipment operation. The *sensitivity* of soil to disturbance is the product of that soil's resiliency and susceptability to that disturbance process. With this definition of soil sensitivity, the most sensitive soils in a landscape are those with low resiliency and high sensitivity. In Sharps Creek, the most sensitive soils to disturbance, including effects of fire and timber harvest, are the rocky soils on steep slopes in upper Sharps Creek that have low resilience.

Soil properties that affect resiliency include properties important to plant growth including soil moisture, organic matter, temperature, structure, rooting depth, etc. For example, where soil moisture limits plant growth, soil properties that affect water retention (soil depth, texture, structure, rock content and organic matter) are used to determine resiliency.

In upper Sharps Creek, most soils are steep to very steep (>60% slopes). Most soils are also very rocky (35 to 60% rock) to extremely rocky (>60% rock fragments). On steep slopes, shallow rocky soils have low resiliency and they are susceptible to erosion from both mass-wasting and surface erosion process.

Soil temperature also effects resiliency. In upper Sharps Creek, elevation , aspect and soil depth were used to define warm and cold temperature regimes. Cold, rocky soils in upper Sharps Creek that are shallow and moderately-deep have low resilience. Cold, deep soils have moderate resilience.

Table 5. Resiliency Properties of High Elevation Soils in Sharps Creek

Resilience	Soil Depth	Rock Fragments	Aspect (Elevation)	BLM Soil Resiliency Code
Low	Shallow (0-20”)and Moderately Deep (20-40”)	All	North (> 3200’)and South (>4600’)	4
Moderate	Deep (40”)	All	North (> 3200’)and South (>4600’	7

At low elevations on warm sites, soils depth, aspect and rock fragments content were used to determine resiliency. These are the soil properties that most affect soil moisture retention as well as resiliency.

Table 6. Resiliency Properties of Low Elevation Soils in Sharps Creek

Resilience	Soil Depth	Rock Fragments	Aspect (elevation)	BLM Soil Resiliency Code
Low	Shallow	All	North (<3200’) South (>4600’)	3
	Moderately Deep	> 60%	North (<3200’) South (>4600’)	3
Moderate	Moderately Deep	35-60% or >40% cobbles	North (<3200’) South (>4600’)	6
	Deep	>60%	South (>4600’)	3
High	Deep	All	North (<3200’)	9

Landscape Area Soil Quality

Soil quality is an overall measure of soil’s condition in a given disturbance regime, including both natural and man-caused disturbances. Soil quality represents the sum of the effects of disturbance on the productive capacity of a soil. Simply put, the highest quality soils support and sustain the most productive ecosystems. The sensitivity of soil to changes in quality, or productive capacity, is a product of a soil's resiliency and its susceptability to disturbance-related productivity losses.

Lower Sharps West is dominated by soils of high to moderate resiliency. High resiliency, clayey soils in this area such as the Honeygrove soil series are susceptible to surface erosion when bare because of the series' low permeability sub-soils. These same soils are susceptible to compaction because of fine-texture soil surfaces and because they exist on gently sloping lands that are easily accessible to machinery.

Lower Sharps East is dominated by soils of moderate resiliency . Soils are generally shallower on steep slopes and southerly aspects characteristic of this area. Soil organic matter, a soil property important to soil resiliency is lower as a result of higher decomposition rates and fire return intervals on south aspects.

Upper Sharps is dominated by soils of low resiliency. Most high elevation soils, except the deepest ones have low resiliency because they are cold. At lower elevations, shallow and/or extremely rocky soils have low resiliency because of low moisture and nutrient storage. Deeper soils at lower elevation have moderate resiliency. These low to moderate resiliency soils are susceptible to surface erosion on steep slopes when bare and are susceptible to mass erosion processes along drainageways.

Chapter 3 Current and Reference Conditions

Vegetation

Structural stage distribution

The distribution of current and reference vegetation in Sharps Creek is tabulated below in three succession stages; early-, mid- and late succession. The early succession stage used in this table includes all stages less than 80 years old and includes both establishment and thinning vegetation stages. Similarly, the mid-succession stage includes mature stand between generally the ages of 80 to 150 years. The late succession stage includes both transitional and old growth vegetation stages that are generally greater than 150 years in age.

Table 7. Distribution of Historic and Current Vegetation Stages in Sharps Creek Landscape Areas

Landscape Area	Vegetation Stages (percent of area)					
	Early-		**Mid-**		**Late-**	
	Reference[a]	Current	Reference	Current	Reference	Current
West Lower Sharps	16	96	68	1	16	3
East Lower Sharps	7	58	86	11	7	31
West Upper Sharps	NA	51	NA	11	NA	38
East Upper Sharps	NA	15	NA	49	NA	36
Upper Sharps (East & West)	7	31	44	34	49	34

[a] The distribution of Reference Vegetation Stages in this table is derived from Brice Creek 1850 Reference Vegetation in comparable landscape areas of Brice Creek. The geomorphology and climate of Brice and Sharps Creeks are very similar and , as a result, the two drainages probably had comparable vegetation patterns over time. Also, the mapping of Reference Vegetation in Brice Creek was done at a scale that is comparable to current vegetation mapping in Sharps Creek

By comparing current and reference vegetation stages in the table above, one can see how management and time have altered the distribution of structure stages. The early succession stages have increased in all landscape areas as a result of timber harvest, and early-seral vegetation has increased most dramatically in the West Lower Sharps. Timber harvest has also reduced the extent of mid-succession vegetation in both West Lower Sharps and, to lesser extent, East Lower Sharps and West Upper Sharps. Some of the mid-succession, reference-condition stands have become late succession stage under the current conditions in East Lower Sharps. The current distribution of structure stages has changed the least from the reference condition in Upper Sharps Creek landscape areas.

By comparing the distribution of current and reference vegetation stages *by landunit*, one can see the effect of management on the distribution of structure stages on different types of lands and vegetation in Sharps Creek.

Table 8. Sharps Creek Current and Reference Vegetation by Landunit

Landunit	Vegetation Stages (percent of area)					
	Early-		Mid-		Late-	
	reference	current	reference	current	reference	current
Warm/Dry Gentle	13	49	61	24	26	28
Warm/Dry /Steep	14	31	48	34	38	36
Warm/Moist /Gentle	17	91	60	2	23	7
Warm/Moist /Steep	15	59	47	9	38	32
Cool/Dry /Steep	17	30	26	50	56	21
Cool	25	42	32	36	43	22

By comparing current and reference amounts of early succession vegetation, it appears that timber harvest has most changed the current distribution of vegetation stages in the most productive warm/moist landunits. At the same time, harvest-related changes have affected the less productive warm/dry landunits less, as the current distribution of early succession stages shows compared to reference conditions. At high elevation in cool landunits, timber harvest has reduced the amount of late-succession vegetation stages compared to reference conditions.

Structural Stage Development by Landunit

The process of succession is characterized by different structure stages that, in a simple way, represent age classes. The rate that vegetation progresses through structure stages is affected by a site's moisture and temperature regimes, by competition among species and by other site factors that affect the occupation and growth of different species following disturbance. For even age stands, the rate of structure stage development can be characterized by landunit. For example, the early succession stage generally has been characterize as stands less than 80 years of age, but this early succession stage occupies a warm/moist site for as little as 60 years , a cool site for 75 years and a warm/dry site for as long as 110 years. Differences in the growth rates and ages of vegetation structural stages by Landunit reflects stand exam data for young, mature and Old growth forests in the little River drainage, North Umpqua River basin and the Western Cascades geologic province. (USDA & USDI, 1995, Appendix C-7).

Table 9. Structure Stage Development by Landunit

Landunit	Height. Growth	**Age Range**	Growth	**Age Range**	Growth	**Age Range**	Growth	**Age Range**	Growth	**Age Range**	**Age**
Cool	4.5’	**0-15**	40/20	**15-25**	35/20	**25-45**	27/20	**45-75**	15/20	**75-141**	**141+**
Warm / Moist	4.5’	**1-10**	40/20	**10-20**	46/20	**20-35**	32/20	**35-60**	19/20	**60-112**	**112+**
Warm/ Dry	4.5’	**0-12**	31/20	**12-25**	26/20	**25-52**	13/20	**52-112**	17/20	**112-172**	**172+**
DBH	0-1”		1-5”		5-12”		12-20”		20-30”		30”+
Brown’s stage	Grass-forb		Shrub		Open Pole		Closed Pole		Mature		Old Growth
Succession Stage	Early								Mid-		Late

Snags and Large Woody Material by Landunit

The presence and abundance of snags and logs is a product of succession and disturbance. Differences in amounts of large wood is thus related to vegetation structure stage. In the development of an even-age stands in the absence of fire disturbance, snags and large wood are highest in the early stage , lowest in the mature stage and intermediate in abundance in late succession stage (Spies et al, 1988). The effect of fire disturbance on the large wood resource is highly variable and depends upon both the frequency and the severity of the disturbance regime under which a forest develops. For example, in Upper Sharps Creek, the lowest levels of snags and logs exist in Dry/Steep landunits where fire frequency and severity are relatively high. Frequent and severe fire effects combined reduce the ability of a site to produce and sustain large wood structure. Differences in snags and logs by Landunit in unmanaged mature and old growth forest in upper Sharps Creek reflects timber stand exam data from that vicinity (data for the warm/moist/gentle landunit is from Brice Creek exam data).

Table 10. Sharps Creek Snags and Large Wood Data Summary

Landunit	Snag /Log	Plots (N)	SUM Snag/ Log (feet)	MEAN Hgt./Lgth. (lin.ft. per ½ acre)	Standard Deviation (feet)	Mean Snags/Plot (½ acre)
Warm/Moist/Gentle	SNAGS + LOGS	71	na	415	376	na
Warm/Moist/Steep	SNAGS	22/45	2724	60.5	119.3	2.32
Warm/Moist/ Steep	LOGS	44/45	18147	403.3	267.9	
Warm/Moist/ Steep	SNAGS + LOGS	45	20,871	463.8	266.2	
Warm/Dry/Gentle	SNAGS	38/65	3990	61.4	91.7	2.13
Warm/Dry/Gentle	LOGS	54/65	13,300	204.6	246.0	
Warm/Dry/Gentle	SNAGS + LOGS	65	17,290	266.0	208.7	
Warm/Dry/Steep	SNAGS	53/92	3706	40.3	59.6	1.49
Warm/Dry/Steep	LOGS	84/92	19,259	209.3	198.6	
Warm/Dry/Steep	SNAGS + LOGS	92	22,965	249.6	177.4	
Cool	SNAGS	16/37	1197	32.4	61.4	1.63
Cool	LOGS	34/37	5258	139.4	151.6	
Cool	SNAGS + LOGS	37	6355	171.4	134.0	
Cool/Dry/Steep	SNAGS	11/18	527	29.3	50.3	1.36
Cool/Dry/Steep	LOGS	15/18	1573	87.4	65.6	
Cool/Dry/Steep	SNAGS + LOGS	18	2100	116.7	65.2	

Differences between mean lengths of snag + logs in the warm/moist/steep and warm/dry/steep landunits. appears to be significant. The comparison of means in warm/dry/steep and cool/dry/steep also appears to be significant. However, comparison of means with such large differences in sample variances is ackward, and forces one to ask the question, “are these differences relevant to this analysis?.” In fact, amounts of debris and numbers and size of debris pieces generally increase with site moisture, probably as a result of higher productivity, lower fire frequency and lower decay rates on moist sites (Spies & Franklin, 1991)

Chapter 5 Recommendations for Vegetation Management within Sharps Creek Landscape Areas

The following recommendations were developed in response to the answers for two key questions:

How have the vegetation conditions changed in Sharps Creek and what are the trends?

Are there assoications between vegetation, soils and other site variables that would be useful to reference while prescribing for management activities?

The context for the following recommendations may be found Table x. **Distribution of Historic and Current Vegetaion Stages in Sharps Creek Landscape Areas** and Table x**. Sharps creek Current and Reference Vegetation by Landunit**.

1. Use Landscape Areas as a framework to establish a Desired Condition for vegetation. Landscape analysis to support a Desired Condition within Landscape Areas may integrate desired conditions for Riparian Reserves, snags and large wood, the pattern of vegetation structural stages (patch sizes and frequencies), road densities and other resource issues within landscape areas.

2. Use *The Augusta Project* analysis techniques as tools for conducting a landscape analysis and developing Desired Landscape Patterns (USDA Forest Service, 1993).

3. Project Desired Landscape Vegetation Patterns by using the relationships between vegetation (Plant Association Groups) and physiography as defined by Sharps Creek Landunits. This pattern would be defined by the distribution of vegetation structure stages *within* Plant Association Groups (Landunits).

4. Compare the current vegetation pattern within Landunits and Landscape Areas to the Desired Vegetation Pattern developed under recommendation 3 to identify opportunities for vegetation treatment. The following are *examples* of recommended treatments based on a comparison of reference and current vegetation conditions, assuming that the Desired Condition specifies a shift toward a reference distribution of vegetation stages (Refer to Table x. **Distribution of Historic and Current Vegetation Stages in Sharps Creek Landscape Areas):**

West Lower Sharps - use thinning and partial harvest to accelerate the development of early- and mid-seral stands, especially in riparian areas.

East Lower Sharps - use thinning to accelerate the development of early-seral to the mid- seral stage Use Partial harvest and fuel reduction treatments to balance the distribution of mid- and late-seral stages.

West Upper Sharps - use treatments to develop mature stands form early- vegetation stages.

East Upper Sharps - use vegetation treatments as necessary to maintain overall distribution of vegetation stages. Re-introduce fire.

The above examples do not specify the location or extent of the recommended type of treatment. This specificity would require an analysis of the current condition of vegetation stages by Landunit within Landscape Areas as well as the development of a Desired Landscape Vegetation Pattern. These analysis products are beyond the scope of this Sharps Creek Watershed Analysis.

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Appendix E

Terrestrial Species and Habitat

Brice Creek Moderate and High Intensity Fire Episodes

Fire Episode Year	Time Since Previous Fire	Acres of Fire Episode
1568	N/A	33,330
1636	68	20,459
1698	62	33,330
1751	53	21,404
1766	15	19,674
1780	14	17,062
1795	15	31,022
1831	36	33,293
1896	65	18,071
	Total of Time 329 years	Total Acres 227,695

The moderate to high intensity fires return interval for Brice Creek watershed was determined to be on an average of 41 years. The natural fire rotation is 48 years. The average site fire frequency was 65 years. The fire intensity and return interval may vary in forested stands within the watershed depending on slope, aspect and elevation, creating varying densities of snags throughout the watershed.

Expected tree mortality from fire episodes of moderate to high intensity fires between fire rotations are calculated below.

Approximate Number of Snags Greater than 15" dbh Created per Fire Rotation.

42,500	acres	x	37%	area low intensity	x	90	tpa	=	1,415,250	trees	x	15% =	212,288	snags per fire rotation
42,500	acres	x	45%	area mod intensity	x	90	tpa	=	1,721,250	trees	x	50% =	860,625	snags per fire rotation
42,500	acres	x	18%	area high intensity	x	90	tpa	=	688,500	trees	x	85% =	585,225	snags per fire rotation
									Total snags per fire rotation			=	1,658,138	snags
							1,658,137 snags divided by 42,500 acres					=	39	snags/acre

The patch size and level of mortally was derived from Fire History and Pattern in a Cascade Range Landscape by Morrison and Swanson (1990). Some assumptions applied to this analysis: 1) That the watershed was represented best by the Cook-Quentin area. 2) The fires in Sharps Creek analysis area, had larger areas of lower and moderate intensity than Cook-Quentin area. This is a result of shorter fire rotations and a corresponding reduction in fuel loading, which would reduce the severity of the fires. 3) Fewer larger live trees per acre in reference condition than current condition . Under burns removed fire-sensitive and late-seral species and thinned young and some older douglas-fir species while still maintaining a complex aged old-growth stand with large snags and down wood. 4) The mean tree mortality was used in each intensity class: low, 15 percent ; moderate, 50 percent; and high, 85 percent.

Additionally, snags are created by other processes such as disease, insect infestation and suppression mortality; representation of snag densities from these process can best be gained from studies that did not include mortality from recent fire disturbance.

Class I, II and III snags per acre within western hemlock associations before recent disturbance

Reference	Diameter Range	Sample Source	Mean Snag Number
Spies and Cline 1988	avg. dbh 22"	Cascade Old-growth	18 Snags
Hemstrom ,USF Willamette	>20" dbh	Ecology plots	6 Snags
White, USF Umpqua 1999	10" to 19" dbh	Ecology plots	18 Snags
	>20" dbh		15 Snags
Davis, USF Umpqua Little River AMA WA 1999	10" to 20"+ dbh	AMA Little River Late-successional	11 Snags
Upper Steamboat WA 1998	10" to 20" dbh	Upper Steamboat Late-successional	12 Snags

Data from the chart above suggest that areas within the watershed that were or will be excluded from fire disturbance for long intervals (200 years +) would have snag densities ranging from 6 to 18 snags per acre or a mean of 12 snags per acre.

The trend for the watershed under current management will be that snag densities will increase to a mean density of 12 snags per acre in LSRs and Riparian Reserves, provided that (1) stands continue to develop and be maintained as old-growth stands; and (2) if fires occur in these areas, they would not to be salvaged. This condition would move approximately 34 percent of the watershed back to some realm of natural snag densities.

Private ownership will likely continue to follow State Forest Practices requirements of two snags per acre for each harvest rotation (approximately 60 years) on 37 percent (15,700 acres) of the watershed. This will result in deficits of approximately 47 snags per acre on 15,700 acres (733,975 snags) per 60 year harvest rotation compared to reference conditions under a fire disturbance regime: (39 snags / fire rotation 48 year = .8 snags per year) x 60 years = 48.75 snags per acre x 15,700 actres = 765,375 snags - (2 snags per acre x 15,700 = 31,400 snags) = 733,975 snags per acre deficits. This management will contribute to approximately 4 percent of references condition of snags.

However, most private ownership is located in the northwest portion of the watershed which likely had lower severity fires and generally contributed fewer snags per acre (ranging from 12 to 30 snags per acre) towards the watershed snag budget of 1,658,138 snags per fire rotation.

The Forest Service Matrix land allocation will manage at a minimum nine hard snags per acre for each harvest rotation of approximately 80 years on 24 percent (10,015 acres) of the watershed. This will result in deficits of approximately 25 snags per acre on 10,015 acres (550,825 snags) per 80 year harvest rotation compared to reference conditions under a fire disturbance regime. (39 snags / fire rotation 48 year = .8 snags per year) x 80 yr. = 64 snags per acre x 10,015 acres = 640,960 snags - (9 snags per acre x 10,015 = 90,135 snags) = 550,825 snags per acre deficits. This management will contribute to approximately 14 percent of reference condition snag habitat. Some of this deficit could be mitigated if multiple entries are made to create snags in a stand before regeneration harvest or in a change in silviculture practices to allow for more natural suppression, diseases and insect mortally to occur within the stand before final harvest.

Based on recommendations presented in Chapter 5, it is assumed that the BLM would manage for a minimum density of nine hard snags per acre within a drainage. Management would likely result in higher densities of snags in some portions of the drainage and lower densities in others. This will depend on current hard snag density, ownership and land allocations. Harvest, over time, would likely occur within 3,807 acres of connectivity allocation with an average harvest rotation of 150 years. This would result in a deficit of approximately 111 snags per acre on 3,807 acres. (422,577 snags) per 150 year harvest rotation compared to reference conditions under a fire disturbance regime. (39 snags / fire rotation 48 years = .8 snags per year) x 150 years = 120 snags per acre x 3,807 acres = 456,840 snags - (9 snags per acre x 3,807 = 34,263 snags) = 422,577 snags per acre deficits. This management would contribute to approximately 7.5 percent of the reference snag habitat. Some of this deficit could be reduced if multiple entries are made to create snags in a stand before regeneration harvest, in a change in silviculture practices to allow for more natural suppression, and by restricting salvage operations in reserves.

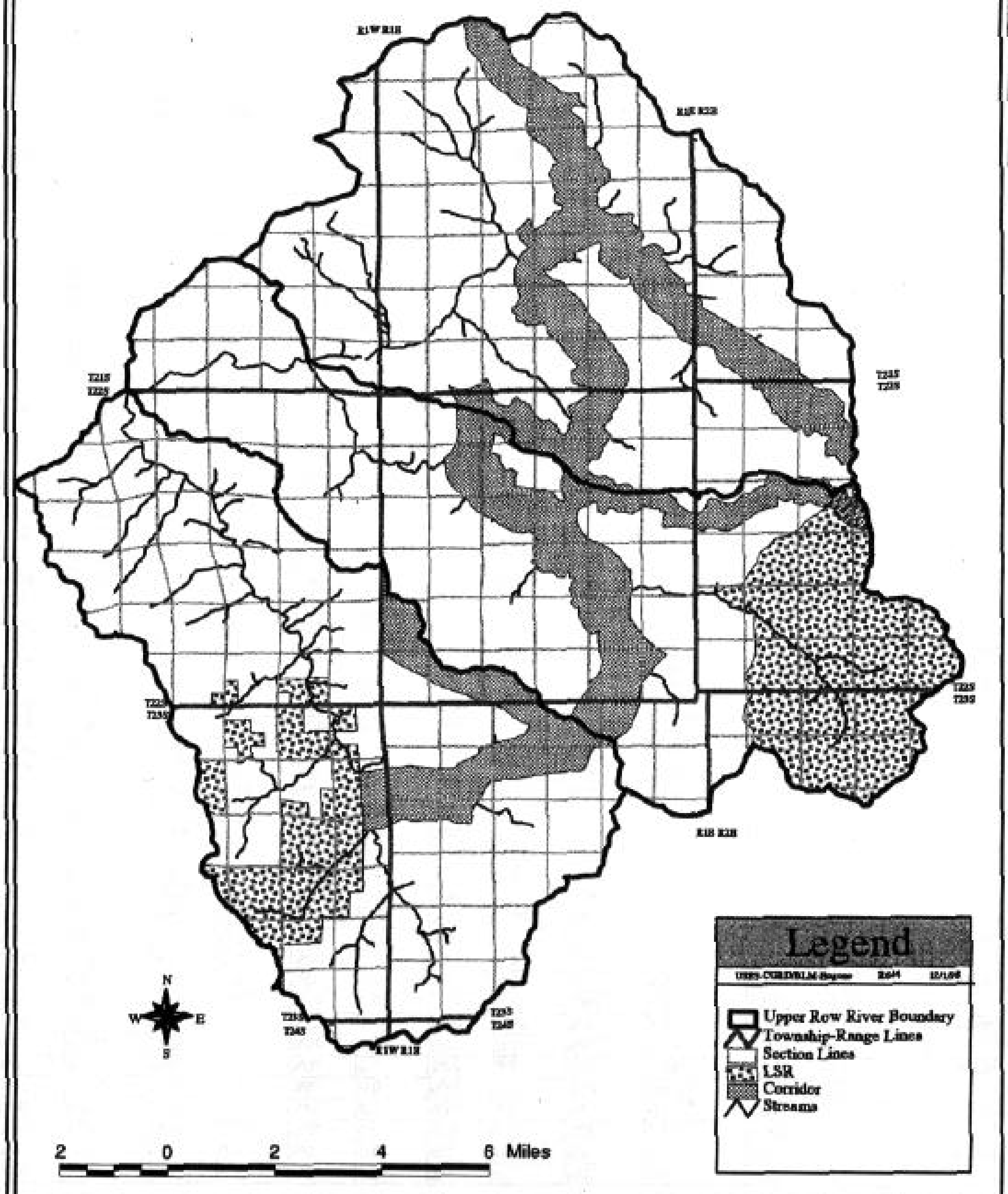
It is estimated that there is currently only one hard snag per four acres within the unmanaged natural forested stands within the watershed, this can be partially contributed to fire suppression and stand age (approximately 50 percent of the watershed). The other 50 percent (21,000 acres) of the watershed has been harvested under intensive management with little or no snags retained; 28 percent of this area currently has no potential for snags greater than 15 inches in diameter because they are young clear-cut plantations with no larger residual trees remaining. The remaining portion has been thinned regularly, eliminating natural snag production from trees that would have been suppressed, or trees that exhibit decay, diseased or infested with insects. This suggests that there is only one hard snag per eight acres, 5,312 snags, within the watershed. Or a deficit of 72 hard snags per eight acres. The watershed has a potential deficit of 377,188 hard snags and is deficit 1,573,137 snags in all decay classes or an estimated loss of 95 percent of the reference snag habitat because of fire suppression and other management actives in the last 50 years.

The important thing to know is that historically there where much higher snag densities within the watershed and likely a correlating relationship to those dependent species.

Spotted Owl Pairs of Sharps Creek Watershed

Owl pair number	Buffer radius (miles)	Dist total (acres)	Dist suitable (acres)	Current % suitable	Available (acres)	Post % suitable	Reprod 60yr add	Suitable 60yr %	Reprod 80yr add	Suitable 80yr %	Reserve total 100yr	Suitable 100yr %
O132A	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	29.9	29.9	100%	0.0	100%	0.0	100%	0.0	100%	0.0	0%
0132A	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	2.4	2.4	100%	0.1	95%	0.0	95%	0.0	95%	0.0	0%
O137	0.7	523.3	478.1	91%	152.7	62%	19.0	66%	19.0	66%	254.3	49%
	1.2	1479.4	1361.8	92%	391.5	66%	27.4	67%	27.4	67%	828.9	56%
0137A	0.7	84.4	66.1	78%	28.2	45%	3.6	49%	3.6	49%	46.3	55%
	1.2	671.7	595.3	89%	219.1	56%	27.4	60%	27.4	60%	400.2	60%
O148	0.7	86.1	81.9	95%	18.3	74%	0.0	74%	0.0	74%	20.1	23%
	1.2	800.1	431.4	54%	97.4	42%	65.9	50%	210.8	68%	472.8	59%
O522	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.7	0%
	1.2	66.1	45.3	68%	20.8	37%	0.0	37%	0.0	37%	66.1	100%
133	0.7	492.5	296.7	60%	178.0	24%	15.0	27%	16.0	27%	272.3	55%
	1.2	1447.2	844.9	58%	360.1	34%	70.0	38%	111.1	41%	891.0	62%
134	0.7	712.5	325.1	46%	22.2	43%	46.1	49%	199.9	71%	712.5	100%
	1.2	2047.1	1198.3	59%	232.5	47%	132.7	54%	385.0	66%	2047.1	100%
135	0.7	980.2	717.7	73%	263.9	46%	0.0	46%	95.3	56%	624.0	64%
	1.2	23334.1	1794.8	8%	662.1	5%	0.0	5%	166.5	6%	1524.8	7%
136	0.7	980.2	973.0	99%	262.6	72%	0.6	73%	0.6	73%	716.3	73%
	1.2	2880.5	2624.3	91%	845.7	62%	90.5	65%	91.1	65%	1973.8	69%
137	0.7	492.4	349.5	71%	145.5	41%	0.0	41%	0.0	41%	378.5	77%
	1.2	1447.8	1044.8	72%	481.9	39%	42.2	42%	46.5	42%	860.2	59%
138	0.7	980.2	865.7	88%	327.3	55%	0.7	55%	0.7	55%	598.6	61%
	1.2	2706.3	2407.9	89%	1052.6	50%	67.0	53%	67.0	53%	1520.0	56%
139	0.7	839.2	550.5	66%	319.0	28%	44.5	33%	44.5	33%	583.0	69%
	1.2	2399.9	1778.9	74%	813.9	40%	56.4	43%	56.4	43%	1677.5	70%
140	0.7	980.2	980.2	100%	297.5	70%	0.0	70%	0.0	70%	682.7	70%
	1.2	2880.5	2648.1	92%	946.5	59%	0.0	59%	17.7	60%	1881.4	65%
141	0.7	980.2	970.1	99%	350.1	63%	0.0	63%	0.1	63%	629.9	64%
	1.2	2880.1	2544.6	88%	838.8	59%	0.0	59%	120.6	63%	1942.3	67%
144	0.7	876.4	750.5	86%	264.9	55%	0.0	55%	0.0	55%	552.9	63%
	1.2	2160.9	1881.5	87%	637.6	58%	39.1	59%	39.1	59%	1415.8	66%
150	0.7	980.2	895.6	91%	263.9	64%	44.2	69%	44.2	69%	699.4	71%
	1.2	2880.5	2717.5	94%	909.6	63%	44.2	64%	44.2	64%	1905.3	66%
201	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	71.1	69.0	97%	47.3	30%	0.0	30%	0.0	30%	25.7	36%
202	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	182.5	163.5	90%	22.1	77%	0.0	77%	0.0	77%	151.1	83%
204	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	150.9	118.5	79%	19.0	66%	0.0	66%	0.0	66%	146.1	97%
206	0.7	75.2	75.2	100%	13.6	82%	0.0	82%	0.0	82%	65.5	87%
	1.2	341.8	274.5	80%	70.4	60%	0.0	60%	0.0	60%	341.8	100%
541	0.7	110.5	96.8	88%	15.7	73%	0.0	73%	4.0	77%	92.2	83%
	1.2	927.2	784.9	85%	235.0	59%	0.0	59%	28.1	62%	662.3	71%
574	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	44.8	21.4	48%	0.0	48%	0.0	48%	0.0	48%	36.9	82%
2112	0.7	389.8	304.0	78%	122.6	47%	0.0	47%	0.0	47%	0.0	0%
	1.2	1302.3	962.2	74%	463.0	38%	0.0	38%	0.0	38%	0.0	0%
2112A	0.7	61.6	52.2	85%	19.0	54%	0.0	54%	0.0	54%	0.0	0%
	1.2	646.4	455.2	70%	197.1	40%	0.0	40%	0.0	40%	0.0	0%
2113	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	51.4	51.4	100%	0.0	100%	0.0	100%	0.0	100%	51.4	100%
2877	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	239.3	234.3	98%	16.2	91%	0.2	91%	0.2	91%	213.3	89%
3943	0.7	120.9	115.4	95%	31.8	69%	3.1	72%	3.1	72%	47.5	39%
	1.2	699.4	342.9	49%	112.6	33%	83.9	45%	132.1	52%	351.4	50%
5036	0.7	376.6	262.1	70%	0.0	70%	0.0	70%	0.0	70%	376.6	100%
	1.2	1350.0	1015.4	75%	0.0	75%	0.0	75%	0.0	75%	1350.0	100%
5056	0.7	76.9	41.9	54%	0.0	54%	0.0	54%	10.8	69%	76.9	100%
	1.2	597.1	191.9	32%	0.0	32%	0.0	32%	191.5	64%	597.1	100%
5339	0.7	0.0	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
	1.2	28.7	0.0	0%	0.0	0%	18.8	66%	18.8	66%	18.7	65%

Upper Row
Habitat Connectivity Corridor



Appendix F

ACS
(USFS)

Appendix F

Methodology for Standard Assessment of ACS Objectives for Riparian Reserves in the Sharps Creek Watershed

Requirement for assessment of proposed activities

In general, the standards and guidelines for RR prohibit or regulate activities in RR that retard or prevent attainment of the ACS (ROD C-31). The purpose of this section is to establish a methodology to assess typical projects that may affect RR. The assessment consists of a brief discussion of the implications of each of the nine ACS objectives (ROD B-11) in view of the current best knowledge of the Sharps Creek watershed. This discussion is followed by measurable goals to define the conditions needed to satisfy the intent of the ACS objectives. Also included is a rationale of the goals and the methodology to assure attainment of the goals.

The ROD states that a "baseline" must be established from which to assess the current condition. Specifically, the ROD states that complying with ACS objectives means that an agency must manage the riparian-dependent resources to maintain the existing condition or implement actions to restore conditions. The baseline from which to assess maintaining or restoring the condition is developed through WA (ROD B-10). The following section is intended to meet the ROD requirement for determination of the baseline.

Development of Assessment Baseline

The stated purpose of the RR is to "conserve aquatic resources as well as provide dispersal habitat for spotted owls and suitable habitat for numerous species" (ROD 24). The overall objectives were identified as "providing for the long-term health and continued functioning of late-successional and old-growth ecosystems, and maximizing economic benefits." (ROD page 17). Since many of the species in question are directly associated with the RR it seems reasonable that the RR need to be managed to achieve late successional old growth (LSOG) characteristics in the proportions shown in Table 1.

The percentage values are thought to have varied +/- 10 percentage points over time. For the purpose of this analysis a stand with an average age of 250 years with a minimum age of 80 years would qualify as LSOG.

Age Class	Percent of Watershed	Successional Classification
0-80	20%	Regeneration
80-200	25%	Mid &Late-successional
200-500	55%	Old Growth

Table 1. Estimated age distribution of forested lands within Sharps Creek Watershed.

Therefore, in order to best match LSOG conditions, the **baseline goal** for the RR in the Sharps Creek Watershed is for the oldest 55% of the RR to have an average age of 300 years and youngest 75% of the RR to have an average age of 95 years. The overall average age for the RR within the watershed would then be 210 years[1].

Since the average stand age of the present RR is approximately 90 years (see Chapter 3 for analysis) it is apparent that a dedicated 120 year restoration program is needed to get the average age to 210 years. Assuming no natural disturbance during this time, the rate of restoration of the RR would be 1/120 or 0.8% per year. As a result, the general management strategy to meet ACS objectives in the Sharps Creek RR will be to restore the RR to a LSOG condition by allowing it to recover at the rate of 0.8% per year until the baseline goal for the entire watershed is met.

If the RRs in the watershed reaches a distribution with the oldest trees exceeding 80% LSOG (average age about 210 years) there would be an opportunity to allow natural disturbances to take place or to consider some reduction of the LSOG component.

General comments about the Goals and Methods

Sharps Creek is a relatively resilient watershed and the rate of timber harvest has not been as high as that in Layng Creek. Consequently restoration projects were not identified as priority items within Sharps Creek. However, a major forest management issue within Sharps Creek RR is the departure from the baseline LSOG vegetative conditions. Recovery to the baseline condition will be a long term process and in the interim critical structures in the RR such as road crossings will have to be either maintained, restored or obliterated. Also, there may be opportunities to actively manage specific areas to increase the rate of recovery to the LSOG condition. For each of the nine ACS objectives one or more goals has been established to assure that these objectives are met.

To assess how well the ACS Objectives are being met, the general strategy for Sharps Creek Watershed is to complete the Drainage assessment procedure on each drainage as projects are proposed. Included in this Appendix is a description of the drainage assessment procedure and an example assessment for China Creek. Meeting the goals described below will be considered sufficient to satisfy the corresponding ACS Objective. In the event that a goal cannot be met prior to project development, a full assessment of the effect of not meeting the goal in terms of the ACS objectives will be included in the project NEPA document. These goals may be modified if the modified goal can be shown to satisfy the intent of the particular ACS Objective. This modification process will require full review by the District staff and approval by the District Ranger.

[1] Note: since the function of trees greater than 400 years doesn't change significantly, for purposes of computing the average, all trees older than 400 years will be counted as age 400.

Width of Riparian Reserves in Sharps Creek

The typical site tree for Sharps Creek was found to be 180 feet in height. Consequently the slope distance of the Class 2 and Class 3-4 riparian buffers are 360 feet and 180 feet respectively. This distance equates to a 167 foot horizontal distance for a 40% side slope.

Goals and Methods to satisfy the nine ACS objectives within RR.

ACS Objective 1. Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Discussion: This objective can be met by adopting the recommended Method described above. The timber stands within the RR are a significant watershed scale feature which can be gradually restored to their full potential. The final result will provide both an essential ecosystem component and also will provide large wood material needed for the channels. However, because of the relatively narrow form of the RR, even a fully restored condition will not function in as complete of a manner as a large intact block of LSOG such as a LSR unless the RR is associated with a corridor zone.

Goal 1.1 Establish 80% of RR stands in LSOG condition.

Rationale: With current knowledge, full restoration to the LSOG condition within the RR is the only way to ensure protection of the aquatic systems for species adapted to a LSOG ecosystem.

Method: No harvest of LSOG type material (includes wood greater than 20" diameter - standing or down) until baseline condition (as described in goal 3.1) is achieved (approximately 120 years). Harvest of the smaller sizes will be done only to promote the conversion to a LSOG stand.

ACS Objective 2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Discussion: The RR provide important longitudinal connectivity for smaller riparian organisms from the mouth of each stream to the watershed ridge top. Many riparian related species need to move up and down the channels to adjust for seasonal changes in climate and flow conditions. The RR also provides important lateral connectivity between the aquatic zone and the upland terrestrial zone. The life cycle of many riparian species is dependent on this transition zone being intact and fully developed.

Barriers to this connectivity within stream channels can be defined as any artificial obstruction or vertical displacement that is more severe than the natural channel condition in the immediate area. Likewise, a barrier to terrestrial organisms within the RR can be defined as any artificial opening or structure that would impede the natural movement of small terrestrial organisms. e.g. an opening can provide a physical barrier or it can affect the micro-climate sufficiently to act as a barrier or it might expose the organism to predation. Since different species and organisms have different connectivity needs, the goals are divided into the following categories:

Goal 2.1 For fish bearing channels: 100% of the channels free of artificial barriers. Determined by the percentage of class II stream length below artificial fish barriers (culverts with 3ft falls).

Rationale: Federal lands provide the main habitat for LSOG adapted aquatic species and elimination of the artificial barriers will assure optimal utilization of this habitat. Restoration of fisheries are high priority under the ROD.

Method: Develop an inventory list of artificial in-channel barriers. Set priorities for restoration consistent with the overall wildlife/ fish management strategy. Require barrier removal in drainages with planned projects as a mitigation requirement prior to project development.

Goal 2.2 For non-fish channels: In any drainage, at least 50 % of the non-fish channels will be free of artificial barriers. Determined by the percentage of class III and IV stream lengths below artificial barriers to aquatic organisms (culverts with 1ft falls).

Rationale: Our knowledge of small aquatic associated organisms is limited but it is known that some of them move up and down the channel zone in response to life cycle needs and varying stream flow/ climate conditions. The 50% maximum goal is rather arbitrary but will assure that this component is at least maintained and it should serve until better knowledge about the particular needs of the species is available.

Method: Develop an inventory list of artificial in-channel barriers. Set priorities for restoration consistent with the overall wildlife/ fish management strategy. Require barrier removal in drainages with planned projects prior to project development. Implementation needs to be coordinated closely with Access and Travel Plan objectives. Channels that are nearly 100% barrier free within a drainage will have higher priority for restoration.

Goal 2.3 For barriers that impede terrestrial travel parallel to the fish bearing portion of the stream: In any drainage, at least 50% of the class II stream channel will be completely free of artificial perpendicular barriers. Determined by the percentage of class II stream length without artificial barriers that impede travel parallel to the stream channel.

Rationale: A road would probably be the most common type of longitudinal barrier and, as it relates to impeding travel, probably is not as critical as a channel barrier. Bridges can also be considered a barrier. This goal is intended to assure that a significant portion of the fish bearing channel be free of perpendicular terrestrial barriers.

Method: Prior to project development identify road crossings and any other terrestrial RR barriers in the drainage. Provide the necessary restoration to meet the goal. Restoration of RR should be a mitigation requirement for projects planned within a drainage.

Goal 2.4 For barriers that impede terrestrial travel parallel to the non-fish streams: In any drainage, at least 50% of the class II or IV stream channel will be completely free of

artificial perpendicular barriers. Determined by the percentage of class III and IV stream length without artificial barriers that impede travel parallel to the stream channel.

> **Rationale:** A road would probably be the most common type of longitudinal barrier and, as it relates to impeding travel, probably is not as critical as a channel barrier. Bridges can also be considered a barrier. This goal is intended to assure that a significant portion of the non-fish bearing channel be free of perpendicular terrestrial barriers.

> **Method:** Prior to project development identify road crossings and any other terrestrial RR barriers in the drainage. Provide the necessary restoration to meet the goal. RR associated with tributaries that are nearly barrier free will have higher priority for restoration. Restoration of RR should be a mitigation requirement for projects planned within a drainage.

Goal 2.5 For barriers that impede terrestrial travel perpendicular to fish bearing stream channels: In any drainage, no more than 25% of the RR along class II stream channels will contain a parallel terrestrial barrier such as a road. Determined by the percentage of class II stream length having artificial barriers that impede travel perpendicular to the stream channel.

> **Rational:** With limited knowledge of the effect of these barriers it is difficult to set a meaningful goal however, this goal should serve as a useful benchmark. If it is exceeded it will trigger additional assessment. Note that this goal applies only to drainages. The "remnant" basins (see definition page 1) associated with the main stem of Sharps Creek are not included.

> **Method:** Inventory encroachment zones and identify the restoration priorities based on relative issues and needs of the Access and Travel Management Plan. Mitigation should be tied to planned projects within a drainage.

Goal 2.6 For barriers that impede terrestrial travel perpendicular to non-fish streams: In any drainage, no more than 25% of the RR along class III and IV stream channels will contain a parallel terrestrial barrier such as a road. Determined by the percentage of class III and IV stream length having artificial barriers that impede travel perpendicular to the stream channel.

> **Rational:** With limited knowledge of the effect of these barriers it is difficult to set a meaningful goal however, this goal should serve as a useful benchmark. If it is exceeded it will trigger additional assessment. Note that this goal applies only to drainages. The "remnant" basins (see definition page 1) associated with the main stem of Sharps Creek are not included.

> **Method:** Inventory encroachment zones and identify the restoration priorities based on relative issues and needs of the Access and Travel Management Plan. Mitigation should be tied to planned projects within a drainage.

ACS Objective 3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Discussion: In Sharps Creek, large wood, both standing and down, is the single most important component affecting the physical integrity of the aquatic system that is manageable. This material serves to resist channel erosion during peak flow events (see peak flow discussion), provide structure for pool development and also provide habitat, food, and refuge for aquatic organisms.

Goal 3.1 Maintain 80 pieces of large woody material (greater than 24" diameter and greater than 50' long) per mile of stream. Levels of LWM in fish bearing streams obtained from fish surveys.

Rationale: High levels of large woody material are needed to restore the physical integrity of the aquatic system within the RR. This goal applies to 100% of the RR because LWD has historically been an essential component of all riparian areas, even those areas that are not in LSOG condition. Generally, in these areas large quantities of LWD would remain even after a large natural disturbance converted the LSOG stand.

Method: No harvest of LSOG type material (standing or down) until goal 3.1 is achieved for the affected RR area. Harvest (including salvage) must be consistent with the ACS Objective 3. In the interim, manage the area to simulate LSOG characteristics as much as possible.

Road crossings or other in-channel structures are to be designed to not degrade the physical integrity of the channel area. The hydraulic resistance produced by the structure needs to be consistent with that of the original channel.

Goal 3.2 Maintain or restore channel conditions for fish habitat and water quality as needed. Determined by professional judgment of a fish biologist or hydrologist.

Rationale: If restoration funds are available, the physical integrity of the channels can be improved with designed structures.

Method: Use stream inventory data to identify the high priority sites. Implement restoration when funds are available.

Goal 3.3 Protect existing structures and/ or improvements in a manner that has the least impact on the natural dynamics and function of the channel. Avoid new structures in the RR as much as possible. Remove unnecessary structures. Determined from forest records and culvert inventories.

Rationale: Structures or other improvements that alter the channel, banks, and floodplain can change the dynamic function of the stream system and can, in turn, change the characteristics of the system for a significant distance downstream. These changes can cause a reduction of diversity and complexity of stream channel characteristics and a general departure from the targeted LSOG condition.

Method: Inventory all structures within the drainage. If the structure is essential, fully consider the effect on the natural dynamics of the channel including channel meandering and floodplain function. in particular, avoid adding instability to the channel which would cause the channel to function outside of its range of natural variability. Remove nonessential structures.

ACS Objective 4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Discussion: Managing all the RR for full ROD buffers width until the baseline condition described above is obtained will assure that most of the surface waters are contained in a LSOG environment and have similar WQ characteristics.

Goal 4.1 Maintain WQ at current levels or better. Determined by professional judgment of a fish biologist or hydrologist.

Rationale: Water quality has been actively managed in Sharps Creek because of its use as a municipal supply and overall water quality as determined at the municipal intake is considered to be good. Water quality throughout the watershed is expected to better match the water quality typical of LSOG systems as the baseline objective is reached.

Method: New projects within the RR must be strictly controlled to assure that the WQ in the project zone is not degraded. Existing projects such as road crossings and campgrounds need to be assessed and the chronic problem sites need to be systematically improved. Continue to monitor WQ to assure that the WQ is being maintained or improved. (See next objective for sediment objectives.)

Do not transport or apply chemicals within the watershed which do not have an established drinking water standard. Evaluate all proposed chemical applications or use for consistency with ACS objectives. Avoid application of fire retardant to RR areas. Assure that retardant is compatible with drinking water standards at the start of the field season.

ACS Objective 5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Discussion: Sediment has been actively monitored and managed in the Sharps Creek watershed as described in the main document However, the LWD component needs to be restored if, at the project site level, the sediment regime is to match the characteristics of a LSOG system. In particular, the timing, distribution and composition of sediment associated with debris avalanches as well as channel storage of sediment will change over time as LWD accumulations are restored.

Road crossings can contribute sediment to the system and this source should be managed to keep this contribution to a minimum.

Goal 5.1 Each drainage have less than 600 feet of road feeding directly into a stream channel per mile of stream channel. No net increase in feeding road distance to occur in any drainage. Determined from culvert surveys.

> **Rationale:** Direct contribution from roads is a small but potentially significant source of sediment which does not match the natural regime.
>
> **Method:** Prior to project implementation complete the crossing inventory for the drainage and determine the relative amount of road contribution. If the result for the entire drainage is greater than 200 feet per mile, seek opportunities to reduce the excess by at least 25% per project. Road outsloping may be an effective way to reduce the crossing contribution. For new construction assure that there is no net increase in the amount of road contributed sediment. This may require that mitigation of existing roads takes place concurrent with the construction.

Goal 5.2 Each drainage will have no road crossing with a risk rating of greater than 500 and an average risk rating more than 500. New projects are not to cause a net increase in the risk values for the drainage. Determined from culvert surveys.

> **Rationale:** Road crossing failures have the potential of creating excessive amounts of sediment which could adversely affect the local ecosystem. Particularly significant are failures that cause the effective channel to be diverted down the road into another drainage area. This situation causes an over load on the receiving channel and can cause excessive damage all of the way down to the mouth of the affected stream. Also, it is reasonable to assume that fish bearing streams will generally have relatively higher resource values than non-fish bearing streams. These differences in risk and values should be reflected in the rating system.
>
> **Method:** Prior to implementing a new project inventory all crossings in the project drainage and determine the risk ratings. If the goals are not met perform mitigation to reduce the excess total risk score by at least 25%. Continue to apply this strategy for each new project until the goal is met. If the goal is met provide appropriate mitigation so that there is no net increase in risk after the project is completed.

ACS Objective 6. Maintain in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Discussion: Peak flows are generally recognized as a significant channel forming mechanism. Analysis of flow records indicate that, at the watershed scale, the mean value of the peak flows have not significantly changed in the past sixty years (see peak flow analysis in Layng Ck WA). Flows are driven to a large extent by weather patterns which are highly variable. Local management activities may influence the timing of the run off at the local level through snow storage, fog drip reduction etc. However, it is thought that these changes are well within the variability of the precipitation patterns. Again, reduction of the LWD with the associated reduction of structural integrity of the channels is thought to the most significant management related impact in the RR that affects the flow regime. However, at the local level, road systems can intercept water (both surface runoff and groundwater) and redirect it to another location. Technically this is not an "in-stream" flow but this effect can affect the hydrology associated with ponds, wetlands and unstable areas.

Goal 6.1 Avoid alteration of flow pathways or water storage areas within the RR by new road construction. Inventory known problems within the drainage and arrange to correct the high priority items. Determined by the professional judgment of a hydrologist.

Rationale: Road construction can alter local hydrology and indirectly affect riparian, aquatic, and wetland habitats. Existing roads need to be assessed for their effect on the hydrology of the local wet areas greater than 1/4 acre. Also, water directed to unstable areas can result in accelerated rates of mass wasting.

Method: Prior to project development within a drainage review new road designs to assure a minimal impact on local hydrology. Put particular emphasis on protection of wet area and unstable areas. On existing roads review the drainage of roads in the vicinity of wet areas and / or unstable areas greater than 1/4 acre. Pay particular attention to down slope influences.

ACS Objective 7. Maintain the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Discussion: The extent of floodplain inundation depends upon the amount of water passing through the system as well as the rate of flow of the water. Channel segments with high hydraulic resistance to flow will have slower flow velocities and, consequently, higher flood levels. The hydraulic resistance can vary greatly, depending upon the amount of LWD and the extent of riparian vegetation in the floodplain. Typically a large flow event will wash out the floodplain vegetation which will then slowly reestablish. Large wood is also usually redistributed during these events. The age of the riparian vegetation provides a good indication of the year of the flood event that caused the last wash out. The point is that there is a large amount of variability in the flood plain hydraulic characteristics but the LWD plays a significant role in streams with LSOG characteristics. The gradual increase of large woody material caused by managing for the baseline condition should tend to dampen the current increase in variability in flood levels.

Road encroachment in a floodplain within the RR can reduce the effective cross sectional area of the floodplain which would cause higher flood flows through the reach. Also, as discussed in Objective 6, roads can intercept water and alter the hydrology at the local level which may affect meadows and wetlands. Road placement and drainage design are the main factors for these issues.

Goal 7.1 Have LWD levels in floodplains that are characteristic of LSOG systems and manage the flood plains to function in a manner that is characteristic of LSOG systems. Determined by the professional judgment of a fish biologist or hydrologist.

Rationale: The LWD material can directly affect the flood plain characteristics and need to be managed to achieve LSOG levels both in size and quantity of material. Because of the large wood, LSOG systems tend to have a relatively higher hydraulic resistance through the main flow zone. On areas with larger flood plains, there may be opportunities to simulate this effect until the LWD accumulations are restored.

Method: Manage the RR for maximum LWD and in the interim, if appropriate, simulate the flood plain hydraulic characteristics of a LSOG system.

Goal 7.2 Minimize the effect of road encroachment on flood plains. (Less than 4% encroachment on fish bearing streams within any drainage.) Determined by the percentage of Class I and II RR that is roads.

Rationale: Road encroachment in the floodplain may increase the effective height of flood flows in the affected reach and may also alter the channel dynamics.

Method: Prior to project development, inventory the affected drainage for miles of encroachment. Consider mitigation if appropriate considering the Access and Travel objectives and long range road management plan.

ACS Objective 8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Discussion: Managing the RR to achieve the baseline identified above should gradually meet that objective to the extent that RR can function as LSOG systems. There may be opportunities to manage the plant communities in specific portions of the RR to better match the characteristics of the LSOG ecosystem. Typically these opportunities would include practices that would accelerate the recovery to the LSOG condition e.g. precommercial thinning within regenerating stands that encroach into the RR. Priority attention should also be given to areas with unique characteristics to increase the quality of the diversity of the area. Opportunities to enhance the habitat of sensitive plants should also be considered.

Road crossings within the RR effectively prevents the affected portion to function as a LSOG system for the life of the road. A temporary opening such as a logging corridor will, to a lesser degree, delay the goal of full recovery to the LSOG ecosystem.

Goal 8.1 At a minimum maintain the restoration rate of 0.8% per year for the unique habitat areas. Attempt 10% of the total enhancement projects for the drainage per basin project. Proactively control natural disturbance within the RR. Determined by the professional judgment of a wildlife biologist.

Rationale: Rapid restoration of the baseline diversity of the RR is consistent with the overall ROD objectives.

Method: Review the RR associated unique habitat areas within the drainage and identify potential site enhancement projects. Assure that these areas are not going to be set back by the planned matrix activity. Look for opportunities to enhance some of the plant habitat. Continue an active sensitive plant management program.

Manage for maximum growth within RR until the baseline level is reached. This would include fire suppression and disease control.

Goal 8.2 Within any drainage the road crossing density is not to exceed 2 crossings per mile of stream.

Rationale: Road right-of-way reduces the amount of growing sites within the RR. This goal limits the maximum reduction to about 2% of the total RR area within the drainage. This is equivalent to about two years of recovery growth at the rate of 0.8% per year.

Method: Limit road crossings per the goal.

Goal 8.3 Within any drainage created openings (non road) needed for management of matrix lands will be less than .4% of the total RR within any decade. Determined by the professional judgment of a wildlife or fisheries biologist.

Rationale: There may be an occasional need to affect the vegetative structure of an RR to best manage the adjacent lands. Use of a logging corridor is a possible example. These openings will not be a permanent set back and will eventually recover. The net new growth of the RR is about 11% per decade and this goal would represent a maximum reduction in the natural restoration rate of about 4%. The effect of this opening can be further reduced by leaving in the RR any cut wood material greater than 24 inches diameter.

Method: Keep created openings within the RR to a minimum. If the net effect of the alternative to the opening option has a more severe impact, consider an opening but leave wood greater than 24 inches within the RR. Consider placement options to best meet the ACS objectives. Track number of newly created openings (dated from 1995) within the drainage and limit the running total to .4% per decade for the affected drainage.

Goal 8.4 Manage regeneration plantations that encroach on RR for maximum conversion to LSOG conditions. Determined by the professional judgment of a silviculturist.

Rationale: New plantations within the RR may need management to assure a optimal transition to LSOG conditions. Left unattended the stand may become a Douglas- fir thicket.

Method: Recommend thinning to 12 x 12 spacing to stimulate growth. Need site specific prescription to assure consistency with ACS and other objectives. Manage for LSOG type diversity. Recommend leaving all non-conifer species and selecting for western red cedar. Leave all hardwoods and woody brush vegetation on over steepened (greater than 60%) slopes adjacent to the stream channel.

ACS Objective 9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

Discussion: The final habitat characteristics of the RR will be limited by their narrow width and will not alone support all of the LSOG characteristics. However, achievement of the baseline condition will provide the optimum opportunity to meet the ACS objectives and there may be opportunities to manage the habitat in specific portions of the RR to better match the characteristics of the LSOG ecosystem. Priority attention would be given to areas that are supporting sensitive species with the immediate goal of increasing the local populations.

Goal 9.1 At a minimum maintain the natural recovery restoration rate of 0.8% per year for the unique habitat areas. Attempt 10% of the total enhancement projects for the drainage per basin project. Determined by the professional judgment of a wildlife biologist.

Rationale: Increasing the size of sensitive species populations is consistent with the overall ROD objectives.

Method: Review the RR associated unique habitat areas within the drainage and identify potential habitat site enhancement projects. Assure that these areas are not going to be set back by the planned matrix activity. Attempt to accomplish 10% of the identified enhancement projects within the drainage.

Standard ACS Objectives Assessment
China Creek Drainage #03S

This Standard Assessment will be recommended to be implemented through the watershed analysis for Sharps Creek. This Standard Assessment assures that the Aquatic Conservation Strategy (ACS) Objectives are being met. Typically this type of drainage assessment will be completed as part of the NEPA work as projects are proposed within a particular drainage. Subsequent projects within the same drainage will be able to tier off of the same watershed analysis. The assessment provides an immediate indication of the condition of the watershed area in terms of specific ACS Objectives. Routine implementation of this assessment procedure will also yield a data base that will eventually allow direct comparison of the relative condition of all of the drainages in the District.

General Characteristics

1	Area of Drainage:	807.0 acres	1.3 mi2
2	Total Stream Miles	5.2 miles	4.1 mi/mi2 Stream Density
3	Total Class 1-2 Stream Miles	1.3 miles	
4	Total Class 3-4 Stream Miles	3.9 miles	
5	Total Riparian Reserve Area	0.4 mi2	30.9% of Drainage
6	Class 1-2 RR Area	0.2 mi2	
7	Class 3-4 RR Area	0.2 mi2	
8	Total Road Miles	4.5 miles	3.5 mi/mi2
9	Number of Stream Crossings	7	1.3 Crossings per Mile of Stream
10	Road Within Class 1-2 RR	3.6 Acres1	3.4% of Class 2 RR
11	Road Within Class 3-4 RR	2.7 Acres1	1.9% of Class 3-4 RR
12	Total Sediment Feed Distance	3374 Feet	649 Feet/ Mile of Stream Channel
13	In-channel Barriers in Stream Class 2	1	1 culvert with 19in waterfall, non-fish barrier only.
14	In-channel Barriers in Stream Class 3-4	4	4 Culverts with 7, 3.5, 3.2 and 2.5 feet waterfalls.
15	Class 2 Stream Length above In-channel Barriers	0.7 miles	54% of Total Class 2 Stream Length (non-fish barrier)
16	Class 3-4 Stream Length above In-channel Barriers	1.2 miles	31% of Total Class 3-4 Stream Length
17	Class 2 Stream Length with Parallel Terrestrial Barriers	0.95 miles	37% of Total Class 2 Stream Length (74% on one side)
18	Class 3-4 Stream Length with Parallel Terrestrial Barriers	0.38 miles	10% of Total Class 3-4 Stream Length (roads on both sides)
19	Acres of LSOG in Riparian Reserve	60.4 Acres	24.3% of total RR Acres
20	Maximum RI for Culvert Failure	100	Low risk (Goal is < 500)
21	Average RI for Culvert Failure	31	
22	Maximum Culvert Drop	7.0 feet	
23	Average Culvert Drop	2.6 feet	
24	Maximum Stream Gradient at Crossing	40 %	
25	Average Stream Gradient at Crossing	20%	

1 Based on 27 ft road width.

China Creek Drainage Standard ACS Assessment

Standard ACS Assessment Summary

Assessment Goals	Goal	Current Condition	Comments
Goal 1.1 Amt. of LSOG	> 80 %	24.3%	Manage for LSOG
Goal 2.1 Fish bearing Streams Free of In-channel Barriers	100%	100%	OK
Goal 2.2 Non-fish-bearing Streams Free of In-channel Barriers	> 50 %	69%	OK
Goal 2.3 Fish bearing Streams Free of Perpendicular Terrestrial Barriers	> 50%	46%	Poor
Goal 2.4 Non-Fish bearing Streams Free of Perpendicular Terrestrial Barriers	> 50%	69%	OK
Goal 2.5 Fish Bearing Streams Free of Parallel Terrestrial Barriers	> 75%	63%	Poor
Goal 2.6 Non-Fish Bearing Streams Free of Parallel Terrestrial Barriers	> 75 %	90%	OK
Goal 3.1 Amount of Large Woody Material	80 pieces per mile (>24' & >50' long)	Deficient	Manage for LSOG
Goal 3.2 Channel Restoration	Good Condition	Poor	Manage for LSOG
Goal 3.3 Structure Management	Minimal Impact by culverts, bridges, fire water sources, etc.	Low Impact: 1.3 culv/stream mile, and 1 Water Source	
Goal 4.1 Water Quality	High Quality	OK	
Goal 5.1 Road Sediment Feed Distance	< 600	649 ft/stream mile	Poor
Goal 5.2 Road Crossing Risk	No Risk (< 500)	No Risk (<500)	OK
Goal 6.1 Site Hydrology	No Risk		
Goal 7.1 Riparian LWD	LWD	Deficient	Manage for LSOG
Goal 7.2 Road Encroachment on Fish-bearing Streams	< 4%	3.4%	OK
Goal 8.1 Unique Habitat	Retain restoration rate of 0.8% / year for unique habitats	50% Impacted	Recover through natural processes
Goal 8.2 Road Crossing	Minimal Impact: (< 2 crossings/mile of stream)	Impact: 1.3 crossings per stream mile	OK
Goal 8.3 Created Openings within RR	New openings kept at 0.4% / decade	No new	Manage for LSOG
Goal 8.4 Plantation Management	LSOG Conditions	Deficient	Manage for LSOG
Goal 9.1 Unique Habitat within RR	Retain restoration rate of 0.8% / year for unique habitats	Deficient	Attempt 10% enhancement/basin project

Assessment Narrative for China Creek Drainage:

This narrative addresses the current conditions of the China Creek drainage in terms of the ACS objectives described in the ROD and the associated goals as part of the Standard ACS Assessment.

ACS Objective 1. Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Goal 1.1 Establish 80% of RR stands in LSOG condition.

At Present time 24.3% of the Riparian Reserve (RR) is in what would be considered Late Successional Old Growth. Extensive harvesting has occurred within the RR. Further harvesting within the RR is not recommended or currently planned.

ACS Objective 2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Goal 2.1 For fish bearing channels: 100% of the total channel length will be free of in-channel artificial barriers.

The fish bearing portion in the drainage is free of artificial barriers. There is one culvert that is in the fish bearing section, however it is not considered a migration barrier.

Goal 2.2 For non-fish channels: In any drainage, at least 50% of the non-fish channel length will be free of in-channel artificial barriers.

In the non-fish bearing portion of the streams, there are 6 culverts, with 4 of them being migration barriers to non-fish aquatic organisms. The falls from these culverts are 7, 3.5, 3.2, and 2.5 feet high. With 69% of the non-fish bearing stream lengths being free of barriers, the current condition is within the desired goal.

Goal 2.3 Terrestrial barriers perpendicular to fish bearing streams: In any drainage, at least 50% of the fish bearing stream length will be completely free of artificial perpendicular barriers that impede terrestrial travel parallel to the stream.

There are 1.29 miles of fish bearing stream within the drainage, of which 46% are free of artificial longitudinal terrestrial barriers. The current condition is below the desired goal of more than 50%.

Goal 2.4 Terrestrial barriers perpendicular to non-fish bearing streams: In any drainage, at least 50% of the non-fish bearing stream length will be completely free of artificial perpendicular barriers that impede terrestrial travel parallel to the stream.

There are 3.91 miles of non-fish bearing stream within the drainage, of which 69% are free of longitudinal terrestrial barriers. The current condition is within the desired goals.

Goal 2.5 Terrestrial barriers parallel to fish bearing streams: In any drainage, at least 75% of the fish bearing channel length will be completely free of artificial barriers that impede terrestrial travel from upslope areas to the stream channel. (A road that runs parallel to the stream within the RR is considered terrestrial barrier.)

There are 1.3 miles of fish bearing stream within the drainage, of which 63% are free of parallel terrestrial barriers. Road 23 extends along much of the Class 2 stream. The current condition is well below the desired goal of at least 75%.

Goal 2.6 Terrestrial barriers parallel to non-fish bearing streams: In any drainage, at least 75% of the non-fish bearing channel length will be completely free of artificial barriers that impede terrestrial travel from upslope areas to the stream channel. (A road that runs parallel to the stream within the RR is considered terrestrial barrier.)

There are 3.9 miles of non-fish bearing stream and 90% are free of parallel terrestrial barriers. The current condition is well above the desired goal.

ACS Objective 3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Goal 3.1 Maintain 80 pieces of large woody material (greater than 24" diameter and greater than 50` long) per mile of stream.

The stream inventory indicatd an average of 3.75 pieces of LWM per mile within the fish-bearing portion of the stream. The aquatic habitat is considered to be in fair condition. The upslope, along the tributaries, particularly adjacent to past harvest units, are mostly deficient in large woody material.

Goal 3.2 Maintain or restore channel conditions for fish habitat and water quality as needed.

The stream survey indicated a fair number of pools with dimensions that are considered adequate for this size of stream. A few areas of active erosion within the main channel was noted. Road 23 runs parallel to much of the mainstem of China Creek limiting LWM recruitment and possibly confining the stream. Previous harvest in the RR has also decreased the amount of LWM available to the channel. Debris torrents have occurred on some of the tributary streams were the riparian was harvested. The main channel has portions that are bedrock controlled naturally but several sections of China Creek have probably been scoured to bedrock due to management activities. Most of the second growth trees are well spaced and growing well. There is a moderate amount of blowdown in Riparian Reserves of the upper portions of the tributaries. Managing for LSOG is expected to improve current conditions.

Goal 3.3 Protect existing structures and/ or improvements in a manner that has the least impact on the natural dynamics and function of the channel. Avoid new structures in the RR as much as possible. Remove unnecessary structures.

There is one fire water source (pump chance) within the China Creek drainage. It is located along Rd23 within the fish-bearing portion of China Creek. A spur road approximately 100 feet long leads down to the stream. The pump chance is undeveloped. It is recommended that if this site continues to be used as a water source, that it remain in an undeveloped condition.

Although the road density is high, a low number of stream crossings (1.3 culverts per stream mile) are within the China drainage.

ACS Objective 4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Goal 4.1 Maintain WQ at current levels or better.

The water quality in the drainage is good. The 7-day maximum water temperature was 59.3^{o}F in 1997, well below the State standards. Other water quality standards are also expected to be within state standards.

ACS Objective 5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Goal 5.1 Each drainage have less than 600 feet of road feeding directly into a stream channel per mile of stream channel. No net increase in feeding road distance to occur in any drainage.

Road density is high in the China Creek drainage. Road related sediment comes from road runoff and from road related earth failures. The inventory indicates that at present time, there are 649 feet of road feed per mile of stream. This is above the goal of < 600 feet of road feed per mile of stream.

Goal 5.2 Each drainage will have no road crossing with a risk rating of greater than 500 and an average risk rating more than 500. New projects are not to cause a net increase in the risk values for the drainage.

A standard culvert risk assessment was undertaken to determine the risk value of all culverts within the drainage. At present time the assessment indicates an average value of 31, well below assessment goals of < 500, with the highest being 100, also well within assessment tolerances.

ACS Objective 6. Maintain in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Goal 6.1 Avoid alteration of flow pathways or water storage areas within the RR by new road construction. Inventory known problems within the drainage and arrange to correct the high priority items.

The watershed analysis for Layng and Brice Creeks concludes that there was no cumulative peak flow problem downstream at the Row River gauge. However, local effects of harvest/road activities are unknown. The Hydrologic Recovery Percentage for China Creek Drainage has been estimated to be at 91% in the year 2001. This indicates the drainage is fairly recovered, however, the road density is high at 3.5 miles/square mile.

ACS Objective 7. Maintain the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Goal 7.1 Have LWD levels in floodplains that are characteristic of LSOG systems and manage the flood plains to function in a manner that is characteristic of LSOG systems.

The tributary stream channels are steeply incised, so no large floodplains exist. The mainstem of China Creek has some floodplains. Due to excessive harvest in the RR, LWD is limited. As the younger aged RR reach LSOG conditions, this situation will improve.

Goal 7.2 Minimize the effect of road encroachment on flood plains. (Less than 4% encroachment on fish bearing streams within any drainage.)

Presently, road encroachment does exist within the RR. However, it is at 3.4%, within acceptable tolerances of less than 4%.

ACS Objective 8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Goal 8.1 At a minimum maintain the restoration rate of 0.8% per year for the unique habitat areas. Attempt 10% of the total enhancement projects for the drainage per basin project. Proactively control natural disturbance within the RR.

Two unique habitat areas were identified within the drainage. One is a group of rock out-crops that has experienced no impact from previous management. The other identified area is a hardwood stand along lower China Creek. This hardwood stand has expanded due to road development and past timber harvest activities along lower China Creek. Recommendation would be to allow the natural successional processes of flooding and wildfire to continue.

Goal 8.2 Within any drainage the road crossing density is not to exceed 2 crossings per mile of stream.

Road crossing density is 1.3 crossings per stream mile, below the minimal impact goal of 2 crossings per mile.

Goal 8.3 Within any drainage created openings (non road) needed for management of matrix lands will be less than 0.4% of the total RR within any decade.

Additional created openings within the RR are not planned or expected. Thus the goal of less than 0.4% RR managed per decade will be met.

Goal 8.4 Manage regeneration plantations that encroach on RR for maximum conversion to LSOG conditions.

Regeneration plantations that encroach on the RR will be managed so as to maximize conversion to LSOG conditions. Pre-commercial thinning will leave trees at a spacing of approximately 200 TPA. Western red cedar will be chosen over other conifer species. Hardwoods and woody brush vegetation will be left on slopes greater than 60% adjacent to the stream channel. Further commercial thinning will also enhance conversion.

ACS Objective 9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

Goal 9.1 At a minimum maintain the natural recovery restoration rate of 0.8% per year for the unique habitat areas. Attempt 10% of the total enhancement projects for the drainage per basin project.

Management activities to better match LSOG characteristics will be accomplished on 20 RR acres adjacent to the harvest areas. This activity will attempt to increase snag density to 7 snags per acre.

Appendix G

Roadless
Area
Acreage

Drainage Acres within Roadless Areas

12/11/97	Subwatershed	Area
FAIRVIEW	ADAMS	470.81
	CINGE	1,024.23
	GLENWOOD	54.99
	LICK	20.44
	LOWER FAIRVIEW	338.41
	LOWER SHARPS	546.81
	MID SHARPS	378.46
	UPPER FAIRVIEW	1,099.79
	WALTON	674.89
	WHITE	320.15
		4,928.98
PUDDINROCK	CEDAR	843.19
	CHINA	50.26
	GLENWOOD	630.92
	LOWER MARTIN	36.92
	LOWER SHARPS	284.57
	MID MARTIN	168.32
	MID SHARPS	414.31
	PUDDIN ROCK	229.94
	SADDLE CAMP	412.3
	SAILOR'S GULCH	362.27
	UPPER MARTIN	462.26
	UPPER SHARPS	639.84
		4,535.10
		9,464.08

Unsuitable Soil Within Roadless Areas

12/11/97

		AREA
FAIRVIEW		18.43
	OTLA	18.65
	OTRG	1,680.29
	PTL1	2.05
	PTR2	0.22
	PTRV	3.94
		1,723.58
PUDDINROCK		51.02
	OTRG	1,973.31
	PTR2	9.03
	PTRG	15.51
	PTRR	4.18
		2,053.05
		3,776.63

Current Vegetation In Roadless Areas

12/11/97

		AREA
FAIRVIEW	e	83.49
	m	1,357.07
	nf	133.64
	og	1,281.46
	t	2,062.69
	th	10.73
		4,929.08
PUDDINROCK	e	80.5
	m	1,065.29
	nf	75.42
	og	915.59
	t	2,347.46
	th	50.83
		4,535.09
		9,464.17

Potential Vegetation Within Roadless Areas

12/11/97

		AREA
FAIRVIEW	ABCO	327.38
	PSME	73.43
	TSHE	4,528.24
		4,929.05
PUDDINROCK	ABCO	195.44
	PSME	921.63
	TSHE	3,418.03
		4,535.10
		9,464.15

Appendix H

Mining

Mineral Appendix, Glossary, and Legend

The following lists include claim names of claims which have been identified as being located on Forest Service lands within, or partially within, the Sharps Creek Watershed. The list of patented lode claims represent the individual private claims or private land occupied by mining claims, all of which are located along the Fairview Peak and Bohemia Mountain mineralized area. The other 2 lists include unpatented (public land) placer and lode claims located in the watershed. These lists are based on 1998 Bureau of Land Management microfiche of located mining claims and field reviews of Forest Service lands. These lists are a fair representation of claims considered to be active in that they are legally located and filed upon in county and BLM records. The list may not include all mining claims filed upon during this year due to the recording backlog of mineral location and assessment records.

Glossary

(From *Anatomy of a Mine*. Klamath National Forest 1980)

Adit - A mostly horizontal passage driven from the surface for the working of a lode mine. An edit has only one opening which distinguishes it from a tunnel, which has two openings.

Suction dredge or jet dredge - A type of hydraulic dredge which may range from a simple, self-contained pipe-like venturi containing riffles, that is carried by a diver and operates entirely underwater to larger and more elaborate surface units carried on inflated rubber tubes or styrofoam floats. These devices operated by one or two persons are similar in two ways: I) They rely on a water jet and venturi effect to pick up unconsolidated stream-bottom materials and carry them to a gold recovering device, usually riffles. 2) The suction intake is normally hand-held and is guided by a diver working on the stream bottom. The typical jet dredge entails a small or modest capital outlay and is typically used for recreation-type mining.

Lode - A mineralized ledge, vein or mineral deposit in place.

Mining Claim - That portion of the public mineral lands which a miner, for mining purposes, takes and holds in accordance with the mining laws. A mining claim may be validly located and held only after the discovery of a valuable mineral deposit

Panning - Washing gravel or other material in a Miners' pan to recover gold or other heavy minerals.

Patent - A document by which the Federal Government conveys title to a mining claim to a private individual or company.

Placer Mining - That form of mining in which the surficial detritus id washed for gold or other valuable minerals. When water under pressure is employed to break down the gravel, the term hydraulic mining is generally employed.

Unpatented Mining Claim - A lode or placer claim located on public lands giving the miner rights to mineral resources with surface resources remaining under the authority of the government agency.

Legend

Claim Name - name of the mining claim as filed on the location notice.
Drainage - name of the drainage or topographical landmark in which the claim is located.
NOI - Notice of Intent. A I identifies that a NOI is filed with the Forest Service.
PPO - Plan of Operations. The number indicates the number of Plans of Operations filed on the claim.
Status - A I indicates that the claim is considered to be active in that recording requirements are current.
Riparian - A I indicates that the mining claim or operation involves one or more riparian areas.

Bond - A I indicates whether the PPO includes a reclamation plan and bond.

Patented Mining Claims (Private Land) Within, Or Partially Within, Sharps Creek Watershed

Minerals Survey #565:

El Calado

Mineral Survey #589A:

Black Diamond
White Bear
Jonathan
Stone Easel
David
Nomadic
Damon

Mineral Survey #443

Gem
Rico
Slide
Jasper
Fawn
Newton

Mineral Survey #486

Vesuvius
Nightingale
German Charles
Wild Hog
William Tell
Dixie Queen
Story

Mineral Survey #629

Hazel
Idaho
June

Placer Claims, 1998

#	Claim Name	Drainage	NOI	PPO	Status	Riparian	Bond	Future Bond	Active
1	Christo Contessa ll	Sharps		2	1	1	1		1
2	Dagnabit	Sharps			1	1			1
3	Little Dipper	Sharps	1		1	1			
4	Bud Placer I	Sharps	1		1	1			
5	Emerald City	Sharps			1	1			1
6	Sailor's Gulch	Sharps				1			
7	Hanami ll	Sharps				1			1
8	Neptune Blue I & II	Sharps				1			
9	Smith Falls	Sharps				1			
10	The Placer Claim	Sharps				1			1
11	Norseman	Sharps		2	1	1		1	1
12	Carolina l	Sharps	1		1	1			1
13	Crooked T	Sharps				1			
14	Eagle l	Sharps		1	1	1	1		1
15	Wild Rose	Sharps			1	1			1
16	Butter Cup	Sharps			1	1			1
17	Kit Kat B	Sharps				1			
18	Kit Kat lll (J & D)	Sharps			1	1		1	1
19	Climax l	Sharps		1	1	1	1		1
20	Time Out	Sharps				1			
21	Combination	Sharps		1	1	1		1	1
22	Exodus	Sharps				1			1
23	Easy l	Sharps				1			1
24	Easy ll	Sharps				1			1
25	Silverado l	Sharps		1	1	1	1		1
26	Silverado ll	Sharps		1	1	1	1		1
27	Quicksilver	Sharps				1			
28	Bear Claw	Sharps		1	1	1		1	1
29	The Liberty	Sharps				1			
30	Linny Bell	Sharps			1	1			
31	Middle of Nowhere	Sharps	1		1	1			1
32	Teddy Bear	Sharps	1		1	1			1
33	Empty Bottle	Sharps				1			
34	Cassandra	Sharps				1			
35	High Road	Sharps				1			
36	High Waters	Sharps				1			
37	One Potato	Sharps				1			
38	Irish Luck (Carolina)	Sharps				1			
39	Cupids Cure	Sharps				1			
40	S - K	Sharps				1			
41	Helluvahike	Sharps				1			
42	Gypsy Queen	Sharps				1			
43	Jeez Louise	Sharps				1			
44	Nugget	Sharps				1			
45	2 Bit, 4 Bit, 6 Bit(1 F	Sharps				1			
46	Six Bits	Sharps				1			
47	Gulch	Sharps				1			
48	Moose Breath	Sharps				1			
			5	10	19	48	5	4	21

Lode Claims, 1998

#	Claim Name	Drainage	NOI	PPO	Status	Riparian	Bond
1	Adventure						
2	Golden Crystal	Fairview					
3	Golden Crystal B	Fairview					
4	Old Henry	Calapooya					
5	Romanian Secret	Hardscrabble					
6	Lost Romanian	Hardscrabble					
7	Birds Nest 1	Puddin Rock		1	1	1	1
8	Birds Nest 2	Puddin Rock		1	1	1	1
9	Birds Nest 3	Puddin Rock		1	1	1	1
10	Birds Nest 4	Puddin Rock		1	1	1	1
11	Birds Nest 5	Puddin Rock		1	1	1	1
12	Birds Nest 6	Puddin Rock		1	1	1	1
13	Birds Nest 7	Puddin Rock		1	1	1	1
14	Birds Nest 8	Puddin Rock		1	1	1	1
15	Birds Nest 9	Puddin Rock		1	1	1	1
16	EL-S	Fairview		1	1		1
17	EL-B	Fairview		1	1		1
18	Joan	Fairview		1	1		1
19	Mindy	Fairview		1	1		1
20	Leroy Extension	Fairview		1	1		1
21	Sarah	Fairview		1	1		1
22	Cindy	Fairview		1	1		1
23	Elephant 6	Fairview		1	1		1
24	Elephant 1	Fairview		1	1		1
25	Elephant Lizzie	Fairview		1	1		1
26	Billy Boy	Cat Mountain					
27	Trersa K	Cat Mountain					
28	Stacy D	Cat Mountain					
29	Charlie L	Cat Mountain					
30	Gem	Fairview Peak					
31	Rico	Fairview Peak					
32	Slide	Fairview Peak					
33	Rustler	Puddin Rock		1	1	1	1
34	Climax #4	Puddin Rock		1	1	1	1
35	Climax #5	Puddin Rock		1	1	1	1
36	Climax #6	Puddin Rock		1	1	1	1
37	Star #1	Puddin Rock		1	1	1	1
38	Star #2	Puddin Rock		1	1	1	1
39	Star #3	Puddin Rock		1	1	1	1
40	Golden Star	Puddin Rock		1	1	1	1
41	Nichodemus	Puddin Rock		1	1	1	1
42	Star Ext.	Puddin Rock		1	1	1	1
43	Bonanza	Puddin Rock		1	1	1	1
44	Daisy	Puddin Rock		1	1	1	1
45	Hartley	Puddin Rock		1	1	1	1
46	Hughs	Puddin Rock		1	1	1	1
47	Smuggler	Puddin Rock		1	1	1	1
48	Last Chance	Puddin Rock		1	1	1	1

#	Claim Name	Drainage	NOI	PPO	Status	Riparian	Bond
49	Stibnite	Bohemia Mtn.					
50	Stibnite Ext.	Bohemia Mtn.					
51	South Stibnite	Bohemia Mtn.					
52	Monte Rico	Bohemia Mtn.					
53	Three Brothers	Hardscrable Ridg					
54	Old Timer	Hardscrable Ridg					
55	Challenger	Hardscrable Ridg					
56	Adventurer	Hardscrable Ridg					
57	Bonanza	Hardscrable Ridg					
58	Ambrosai	Hardscrable Ridg					
59	Three Sisters	Hardscrable Ridg					
60	Home Run (Nurd	Hardscrable Ridg					
61	Bobby Lyle	Hardscrable Ridg					
62	Minnehaha	Hardscrable Ridg					
63	Hiawatha	Hardscrable Ridg					
64	Rebel Hill	Hardscrable Ridg					
65	Helen	Fairview Peak		1	1	1	1
66	Popgun	Fairview Peak		1	1	1	1
67	Salvador	Fairview Peak		1	1	1	1
68	Key	Fairview Peak		1	1	1	1
			0	39	29	39	39

Appendix I

Transportation

Road Related Erosion and Sediment Production Assessment

Understanding road sediment requires that the road system be stratified by its ability to deliver sediment to a stream, by the quality of its surfacing, and by traffic levels impacting the road surfacing (Sullivan and Duncan 1980). Roads can be a significant source of sediment to streams in forests, and this sediment can be detrimental to stream ecosystems. Traffic and maintenance grading rejuvenate the supply of fine sediments and thus make roads a potential long-term source of sediment to streams. The costs of total road erosion control or capture of all road derived sediment is prohibitive and, in most locations, unnecessary because the forested slopes below the road capture and store much of the sediment (Reid and Dunne 1984; King and Luce, USFS Intermountain Research Station). Key to predicting if road segments provide significant sources of sediment to streams is determining the "connectedness" of road drainage to stream channels.

The Washington Forest Practices Board (1993) noted "The delivery of road erosion products to the stream system is key to understanding the influence of roads on the stream system . . . Although all roads generate erosion, only a portion of the road system drains into the stream system . . . It is important to determine what proportion of the sediment from a road system is delivered to streams in order to evaluate the contribution of road surface erosion to downstream resources."

A comprehensive field inventory indicated that approximately 88 percent (227 miles) of the road network in the Sharps Creek watershed does not have the potential to deliver sediment to stream channels. However, it was determined that 12 percent (32 miles) of this road network does have the potential to deliver sediment to streams.

The Washington Forest Practices Board (1993) methodology partitions road sediment by origin with 20 percent coming from fill slopes, 40 percent from cut slopes and ditches, and 40 percent from the road surface. Fill slopes without total vegetative cover are rare in these drainages. Only 12 percent (32 miles) of the road network in these watersheds has the opportunity to deliver sediment to a stream channel, and only 22 percent of the 32 miles(7 miles) has cutbanks that have less than 80 percent vegetative cover. Thus, fill slopes play a negligible role, cut banks contribute on 7 miles(2.7%) of the road network, while the road surface is a significant factor on 32 miles of the road network.

Traffic levels are low on road segments capable of delivering sediment. High traffic mainline haul routes are paved.

Most roads in the Sharps Creek watershed and 93 percent of the road segments with sediment delivery potential are rock surfaced. Typically this includes a lift (approximately 6-8 inches) of pit run (larger stone fragments) and a lift (4-6 inches) of crushed gravel with high aggregate quality. This is a significant factor working on behalf of water quality in this drainage. Kochenderfer and Helvey (1987) showed an 88 percent reduction in sediment with a 6-inch lift of 1.5 to 3.3 inch rock, and a 79 percent reduction in sediment with a 6-inch lift of gravel smaller than 1.5 inches. Swift (1984) showed a 97 percent sediment reduction with an 8-inch lift of large stone and a 92 percent sediment reduction with a 6-inch lift of crushed 1.5 inch minus gravel. Swift (1984) found sediment production reduced by 84 percent with a combination of rock surfacing and established grass cover up to the road edge. Burroughs et al. (1985) had similar results with a reduction of 79 percent from rock surfacing (also see Burroughs and King 1989).

Annual sediment yield was calculated using the methodology given in the Washington Forest Practices Board (1993) watershed analysis standards.Total sediment delivered to streams in the Sharps Creekr watershed from roads is estimated to be 1,041 tons per year. Assuming a sediment density of 1.25 tons per cubic yard (based on bulk density of typical soils), this estimated sediment delivery is equivalent to 1300 cubic yards.

The background sediment yield for the Sharps Creek watershed is estimated to be 21,400 tons per year Therefore, the estimated delivered sediment related to road erosion is equivalent to 5 percent of the background level. Relative to natural fluctuations and the capability of current technology to accurately estimate background and road contributions a 5% increase is a negigible amount. Overall, road sediment delivery can be considered to be low and have a negligible impact to the stream channel system.

Confidence in the determination of sediment contributing road segments is high because all roads were field inventoried. The variables with the least confidence are sediment delivery rates and estimation of background sediment levels. The Washington State Forest Practices Board methodology utilized here is a regional system for the Northwest approved in federal guidelines for watershed analysis. The Bureau of Land Management, National Council for Air and Stream Improvement(NCASI) and the USFS Rocky Mountain Research Station are conducting a 5year/500K research effort to establish data/model/rates localized to Western Oregon. Under the Washington State methodology relief culverts within 200 feet of a stream channel are considered contributing. The Western Oregon study shows an average travel distance of 30 feet and a maximum of 130 feet. Early data from the Western Oregon study indicates that the Washington State Methodology overestimates sediment from roads by as much as 2 to 10 times the actual amount. Thus, the rates reported here are likely much lower than even the relatively small amounts reported. This analysis does not address sediment from roads due to mass wasting.

Natural Background Sediment Production

In a study of the Coast Range, Reneau and Detrich (1991) found "...average bedrock lowering rates of about 0.07 mm/year for the last 4,000 to 15,000 years. These rates are consistent with maximum bedrock exfoliation rates of about 0.09 mm./year...Sediment yield measurements from 9 Coast Range streams provide similar basin wide denudation rates of between 0.05 and 0.08 mm/year, suggesting an approximate steady state between sediment production on hill slopes and sediment yield. In addition, modern sediment yields are similar in basins varying in size from 1 to 1500 km2, suggesting that erosion rates are spatially uniform and providing additional evidence for an approximate equilibrium in the landscape."

Utilizing the work of Reneau and Dietrich (1991), a natural sediment yield for the Sharps Creek watershed was determined to be approximately 21,400 tons per year. Surface erosion is not a significant factor under natural conditions given the lush vegetation and porous soils of Western Oregon hillslopes results in an almost total lack of surface runoff outside of stream channels. Roads are obviously not a factor in natural, presettlement yields. It is assumed that this natural background sediment yield is made up almost entirely from soil creep and mass soil movement. Soil creep was estimated (utilizing Washington State Forest Practices Board: Standard Methodology for Conducting Watershed Analysis) to be in the range of 3100 tons per year, which leaves mass wasting accounting for 18,300 tons per year of the natural background sediment yield.

Proportionately, mass soil movement is still the most significant erosion process. There is no data or methodology capable of arriving at even a remotely reasonable approximation of mass soil movement rates as compared to natural rates. Mass soil movement is predominantly an episodic event correlated with major storm years. Existing inventories document landslide rates associated with road building and logging practices of the 1960s and early 1970s. These practices have changed dramatically since the mid-1970s. Much has been done by public agencies and private industry to correct past mistakes (sidecast pullback, improved road design and maintenance, endhaul of construction materials, leave areas in hydrologically sensitive areas, spring burning, directional yarding, etc.). As significant, or perhaps much more significant than the change in management practices, is that most of the road network was established in those earlier periods. In the decades since, the road network has matured in terms of settling of fills, slumping of cut banks, and establishment of cut and fill slope vegetation. Recent extreme winter storm events resulted in the expected proportionate increase in storm damage/repair work to the road system but failed to translate into a corresponding damage/disturbance in the channel system from the perspective of fishery habitat.

Barry Williams
BLM Eugene District
South Valley Resource Area

SHARPS CREEK WATERSHED
TRANSPORTATION MANAGEMENT ANALYSIS
BUREAU OF LAND MANAGEMENT

I. BACKGROUND

The purpose of this document is to determine if there are inconsistencies between existing road maintenance levels and recommendations or resource conditions described in the Sharps Creek Watershed Analysis. Ideally, inconsistencies would lead to corrective actions; these actions would be subject to NEPA analysis prior to implementation.

II. EXISTING ROAD MAINTENANCE LEVELS

The watershed's roads and current road maintenance levels are shown in the table below. Several have been "segmented" to facilitate calculation of road use fees. For the purposes of this document, all segments have been included in their common road number.

Sharps Creek Watershed
Existing Roads and Maintenance Levels
Bureau of Land Management

Road Number	Length	Control	Maintenance	Maintenance Level[1]
22-1-3	1.08	BLM	BLM	4
22-1-4	.21	BLM	BLM	3
22-1-6	1.09	BLM	BLM	3
22-1-9.1	.53	BLM	BLM	4
22-1-9.3		PVT*	PVT*	
22-1-12		PVT*	PVT*	
22-1-14	3.73	BLM	BLM	4
22-1-15	.39	BLM	BLM	3
22-1-15.1	.05	BLM	BLM	3
22-1-15.2	.87	BLM	BLM	3
22-1-15.3	.32	BLM	BLM	3
22-1-15.4	.05	BLM	BLM	3
22-1-17.1	.96	BLM	BLM	3
22-1-17.2	.08	BLM	BLM	3
22-1-17.4		BLM		
22-1-17.5		BLM		
22-1-16	1.68	BLM	BLM	3/1
22-1-20	2.13	BLM	BLM	3
22-1-21	.58	BLM	BLM	5
22-1-21.1	.19	BLM	BLM	3
22-1-21.2	.18	BLM	BLM	3
22-1-22	.26	BLM	BLM	1

Road Number	Length	Control	Maintenance	Maintenance Level[1]
22-1-22.2		PVT*	PVT*	
22-1-22.4	2.72	BLM	BLM	4
22-1-22.5	.38	BLM	BLM	3
22-1-22.6	.23	BLM	BLM	3
22-1-23	.76	BLM	BLM	4
22-1-26	.11	BLM	BLM	3
22-1-26.3	.49	BLM	BLM	3
22-1-26.4		PVT*	PVT*	
22-1-27	.40	BLM	BLM	3
22-1-27.1	.14	BLM	BLM	3
22-1-27.2	.18	BLM	BLM	3
22-1-27.3	.66	BLM	BLM	3
22-1-27.4	.38	BLM	BLM	3
22-1-33	.41	BLM	BLM	3
22-1-34		PVT*	PVT*	
22-1-34.1	.19	BLM	BLM	3
22-1-34.2	.21	BLM	BLM	3
22-1-34.3	.19	BLM	BLM	3
22-1-34.4		PVT*	PVT*	
22-1-35.1	.74	BLM	BLM	3
22-1-35.2	6.64	BLM	BLM	5
22-1-35.4		PVT*	PVT*	
22-1-35.5	.14	BLM	BLM	3
22-1-35.6	.10	BLM	BLM	3
23-1-1	.63	BLM	BLM	3
23-1-1.1	.59	BLM	BLM	3
23-1-1.2		PVT*	PVT*	
23-1-2		PVT*	PVT*	
23-1-2.1	1.07	BLM	BLM	4
23-1-2.2	.40	BLM	BLM	3
23-1-2.3	.16	BLM	BLM	3
23-1-3	.44	BLM	BLM	3
23-1-3.1	.22	BLM	BLM	3
23-1-3.2	.45	BLM	BLM	3
23-1-3.3	.22	BLM	BLM	3
23-1-9	2.17	BLM	BLM	4
23-1-9.1	.41	BLM	BLM	3
23-1-9.2		PVT*	PVT*	
23-1-9.4	.57	BLM	BLM	3
23-1-11	.26	PVT*	PVT*	
23-1-11.1	.96	PVT*	PVT*	
23-1-12	.68	BLM	BLM	5
23-1-13	9.88	BLM	BLM	5
23-1-14	.20	BLM	BLM	3
23-1-22	.17	BLM	BLM	3

Road Number	Length	Control	Maintenance	Maintenance Level[1]
23-1-22.1	.10	BLM	BLM	2
23-1-22.2	.30	BLM	BLM	3
23-1-22.3	.10	BLM	BLM	2
23-1-23	3.03	BLM	BLM	4
23-1-26	.06	BLM	BLM	1
23-1-27	2.94	BLM	BLM	4
23-1-27.1	4.00	BLM	BLM	4/1
23-1-27.4	.20	BLM	BLM	3
23-1-27.5	.15	BLM	BLM	3

*Road under private control and maintenance that crosses BLM-managed lands
[1]Maintenance Levels are: 5=Road open generally all year (may be closed due to snow conditions) and are the highest traffic volume roads; 4=Road open generally all year (except for snow) and which connect major administrative features and have high traffic volume; 3=Road open seasonally or year-round for commercial, recreation or administrative access, negotiable by passenger cars at prudent speeds; 2=Roads open for limited administrative traffic, passable by high clearance vehicles; 1=Roads where minimum maintenance is needed to protect adjacent lands and resource values, closed to traffic.

III. CONSISTENCY FINDINGS

This sections details recommendations of the watershed analysis that would lead to a finding of consistency or inconsistency with existing road maintenance levels.

Watershed Analysis Recommendation

As opportunities arise, restore riparian habitat that is currently occupied by roads.
As feasible, remove roads located within Riparian Reserves.

Consistency Determination: This recommendation was made for several wildlife species in the watershed, including white-footed vole, tailed frog, red-legged frog, yellow-legged frog, western pond turtle, and harlequin duck.

Road maintenance levels are neutral in regards to these recommendations. It is unknown how many of the roads shown in the table above are in riparian habitat. It is also unknown whether or not those roads are included in road use agreements with private timber companies, so the level of opportunity to remove roads from riparian habitat is unknown. As potential road decommissioning opportunities arise, it is recommended that analysis determine (1) which roads fall within riparian habitat, and (2) whether or not habitat exists or could be created for the above species.

Watershed Analysis Recommendation

Reduce road density throughout the watershed that allows human disturbance.

Consistency Determination: This recommendation was made to protect and enhance marten habitat. It appears that the best potential marten habitat on BLM managed lands in this watershed lie within the LSR. Several roads within the LSR may be suitable for decommissioning (see below). Any road closures will essentially reduce human disturbance.

Watershed Analysis Recommendation

All or portions of the following roads in the Lick Creek/Pony Creek area are priority for closure:

22-1-23
22-1-14

Consistency Determination: Both of these roads are in the Lick Creek/Pony Creek area with a maintenance level of 4. This would indicate that they remain open year-round, and that there is a high management need for these roads. The long-term need for these roads can be examined in conjunction with the analysis to determine the drainages' suitability for timber harvest. Until analysis shows that timber harvestshould be minimized in these drainages, this recommendation is consistent with existing maintenance levels.

Watershed Analysis Recommendation

Upgrade culverts to accommodate a 100-year flood event.

Consistency Determination: Road maintenance levels are neutral in regards to this recommendation in that all maintenance levels allow for culvert replacements. However, it is recommended that a culvert analysis be completed on BLM-maintained roads in the Sharps Creek watershed and a Jobs-in-the-Woods contract be let to replace those that are not capable of withstanding a 100-year flood event.

Watershed Analysis Recommendation

Decommissioning roads or improving crossings to reduce landslide potential should be considered highest priority for the Clark Creek drainage.

Consistency Determination: Existing road maintenance levels may be potentially inconsistent with this recommendation. It is recommended that in-depth analysis be completed on BLM-managed roads within the Clark Creek drainage to determine what corrective actions need to be taken.

Watershed Analysis Recommendation

Reduce fragmentation of habitat in LSR from roads and harvest activities. Possible roads include:

23-1-1.1
23-1-2.1, -2.2, -2.3
23-1-3, -3.2
23-1-9, -9.1, -9.4
23-1-26
23-1-27, -27.1, -27.4, -27.5

Consistency Determination: Road maintenance levels may be inconsistent with this recommendation. Except for the 23-1-26 road, all of those shown above are maintenance level 3 or 4. Level 4 roads are generally open year-long, except if closed by snow. Level 3 roads may be open year-round also, but could be closed seasonally. All of the roads appear to dead-end on BLM managed land. An examination of each road record needs to be done in order to determine whether or not BLM has the discretion to close any of these roads. It is recommended that if closing those roads listed above is within BLM's discretion, each road be examined for possible closure. The type of closure (seasonal, decommission, hydrologic obliteration) would be determined based on a site-specific analysis.

CULVERT INVENTORY SHARPS CREEK WATERSHED AREA					
ROAD #	M.P.	CREEK	ACRES	CMP (SIZE)	COMMENTS
2300	1.00	MARTIN CK	?	36"	good condition - not a major drainage
2300	2.20	PUDDIN CK	136	72"	arch pipe (inlet/outlet)
2300	4.46	SADDLE CAMP CK	236	96"	arch pipe good condition
2300	5.35	CHINA CK	128	24"	dry, no water flow
2358	0.45	CHINA CK	63	36"	good condition
2358	9.0	BOHEMIA CK	24	24"	good condition
2358	9.6	BOHEMIA CK	37	36"	no water flow
2358	10.4	GLENWOOD CK	145	60"	good condition
2328	1.5	PUDDIN ROCK CK	233	72"	
2460	13.4	Channel	35	36"	no water flow , dry
2460	13.6	JUDSON ROCK CK	88	36"	good condition
2300-721	0.7	QUARTZ CK	118	30"	good condition
2301-746	0.2	WALTON CK	50	30"	good condition

CULVERT INVENTORY SHARPS CREEK WATERSHED AREA					
ROAD #	M.P.	CREEK	ACRES	CMP (SIZE)	COMMENTS
2300	1.00	MARTIN CK		36"	good condition
2300	2.00	PUDDIN CK		72"	arch pipe (inlet/outlet)
2300	2.20	MARTIN CK		18"	good condition
2300	2.30	MARTIN CK		18"	blocked/dry
2300	2.35	MARTIN CK		18"	blocked/dry
2300	2.45	MARTIN CK		18"	partially blocked
2300	4.30	CHINA CK		?	arch pipe (inlet/outlet)
2300	4.46	SADDLE CAMP CK		?	
2300	4.60			12"	dry, blocked/damage inlet
2300	4.70			12"	dry, blocked/damage inlet
2300	4.75			12"	dry, blocked/damage inlet
2300	4.80			12"	dry, blocked/damage inlet
2300	5.00	CHINA CK		?	good condition
2300	5.09				partially damaged/ inlet blocked
2300	5.20			24"	shot gun pipe - good condition
2300	5.29			24"	pipe and channel dry
2300	5.30			?	grass cover- could not find
2300	5.55			18"	good condition - rubbercloth shot gun outlet
2300	5.65			12"	inlet partially blocked
2300	5.90			12"	inlet partially blocked
2300	6.00			?	grass cover- could not find
2300	6.12			?	grass cover- could not find
2300	6.20			12"	inlet blocked/could not find outlet
2300	6.30			12"	inlet blocked/could not find outlet
2300	6.55			18"	damaged inlet
2300	6.60			?	grass cover- could not find
2300	6.90			12"	inlet in good condition - could not see outlet
2300	7.00			24"	good condition - shot gun outlet
2300	7.2	END OF ROAD	END OF ROAD		END OF ROAD
2358	0.25			?	
2358	0.45	CHINA CK		36"	good condition
2358	0.60			18"	good condition
2358	0.70			?	
2358	1.00			18"	slightly damaged/ operable
2358	1.89			18"	good condition
2358	3.00			12"-18"	need to verify actual size
2358	3.50			24"	
2358	3.88			18"	inlet/shotgun outlet in good condition
2358	5.00			?	
2358					
2358					
2358	9.0	BOHEMIA CK		24"	good condition
2358	9.6			36"	
2358	10.4	GLENWOOD CK		60"	good condition
2328	1.5	PUDDIN ROCK CK		72"	
2328	6.9	END OF ROAD	END OF ROAD		END OF ROAD
2460	13.4	Channel		36"	no water flow , dry
2460	13.6	JUDSON ROCK CK		36"	good condition
2300-721	0.7	QUARTZ CK		30"	good condition
2301-746	0.2	WALTON CK			good condition

SHARPS CREEK WATERSHED ANALYSIS

FOREST SERVICE ROAD LISTING

ROAD #	LENGTH	SURFACE TYPE	MTC. LEVEL	HILLSLOPE POSITION	FUNCT. CLASS	CONST. YEAR	HISTORICAL USE/ACTIVITY
2300 FS	6.50	AGG	3	VB/MS	A	1960	TS/REC/MIN
2300106	0.60	NAT	1	VB	L	1960	TS/MIN/PVT L
2300127	0.50	NAT	1	VB	L	1960	MIN
2300708	0.27	AGG	2	RT	L	1983	TS
2300721	2.91	AGG	2	VB/MS	L	1964	MIN
2300767	1.42	AGG	2	RT	L	1974	TS/PVT L
2300767	0.52	NAT	2	MS/RT	L	1974	TS
2300805	0.65	NAT	2	MS	L	1974	TS/ PVT L
2300808	1.00	NAT	1	VB	L	1960/73	MIN
2301000	4.82	AGG	2	MS	C	1987	TS/REC
2301436	0.34	IMP	2	MS	L	1987	TS
2301742	0.76	AGG	2	MS	L	1987	TS
2301746	0.28	AGG	2	MS	L	1987	TS
2301747	0.26	NAT	2	MS	L	1987	TS
2328000	7.00	AGG	3	MS/RT	C	1983	TS/REC
2328436	0.26	NAT	1	MS	L	1983	TS
2328448	0.60	NAT	1	MS	L	1988	TS
2328453	0.23	NAT	1	MS	L	1988	TS
2328739	0.99	IMP	2	MS/RT	L	1983	TS
2358000	10.70	AGG	3	MS/RT	C	1967	TS/REC
2358411	0.10	NAT	1	MS	L	1967	TS
2358447	0.19	IMP	2	RT	L	1987	TS
2460 FS	7.30	NAT	3	VB /MS	L	1925	REC
2460-165	1.20	NAT	1	MS	L	1960	TS
2460-451	0.10	NAT	1	RT	L	1929	REC/MIN
2460-766	3.13	NAT	2	MS	L	1929	TS/PVT L
TOTAL =	52.63						

ROAD MILES BY MAINTENANCE LEVEL	
MTC. LEVEL 1 =	4.59
MTC. LEVEL 2 =	16.54
MTC. LEVEL 3 =	31.5

MILES OF PRIMARY, SECONDARY AND OTHER ROADS	
PRIMARY =	17.9
SECONDARY =	11.8
OTHER =	23.63

LEGEND	
VB =	VALLEY BOTTOM
RT =	RIDGETOP
MS =	MIDSLOPE
TS =	TIMBER SALE
MIN =	MINING
REC =	RECREATION
PVT L =	PRIVATE LAND

SHARPS CREEK WATERSHED ANALYSIS

FOREST SERVICE ROAD LISTING

ROAD #	LENGTH	SURFACE TYPE	MTC. LEVEL	FUNCT. CLASS	CONST. YEAR
2300 FS	6.50	AGG	3	A	1960
2300106	0.60	NAT	1	L	1960
2300127	0.50	NAT	1	L	1960
2300708	0.27	AGG	2	L	1983
2300721	2.91	AGG	2	L	1964
2300767	1.42	AGG	2	L	1974
2300767	0.52	NAT	2	L	1974
2300805	0.65	NAT	2	L	1974
2300808	1.00	NAT	1	L	1960/73
2301000	4.82	AGG	2	C	1987
2301436	0.34	IMP	2	L	1987
2301742	0.76	AGG	2	L	1987
2301746	0.28	AGG	2	L	1987
2301747	0.26	NAT	2	L	1987
2328000	7.00	AGG	3	C	1983
2328436	0.26	NAT	1	L	1983
2328448	0.60	NAT	1	L	1988
2328453	0.23	NAT	1	L	1988
2328739	0.99	IMP	2	L	1983
2358000	10.70	AGG	3	C	1967
2358411	0.10	NAT	1	L	1967
2358447	0.19	IMP	2	L	1987
2460 FS	7.30	NAT	3	L	1925
2460-165	1.20	NAT	1	L	1960
2460-451	0.10	NAT	1	L	1929
2460-766	3.13	NAT	2	L	1929
TOTAL =	52.63				

MILES OF ROAD BY MAINTENANCE LEVEL	
MTC. LEVEL 1 =	4.59
MTC. LEVEL 2 =	16.54
MTC. LEVEL 3 =	31.5

MILES OF PRIMARY, SECONDARY AND OTHER ROADS	
PRIMARY =	17.9
SECONDARY =	11.8
OTHER =	23.63

SHARPS CREEK WATERSHED ANALYSIS

FOREST SERVICE ROAD LISTING

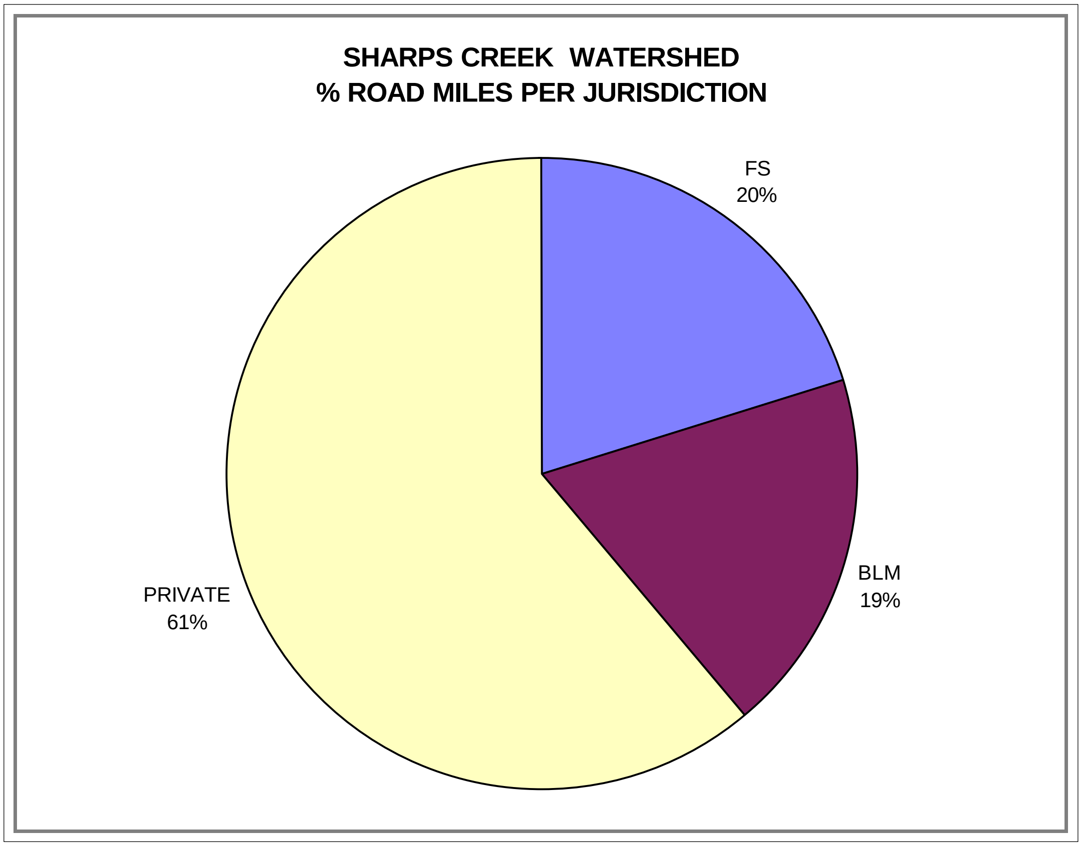
ROAD #	LENGTH	SURFACE TYPE	MTC. LEVEL	FUNCT. CLASS	CONST. YEAR
2300 FS	6.50	AGG	3	A	1960
2300106	0.60	NAT	1	L	1960
2300127	0.50	NAT	1	L	1960
2300708	0.27	AGG	2	L	1983
2300721	2.91	AGG	2	L	1964
2300767	1.42	AGG	2	L	1974
2300767	0.52	NAT	2	L	1974
2300805	0.65	NAT	2	L	1974
2300808	1.00	NAT	1	L	1960/73
2301000	4.82	AGG	2	C	1987
2301436	0.34	IMP	2	L	1987
2301742	0.76	AGG	2	L	1987
2301746	0.28	AGG	2	L	1987
2301747	0.26	NAT	2	L	1987
2328000	7.00	AGG	3	C	1983
2328436	0.26	NAT	1	L	1983
2328448	0.60	NAT	1	L	1988
2328453	0.23	NAT	1	L	1988
2328739	0.99	IMP	2	L	1983
2358000	10.70	AGG	3	C	1967
2358411	0.10	NAT	1	L	1967
2358447	0.19	IMP	2	L	1987
2460 FS	7.30	NAT	3	L	1925
2460-165	1.20	NAT	1	L	1960
2460-451	0.10	NAT	1	L	1929
2460-766	3.13	NAT	2	L	1929
TOTAL =	52.63				

MILES OF ROAD BY MAINTENANCE LEVEL		MILES OF PRIMARY, SECONDARY AND OTHER ROADS	
MTC. LEVEL 1 =	4.59	PRIMARY =	17.9
MTC. LEVEL 2 =	16.54	SECONDARY =	11.8
MTC. LEVEL 3 =	31.5	OTHER =	23.63

SHARPS CREEK WATERSHED ANALYSIS

ROAD DENSITY BY DRAINAGE				
DRAINAGE	ACRES	MILES/ SQ MILE	MILES OF ROAD	ROAD DENSITY
ADAMS	2422.9	3.79	12.1	3.2
BOULDER	2140.6	3.34	25.2	7.5
BUCK	2515.8	3.93	25.3	6.4
CEDAR	858.0	1.34	0	0
CHINA	806.9	1.26	4.5	3.6
CINGE	1045.1	1.63	0	0
CLARK	3340.5	5.22	13	2.5
DAMEWOOD	1337.0	2.09	15.5	7.4
GLENWOOD	1470.0	2.3	6.8	3
GRASSHOPPER	1949.7	3.05	16.3	5.4
LICK	1572.6	2.46	9.2	3.7
LOWER FAIRVIEW	339.8	0.53	0.1	0.2
LOWER MARTIN	556.0	0.87	3.1	3.6
LOWER QUARTZ	773.0	1.21	3.7	3.1
LOWER SHARPS	914.2	1.43	2.4	1.7
MID MARTIN	539.6	0.84	2.3	2.7
MID SHARPS	895.7	1.4	2.4	1.7
PONY	1575.7	2.46	12.8	5.2
PUDDIN ROCK	932.8	1.46	4.8	3.3
REVIER	1144.3	1.79	10.4	5.8
SADDLE CAMP	764.9	1.2	3.5	2.9
SAILOR'S GULCH	431.2	0.67	1.2	1.8
SHARPS	724.4	1.13	4.5	4
STRAIGHT	2041.3	3.19	21.5	6.7
TABLE	1431.7	2.24	15.1	6.8
UPPER FAIRVIEW	1451.7	2.27	3.7	1.6
UPPER MARTIN	681.7	1.07	0.5	0.5
UPPER QUARTZ	1153.4	1.8	4.9	2.7
UPPER SHARPS	819.1	1.28	1.3	1
WALKER	3402.2	5.32	24.5	4.6
WALTON	779.7	1.22	0.8	0.7
WEST FORK QUARTZ	922.5	1.44	4.5	3.1
WHITE	789.8	1.23	2.7	2.2
SHARPS CREEK TOTAL	42502.0	66.46	258.6	3.9

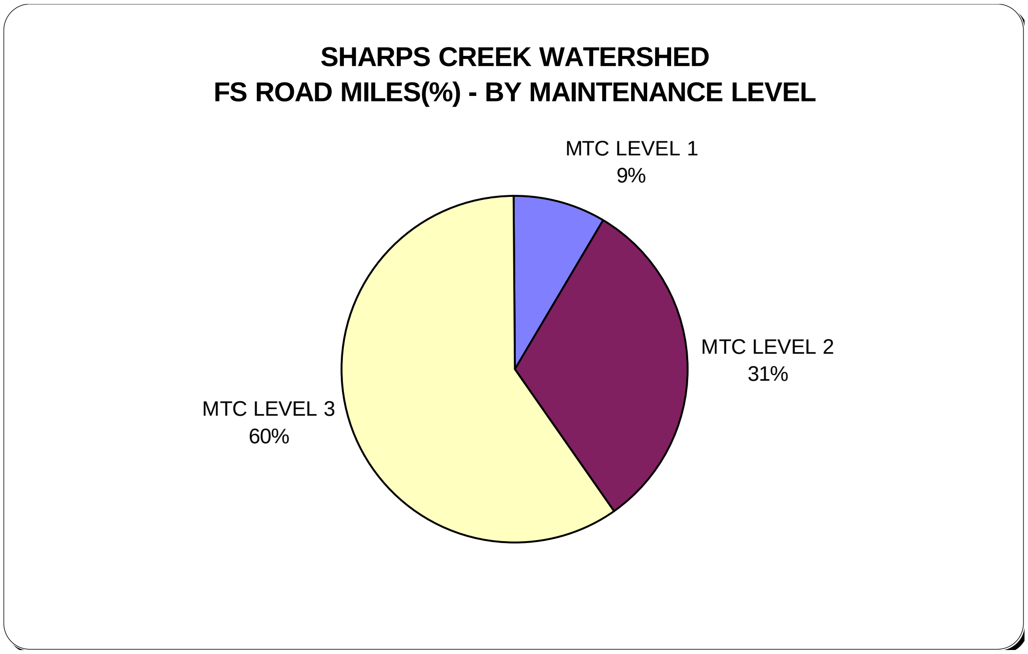
ROAD MILES IN SHARPS CREEK WATERSHED	
JURISDICTION	TOTAL MILES
FS	52.7
BLM	48.1
PRIVATE	157.8
TOTAL MILES	258.6

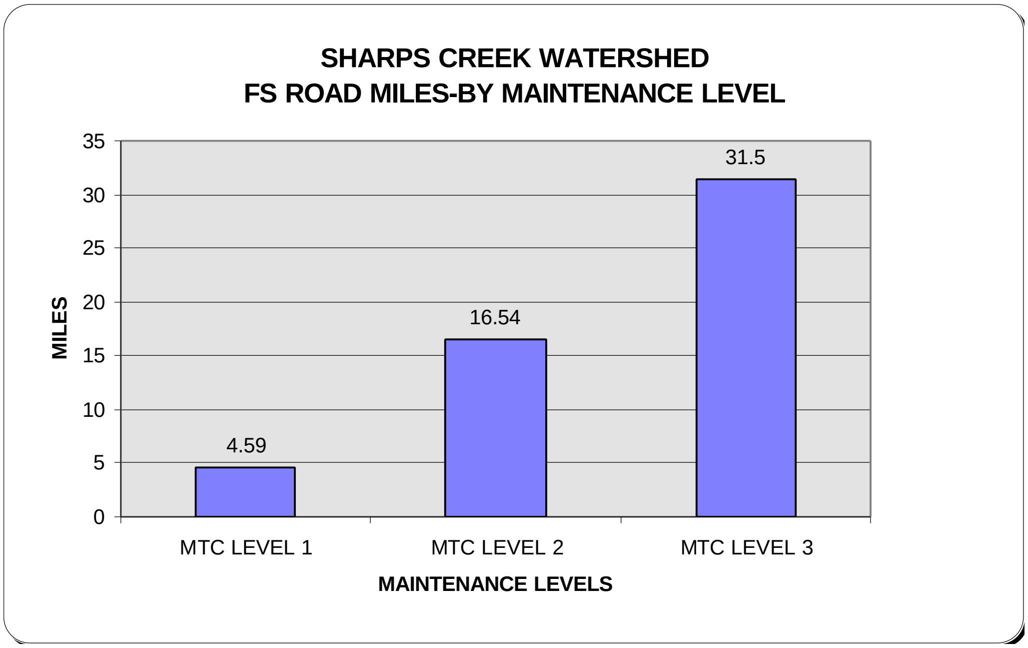


ROAD DENSITY BY JURSIDICTION				
OWNER - SHIP	ACRES	MILES/ SQ MILE	MILES OF ROAD	ROAD DENSITY
FS	17752.0	27.7	52.7	1.9
BLM	9207.0	14.4	48.1	3.3
PRIVATE	15543.0	24.3	157.8	6.5
TOTAL	42502.0	66.4	258.6	3.9

NOTE: ACRES AND MILES OBTAINED FROM GIS QUERY

ROAD MILES - BY MAINTENANCE	
MAINTENANCE LEVEL	TOTAL MILES
MTC LEVEL 1	4.59
MTC LEVEL 2	16.54
MTC LEVEL 3	31.5
TOTAL MILES	52.63





Appendix J

Access & Travel Management (USFS)

Forest Service
Sharps Creek Watershed Analysis
Access and Travel Management
Planning Process

This document describes the Forest Service Access and Travel Management (ATM) planning process used during the Sharps Creek Watershed Analysis on Forest Service managed lands. This process is based almost entirely on the ATM process developed during the Upper Steamboat Creek Watershed Analysis (USDA 1997). The road segments evaluated during this ATM process accessed or were located on land managed by the Forest Service and roads maintained by the Forest Service.

Introduction

In every watershed, the ultimate goal should be a road network blended to serve human needs and restoring the ecosystems. Identification of roads currently impacting or posing a high risk of impacting aquatic and terrestrial resources in the watershed should help to meet this goal. Evaluation of the road network would probably be different in each watershed, depending on the land allocation. For example, less extensive road networks are probably needed to manage Late Successional Reserves than Matrix lands. The purpose of this ATM plan is to identify road maintenance priorities as well as to identify restoration opportunities within the Sharps Creek Watershed.

Sharps Creek is a 42,500 acre watershed. Approximately 63% of the watershed is within federal ownership (Forest Service and Bureau of Land Management). Of this federal ownership, 17,752 acres are managed by the Forest Service. Forest Service land is located within the eastern and southern region of the watershed and encompasses the headwaters of Sharps Creek. Land managed by the Forest Service in Sharps Creek has been identified as Matrix land under the Northwest Forest Plan (1994). Also within the Sharps Creek watershed are two major roadless areas plus 233 acres of the Canton Roadless area (from the Steamboat watershed). The Fairview roadless area is 7,343 acres and the Puddin Rock roadless area encompasses 4,808 acres. Both were evaluated during the RARE II process and non-wilderness use was recommended. Due to development, these two areas have been reduced in size. They are, however, still the largest unroaded and intact areas of late successional vegetation in the Coast Fork subbasin.

The ATM process provides a comparison of human uses with resource impacts of road segments relative to each other within this drainage. The process points out the roads with the highest degree of conflict between human uses and resource impacts, as well as those with little conflict, and everywhere in between. The results of these comparisons could be used as a framework for decision making on whether to maintain, stormproof (reduce risks to aquatic habitat), or decommission roads.

Road Segments

The first part of the process is to break the roads within the drainage into segments. A transportation planner familiar with the road network divided the road system into specific road segments. Segments were based on natural features such as hillslope position, including riparian, midslope or ridgetop (Figure 1).

Each road segment was given its own unique number and then analyzed based on aquatics, wildlife and human use. The three different resource areas developed their own criteria and rating system for evaluation of the road segments. The Aquatic Impacts/Risk Factors (see next page) identified key characteristics of roads as they relate to aquatic resources. From these factors, an Aquatic Impacts Table was created that displayed the rating of the road segment (Table 1). The Wildlife Impact/Risk Factors identified key characteristics of roads as they relate to the major wildlife resources in the watershed. From these factors, a Wildlife Impacts Table was created that displayed the rating of each road segment (Table 2). The Human Use Factors identified key human uses of roads. From these factors, a Human Use Table was created that displayed the rating of the road segments (Table 3).

The factors used to develop the ratings used in each of the three tables were not intended to be comprehensive but were intended to focus on the key resources, pertinent processes and use of roads specific to the watershed.

The strategy was to determine and disclose the importance of each road segment for human use compared to its impacts or risks to aquatic and terrestrial values. Numerical values for rating the different factors was determined (described below) for each of these three tables. Once a total numerical score for each segment in each table was determined, the Interdisciplinary Team (IDT) rated each segment as a high, moderate or low impact to aquatic and terrestrial resources and as a high, moderate or low importance to human use. From these ratings the roads were assigned different management categories based on comparisons of these ratings as described later on.

Rating System

Since the ratings for individual road segments are developed on a localized scale relative to other local road segments, the ratings are NOT transferable in comparing roads across watershed boundaries.

Criteria for rating individual road segments in the Sharps Creek Watershed differed from those used in the Upper Steamboat ATM process. This was necessary to address the different land allocation (Steamboat is designated Late Successional Reserve while Sharps Creek is designated Matrix lands). Wildlife, fisheries, aquatic values, private and public use, and fire risk also differed from those identified in the Upper Steamboat analysis and, hence, created the need for a modified rating system.

The rating system is described below.

Aquatic Impact/Risk Factors

Aquatic factors were developed to capture the key processes associated with roads as they link to the aquatic environments. This list is not intended to be comprehensive. It is intended to be concise and highly pertinent. The list of factors includes; geologic hazard, sediment transport, riparian function, flow effects and proximity to fish stocks.

Geologic Hazard

This factor was developed to incorporate the risk of mass wasting and/or debris flow potential initiating from a road segment. This factor also addresses the risk of road failures directly into streams from valley bottom roads.

Geologic hazard was identified by using the Geologist's Geomorphic mapping as well as slope steepness (0-30%, 31-55%, > 55%) to assess the potential risk of a mass wasting event triggered by the road. Mapped landslides were used in assessing the mass wasting risk as well as on the ground knowledge of failures and aerial photo interpretation.

3 = Low risk. No signs of recent failures reaching or capable of reaching a stream channel. Low torrent potential. Slopes < 30% and outside of earthflow terrain.

6 = Moderate risk. Signs of past failures off road but widely spaced (1 per mile) and not reaching stream channels. Some risk of future failures reaching stream channels but torrent potential low. Slopes of 31-55% within or outside of earthflow terrain.

9 = High risk. Recent failures off road and/or past failures which have reached stream channels. High torrent potential (high stream channel gradients). Slopes > 55%. High risk also includes road segments with oversteepened landings within steep draws or perched upslope of stream channels.

High risk includes road segments within the active floodplain of streams or riparian reserve where failures off road directly enter the stream.

Sediment Transport

This attribute is designed to collect information on how roads route and deliver sediment to streams. This factor addresses chronic sedimentation from ditchlines and road beds. Forest roads have been shown to be a major contributor of sediment to stream channels. Roads supply sediment from steep slopes associated with road cuts and fills, often providing a long-term source of sediment. Ditchline drainage provides a direct link from sediment source to the stream channel. Culverts that plug can either divert and flow down the road or cause the road to fail at the culvert. Information used for this attribute was obtained through a preliminary reconnaissance of the road segments that looked at culvert crossings and ditchline drainage. Where road segments were not examined, professional judgment was used to rate segments based on contour crenulations and the stream map.

0 = Segment has no stream crossings and no risk of plugging or stream diversions. Ditchline drainage is from relief culverts that drain onto stable slopes. Low potential for surface runoff to stream.

3 = The inventoried stream crossings showed that there was short segments of ditchline drainage. OR segment has 1-2 stream crossings but none that are at a high risk of diverting flow if they plug (little or no ditchline drainage), small fills and culverts adequately sized for a large storm event (100 year event).

6 = Segment has one or two stream crossings that may plug and either divert flow or wash out fill due to undersized culverts for drainage area, geology or steep stream channels above culvert. Inventoried stream crossing identified a moderate amount of direct ditchline drainage into stream channels and/or had the potential to deliver surface runoff to streams.

9 = Segment has 2 or more crossings that are undersized for a 100 year storm event and/or the majority of culverts within the segment are at high risk of plugging (diverting flow) and/or washing out fills. Large fills at stream crossings. Substantial amount of direct ditchline drainage with fine sediment delivered to stream channels and/or segments are in close proximity to streams with the potential for direct runoff to stream channels (valley bottom roads).

Riparian Function

This attribute addresses the extent to which road segments lie within riparian reserves, disconnect streams from their floodplains, and prevent development of late seral riparian vegetation. Road segments within floodplains prevent establishment of riparian vegetation (reduce the amount of shade, leaf litter and future source of large woody material to the stream), are sources of sediment, prevent the natural pattern of stream meander (shorten the length of stream) and increase runoff to streams (increasing peak flow and fine sediment inputs). Historically, woody material was removed from streams where valley bottom roads provided access.

Riparian roads are found within riparian reserves but not within the active floodplain of the stream. These road segments reduce riparian vegetation, increase runoff, supply sediment and have the potential to be unstable if located midslope or at a headwall.

A simple way of addressing riparian function is to simply rate out ridgetop, midslope, riparian and valley bottom (floodplain) segments as low, moderate and high risk, respectively. Map interpretations of a stream layer and contour crenulations were first used to estimate the road location next to streams and on the ground verification also occurred.

0 = Segment is ridgetop or high midslope outside of riparian reserves.

2 = Segment is ridgetop or midslope that bisects 1-2 streams but does not parallel them.

4 = Segment is midslope and bisects numerous stream crossings.

6 = Segment is within a riparian reserve and parallels a stream. OR road segment is close to headwall.

8 = Segment is within the active floodplain of a stream.

Flow Effects

This attribute was intended to address how roads affect surface water routing during storm events. Road were driven to estimate the amount of ditchline drainage a road segment has that drains directly to a stream channel. This factor did not attempt to gauge the "extent" of the potential flow effects, but serves more as an index as to whether or not the conditions known to influence surface water routing are present.

0 = None of the inventoried stream crossings within the respective road segment were considered to have ditchline draining directly into a defined stream channel.

2 = < 25% of the road segment is capable of delivering surface flow to stream channels.

4 = 26-50% of the road segment is capable of delivering surface flow.

6 = > 50% of the road segment has surface flow delivery potential.

Proximity to Fish Stocks

This attribute addresses the direct road affects on fish stocks. It incorporates the use of professional judgment regarding fish distributions combined with the "likelihood" of a particular road failure impacting that fish habitat. Features used to judge "likelihood" include angles of tributary junctions below potential landslide areas, stream channel gradients, and distance to nearest fish-bearing waters. This factor assesses the ability of culverts in live streams to pass fish and amphibians.

2 = Segment is not near a fish bearing stream. Any mass failure originating from this segment have a low potential to reach fish bearing waters. Road segment does not have any culverts that prevent fish passage.

4 = Segment is not close to a fish bearing stream but has a low to moderate risk of mass wasting event reaching fish bearing waters.

6 = Segment is in relative close proximity to a fish bearing stream, but not directly adjacent. Any mass failure originating from this segment would have a moderate to high potential to reach fish bearing waters. AND/OR any culvert with segment partially block fish passage. Passage not available to all life stages.

8 = Segment is directly adjacent to a fish bearing stream and has relatively steep gradients that would contribute to the mobility of any given road failure. It is likely that any mass failures originating from this road segment would directly impact a fish bearing channel below. AND/OR any culvert within the segment is a complete barrier to fish.

Table 1 shows the aquatic risk for all road segments.

Road Segment Number	Road Number	Segment Length (Mi)	Slope Position	Geologic Hazard	Sediment Transport	Riparian Function	Flow Effects	Proximity to Fish Stocks	Aquatic Impact Total	Aquatic Impact Rating
1	2460	10.5	VB	6	9	8	6	8	37	**H**
2	2460	4.78	VB/MS	9	9	6	6	8	38	**H**
3	2460	2.63	MS	6	6	2	2	2	18	**M**
4	2301	1.01	RR	3	3	6	2	8	22	**M**
5	2301	3.64	MS	6	6	2	2	2	18	**M**
6	2301-747	0.23	MS	6	6	4	4	2	22	**M**
7	2301-746	0.26	MS	3	6	2	4	2	17	**M**
8	2301-742	0.73	MS	9	0	0	0	2	11	**L**
9	2301-436	0.42	MS	3	0	0	0	2	5	**L**
10	BLM	6.3	VB/MS	9	9	8	6	8	40	**H**
11	23	2.83	VB	9	9	8	6	8	40	**H**
12	23	1.64	VB	9	9	8	6	8	40	**H**
13	23	2.77	MS	6	6	4	4	8	28	**H**
14	23-767	0.59	RT	3	0	0	0	2	5	**L**
15	23-767	2.07	RT	9	0	0	0	2	11	**L**
16	Spur	0.22	RT	3	0	0	0	2	5	**L**
17	23-708	0.21	RT	3	0	0	0	2	5	**L**
18	23-805	0.75	MS	6	0	0	0	2	8	**L**
19	23-805	0.35	RT	3	0	0	0	2	5	**L**
20	23-127	0.6	VB	9	9	8	6	8	40	**H**
21	2328	1.51	MS	6	9	4	2	8	29	**H**
22	Star Road	0.53	VB/RR	6	3	6	2	6	23	**M**
23	2328	3.46	MS	9	9	4	2	6	30	**H**
24	2328-436	0.32	RT	9	0	0	0	2	11	**L**
25	2328-739	0.99	RT	9	0	0	0	2	11	**L**
26	2328-448	0.65	MS	3	3	2	2	2	12	**L**
27	2328	1.75	MS	6	3	2	2	2	15	**L**
28	2328-453	0.18	MS	6	0	0	0	2	8	**L**
29	2358	2.01	MS	9	9	4	2	2	26	**M**
30	2358	0.92	MS	6	3	2	0	2	13	**L**

Table 1. Aquatic Impact Table.

Road Segment Number	Road Number	Segment Length (Mi)	Slope Position	Geologic Hazard	Sediment Transport	Riparian Function	Flow Effects	Proximity to Fish Stocks	Aquatic Imact Total	Aquatic Imact Rating
31	2358	0.73	MS	3	3	2	0	2	10	**L**
32	2358	6.55	MS	6	3	4	2	2	17	**M**
33	23-721	0.89	VB/RR	6	3	8	4	8	29	**H**
34	23-721	1.88	MS	9	9	4	2	8	32	**H**
35	23-808	0.45	VB	9	9	8	6	8	40	**H**
36	23-808	0.61	VB	9	9	8	6	8	40	**H**
37	Spur	0.46	VB	6	9	8	6	8	37	**H**
38	BLM-FS	2.74	MS	3	3	2	2	2	12	**L**
39	2531-760	2.01	MS	3	3	2	2	2	12	**L**
40	2531-760	0.22	MS	3	0	0	0	4	7	**L**
41	2531-720	0.2	RT	3	0	0	0	2	5	**L**
42	2531-809	0.1	RT	3	0	0	0	2	5	**L**
43	2531-750	0.16	RT	3	0	0	0	2	5	**L**
44	2460-766	2.34	MS	9	6	2	2	2	21	**M**
45	2460-165	0.85	MS	6	3	2	2	2	15	**L**
46	2460-461	0.39	MS	9	3	2	2	2	18	**M**
47	2460-451	0.13	MS	6	3	0	0	2	11	**L**
48	2460-Spur	0.39	VB	6	6	8	4	8	32	**H**
49	2358-411	0.11	RT	3	0	0	0	4	7	**L**
50	2358-447	0.22	RT	3	0	0	0	4	7	**L**
51	2460-508	0.41	MS	6	0	0	0	2	8	**L**
52	2460-773	0.35	MS	6	0	0	0	2	8	**L**
53	2241	0.84	RT	6	0	0	0	2	8	**L**
54	2241-841	1.41	MS	6	9	4	2	2	23	**M**
55	Spur-PVT	0.12	RT	3	0	0	0	2	5	**L**
56	Spur-PVT	0.36	MS	6	3	2	2	2	15	**L**
57	Spur-PVT	0.69	MS	3	3	2	2	2	12	**L**
58	3828-175	0.64	MS	3	3	2	2	2	12	**L**
59	2241-842	0.1	MS	3	0	0	0	2	5	**L**
60	2241-748	0.06	MS	6	3	2	2	2	15	**L**

Table 1 (continued). Aquatic Impact Table

Development of the Wildlife Impact/Risk Factors

Wildlife factors and numerical ratings focused heavily on late successional values associated with the LSR objectives. Other wildlife values considered for this area were unique habitats, connectivity and big game winter range.

Threatened and Endangered Species

This factor focused primarily on the northern spotted owl and peregrine falcon. Road segments were rated out as follows:

0 = Segment does not lie or intersect within 0.25 mile of a spotted owl activity center or within 1 mile of high potential peregrine falcon nesting habitat

6 = Segment lies or intersects within 0.25 mile of a spotted owl activity center or within 1 mile of high potential peregrine flacon nesting habitat.

9 = Segment lies within spotted owl activity center or .25 within high potential peregrine nesting habitat.

Fragmentation of Late Successional Forest

This factor addressed the role of each road segment in the context of fragmenting late successional habitat or refugia (Late Successional Areas (LSR's or areas designated in the Layng Creek Watershed Analysis). Numerical rating criteria for road segments are as follows:

0 = Segment is not within late-successional habitat or potential late-successional habitat, and segment is outside late successional refugia

3 = Segment is within late-successional habitat or potential late-successional habitat but outside late successional refugia

6 = Segment is not within late-successional habitat or potential late-successional habitat but segment is within late successional refugia

9 = Segment is within late-successional habitat or potential late-successional habitat and segment is within late-successional refugia.

Connectivity

This factor primarily addresses the fragmentation and loss of habitat within the designated Late Successional Connectivity corridor or riparian reserves.

0 = Segment is not within late-successional corridor or within riparian reserve.

3 = Segment intersects late-successional corridor or intersects riparian reserve.

6 = Late-successional corridor or riparian reserve is intersected more than twice within a mile portion of a segment.

9 = Segment runs longitudinally within late-successional corridor or riparian reserve.

Unique Habitats

Habitats such as wet or dry natural openings, open bedrock outcrops or talus slopes, and areas of vegetative mosaic, are susceptible to impacts from roads that intersect the habitat or are in close proximity. Potential impacts include human disturbance to wildlife species, altered hydrologic function, reduced connectivity between openings, and potential invasion of exotic or noxious plant species. Road segments were numerically rated based on the number of unique habitats within 10 meters of each road segment as follows:

0 = Segment does not intersect or is greater than 10 meters from mapped unique habitats.

6 = Segment intersects or is less than 10 meters from mapped unique habitats.

Table 2 shows the terrestrial risk for all road segments.

Road Segment Number	Road Number	Segment Length (Mi)	Slope Position	Unique Habitats	Fragmentation of LSV	T&E Species	Connectivity	Wildlife Impact Total	Wildlife Impact Rating
1	2460	10.5	VB	0	3	0	9	12	**M**
2	2460	4.78	VB/MS	6	9	0	9	24	**H**
3	2460	2.63	MS	6	3	0	3	12	**M**
4	2301	1.01	RR	0	3	6	9	18	**M**
5	2301	3.64	MS	6	3	6	6	21	**M**
6	2301-747	0.23	MS	0	3	0	3	6	**L**
7	2301-746	0.26	MS	0	3	0	3	6	**L**
8	2301-742	0.73	MS	0	3	0	3	6	**L**
9	2301-436	0.42	MS	0	3	0	3	6	**L**
10	BLM	6.3	VB/MS	6	9	6	9	30	**H**
11	23	2.83	VB	6	9	9	9	33	**H**
12	23	1.64	VB	0	3	6	9	18	**M**
13	23	2.77	MS	0	3	9	9	21	**M**
14	23-767	0.59	RT	0	3	0	3	6	**L**
15	23-767	2.07	RT	0	3	6	3	12	**M**
16	Spur	0.22	RT	0	3	0	0	3	**L**
17	23-708	0.21	RT	0	3	0	0	3	**L**
18	23-805	0.75	MS	0	3	0	3	6	**L**
19	23-805	0.35	RT	0	3	9	3	15	**M**
20	23-127	0.6	VB	6	3	0	9	18	**M**
21	2328	1.51	MS	6	3	0	9	18	**M**
22	Star Road	0.53	VB/RR	0	3	0	9	12	**M**
23	2328	3.46	MS	0	3	6	9	18	**M**
24	2328-436	0.32	RT	0	3	9	0	12	**M**
25	2328-739	0.99	RT	0	3	6	3	12	**M**
26	2328-448	0.65	MS	0	0	0	3	3	**L**
27	2328	1.75	MS	0	3	0	0	3	**L**
28	2328-453	0.18	MS	6	3	0	3	12	**M**
29	2358	2.01	MS	6	3	0	6	15	**M**
30	2358	0.92	MS	0	3	0	6	9	**L**

Table 2. Wildlife Impact Table.

Road Segment Number	Road Number	Segment Length (Mi)	Slope Position	Unique Habitats	Fragmentation of LSV	T&E Species	Connectivity	Wildlife Impact Total	Wildlife Impact Rating
31	2358	0.73	MS	0	3	0	0	3	**L**
32	2358	6.55	MS	6	3	0	6	15	**M**
33	23-721	0.89	VB/RR	6	3	0	9	18	**M**
34	23-721	1.88	MS	0	3	6	6	15	**M**
35	23-808	0.45	VB	6	3	9	9	27	**H**
36	23-808	0.61	VB	0	3	6	9	18	**M**
37	Spur	0.46	VB	6	3	6	9	24	**H**
38	BLM-FS	2.74	MS	0	9	0	3	12	**M**
39	2531-760	2.01	MS	0	3	0	6	9	**L**
40	2531-760	0.22	MS	0	3	0	3	6	**L**
41	2531-720	0.2	RT	0	3	0	0	3	**L**
42	2531-809	0.1	RT	0	0	0	0	0	**L**
43	2531-750	0.16	RT	0	3	0	3	6	**L**
44	2460-766	2.34	MS	6	3	0	6	15	**M**
45	2460-165	0.85	MS	6	3	0	6	15	**M**
46	2460-461	0.39	MS	6	3	0	3	12	**M**
47	2460-451	0.13	MS	0	0	0	3	3	**L**
48	2460-Spur	0.39	VB	6	6	0	9	21	**M**
49	2358-411	0.11	RT	0	0	0	0	0	**L**
50	2358-447	0.22	RT	0	0	0	0	0	**L**
51	2460-508	0.41	MS	6	0	0	0	6	**L**
52	2460-773	0.35	MS	6	0	0	0	6	**L**
53	2241	0.84	RT	0	3	6	6	15	**M**
54	2241-841	1.41	MS	0	3	9	9	21	**M**
55	Spur-PVT	0.12	RT	0	0	0	0	0	**L**
56	Spur-PVT	0.36	MS	0	0	0	0	0	**L**
57	Spur-PVT	0.69	MS	0	0	0	3	3	**L**
58	3828-175	0.64	MS	0	3	0	0	3	**L**
59	2241-842	0.1	MS	0	3	9	0	12	**M**
60	2241-748	0.06	MS	0	3	9	0	12	**M**

Table 2 (continued). Wildlife Impact Table.

Development of Human Use Factors

Factors for the Human Use table were subdivided into five different areas: timber production, silvicultural uses, private access, public access and fire management.

Timber Production

Timber production is a high priority objective in Matrix lands of Sharps Creek and was numerically weighted to reflect this.

0 = Segment does not access or is not needed to access potential timber harvest units.

3 = Segment would not be needed to access timber harvest units within 20 years.

6 = Segments would be expected to be needed to access timber harvest units within 20 years.

9 = Segment accesses current timber sales, sales currently planned or main haul routes.

Silvicultural Uses

This included access to stands that would soon be coming on-line for precommercial thinning or pruning. Stands less than 18 years old were considered viable precommercial thinning candidates while stands older than 18 years old were judged to be entering the stage of commercially viable thinning. Therefore, stands logged after 1978 were considered for access under this attribute. Criteria for rating out road segments for these uses were:

0 = Segment does not access stands needing precommercial thinning.

3 = Access for precommercial thinning desirable but not essential.

6 = Segment accesses stands needing precommercial thinning.

7 = Segment accesses stands that will probably be commercially thinned.

Private Access

The Forest Service is obligated to provide reasonable access to private landowners. This factor was heavily weighted as follows:

0 = Road does not contribute in any way to access to private land.

3 = Road serves as secondary administrative access to private land.

6 = Road serves as one of multiple accesses to private land.

9 = Road serves as the ONLY access to private land.

Public Access

This factor placed a rating on the extent of public use (such as for recreation, woodcutting, etc.) for road segments. Segments were rated out based on priority and level of public use based on the DRAFT list of primary and secondary roads previously developed by the Forest as follows:

0 = Maintenance level I roads, currently blocked off from public use.

3 = Segment is neither a primary nor secondary road, but may be used by the public to some unknown degree

6 = DRAFT secondary roads (based on Forest ATM process)

9 = DRAFT primary roads (based on Forest ATM process)

Fire Risk

This factor was based on a combination of fire intensity mapping and knowledge of past fire occurrence. Fire intensity mapping was based on current vegetation, slope, aspect, elevation, and landform. This factor was considered highly important and was therefore given heavy numerical weighting. Numerical ratings were as follows:

3 = Low intensity area.

6 = High intensity area or low intensity area, fire present since 1970; OR moderate intensity area. Access to fire risk area.

9 = High intensity area, moderate intensity area or primary access to fire risk area.

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Pre-Attack Facilities

Information used for this factor was obtained from inventories and maps of existing pre-attack facilities.

0 = No pre-attack facilities or access to facilities on this segment.

3 = Pre-attack facilities in place, or accessed by way of this road segment.

Table 3 shows the human use for all road segments.

Road Segment Number	Road Number	Segment Length (Mi)	Slope Position	Timber	Mining	Silvicultural Uses	Private Access	Public Access	Fire Risk	Pre-attack Facilities	Human Use Total	Human Use Rating
1	2460	10.5	VB	9	9	6	9	9	9	3	54	**H**
2	2460	4.78	VB	9	9	6	9	9	9	3	54	**H**
3	2460	2.63	MS	9	9	6	6	9	9	3	51	**H**
4	2301	1.01	VB/RR	9	9	6	0	6	9	3	42	**H**
5	2301	3.64	MS	9	0	6	0	6	9	3	33	**M**
6	2301-747	0.23	MS	0	0	6	0	3	6	0	15	**L**
7	2301-746	0.26	MS	0	0	6	0	3	6	3	18	**L**
8	2301-742	0.73	MS	9	0	6	0	3	9	3	30	**M**
9	2301-436	0.42	MS	9	0	6	0	0	6	0	21	**L**
10	BLM	6.3	VB/MS	9	0	6	9	9	9	3	45	**H**
11	23	2.83	VB	9	9	6	9	9	9	3	54	**H**
12	23	1.64	VB	9	9	6	9	9	9	3	54	**H**
13	23	2.77	MS	9	0	6	9	9	9	3	45	**H**
14	23-767	0.59	RT	9	0	6	9	3	6	3	36	**M**
15	23-767	2.07	RT	9	0	6	0	3	6	3	27	**M**
16	Spur	0.22	RT	3	0	6	0	0	3	3	15	**L**
17	23-708	0.21	RT	9	0	6	0	0	3	0	18	**L**
18	23-805	0.75	MS	9	0	7	9	3	6	3	37	**M**
19	23-805	0.35	RT	3	0	7	0	3	6	3	22	**L**
20	23-127	0.6	VB	0	9	0	0	0	3	0	12	**L**
21	2328	1.51	MS	9	9	6	0	9	9	3	45	**H**
22	Star Road	0.53	VB/RR	0	9	0	0	0	3	0	12	**L**
23	2328	3.46	MS	9	0	6	0	9	9	3	36	**M**
24	2328-436	0.32	RT	3	0	6	0	0	6	0	15	**L**
25	2328-739	0.99	RT	9	0	6	0	0	9	3	27	**M**
26	2328-448	2.01	MS	3	9	0	0	0	6	3	21	**L**
27	2328	0.92	MS	9	0	7	0	9	9	3	37	**M**
28	2328-453	0.23	MS	3	0	6	0	0	3	0	12	**L**
29	2358	2.1	MS	9	9	0	9	9	9	3	48	**H**
30	2358	0.9	MS	9	0	6	0	9	9	3	36	**M**

Table 3. Human Use Table.

Road Segment Number	Road Number	Segment Length (Mi)	Slope Position	Timber	Mining	Silvicultural Uses	Private Access	Public Access	Fire Risk	Pre-attack Facilities	Human Use Total	Human Use Rating
31	2358	0.73	MS	9	9	6	0	9	9	3	45	**H**
32	2358	6.55	MS	9	0	6	0	9	9	3	36	**M**
33	23-721	0.89	VB	6	9	7	3	0	6	0	31	**M**
34	721	1.88	MS	6	0	6	0	0	6	0	18	**L**
35	23-808	0.45	VB	3	9	3	9	0	3	0	27	**M**
36	23-808	0.61	VB	0	0	3	0	0	3	0	6	**L**
37	Spur	0.46	VB	0	9	0	3	0	3	0	15	**L**
38	BLM-FS	2.74	MS	9	0	6	0	6	9	3	33	**M**
39	2531-760	2.01	MS	9	0	6	9	3	9	3	39	**H**
40	2531-760	0.22	MS	0	0	6	0	0	9	3	18	**L**
41	2531-720	0.2	RT	0	0	6	0	0	3	0	9	**L**
42	2531-809	0.1	RT	3	0	6	0	0	3	0	12	**L**
43	2531-750	0.16	RT	3	0	7	0	0	3	0	13	**L**
44	2460-766	2.34	MS	3	9	0	9	0	9	3	33	**M**
45	2460-165	0.85	MS	3	0	0	9	0	6	0	18	**L**
46	2460-461	0.39	MS	0	0	0	9	0	3	0	12	**L**
47	2460-451	0.13	MS	3	9	0	0	0	3	0	15	**L**
48	2460-Spur	0.39	VB	0	9	7	0	0	3	3	22	**L**
49	2358-411	0.11	RT	3	0	7	0	0	3	0	13	**L**
50	2358-447	0.22	RT	3	0	7	0	3	3	0	16	**L**
51	2460-508	0.41	MS	0	9	0	9	0	6	3	27	**M**
52	2460-773	0.35	MS	0	9	0	9	9	9	3	39	**H**
53	2241	0.84	RT	9	0	6	0	9	9	3	36	**M**
54	2241-841	1.41	MS	9	0	6	9	3	9	3	39	**H**
55	Spur-PVT	0.12	RT	0	0	0	9	0	6	0	15	**L**
56	Spur-PVT	0.36	MS	0	0	0	9	0	6	0	15	**L**
57	Spur-PVT	0.69	MS	0	0	0	9	0	6	0	15	**L**
58	3828-175	0.64	MS	0	0	0	0	0	6	0	6	**L**
59	2241-842	0.1	MS	0	0	6	0	0	6	3	15	**L**
60	2241-748	0.06	MS	0	0	6	0	0	6	3	15	**L**

Table 3 (continued). Human Use Table.

Integration of Values from Aquatic Impact, Wildlife Impact, and Human Use Tables

Once each road segment was rated out numerically for all the factors in tables 1-3, a "high", "moderate", or "low" rating was derived based on the ranges of the sums of the numerical values within each table. These ratings were determined by taking the entire range of values from one table and subdividing it into thirds with "high" ratings referring to the upper 1/3 of numerical values, "moderate" ratings the middle 1/3, and "low" ratings the lowest 1/3. For example, if the minimum and maximum sums of the numerical values in the Human Uses Table were 3 and 30 respectively, then road segments would be rated out as 3-11 = "low", 13-21 = "moderate", and 22-30 = "high" use. Therefore, this rating scheme only provides a rating of road segments relative to each other within the unit of analysis.

Overall ratings between the three tables were compared to determine a Final Road Analysis Category (Table 4).

Road Segment Number	FS Road Number	Segment Length (mi)	Wildlife Impact Rating	Aquatic Impact Rating	Human Use Rating	Final Road Analysis Category
1	2460	10.5	M	H	H	**MC**
2	2460	4.78	H	H	H	**Quandary**
3	2460	2.63	M	M	H	**MC**
4	2301	1.01	M	M	H	**MA**
5	2301	3.64	M	M	M	**MB**
6	2301-747	0.23	L	M	L	**Decom**
7	2301-746	0.26	L	M	L	**Decom**
8	2301-742	0.73	L	L	M	**MB**
9	2301-436	0.42	L	L	L	**NA**
10	BLM	6.3	H	H	H	**Quandary**
11	23	2.83	H	H	H	**Quandary**
12	23	1.64	M	H	H	**Quandary**
13	23	2.77	M	H	H	**Quandary**
14	23-767	0.59	L	L	M	**MA**
15	23-767	2.07	M	L	M	**MA**
16	Spur	0.22	L	L	L	**NA**
17	23-708	0.21	L	L	L	**NA**
18	23-805	0.75	L	L	M	**MA**
19	23-805	0.35	M	L	L	**NA**
20	23-127	0.6	M	H	L	**Decom**
21	2328	1.51	M	H	H	**Quandary**
22	Star Road	0.53	M	M	L	**MA**
23	2328	3.46	M	H	M	**Quandary**
24	2328-436	0.32	M	L	L	**NA**
25	2328-739	0.99	M	L	M	**NA**
26	2328-448	2.01	L	L	L	**NA**
27	2328	0.92	L	L	M	**MA**
28	2328-453	0.23	M	L	L	**NA**
29	2358	2.1	M	M	H	**MB**
30	2358	0.9	L	L	M	**MA**

Table 4. Final road analysis category.

Road Segment Number	FS Road Number	Segment Length (mi)	Wildlife Impact Rating	Aquatic Impact Rating	Human Use Rating	Final Road Analysis Category
31	2358	0.73	L	L	H	**MA**
32	2358	6.55	M	M	M	**MA**
33	23-721	0.89	M	H	M	**Quandary**
34	721	1.88	M	H	L	**Decom**
35	23-808	0.45	H	H	M	**Decom**
36	23-808	0.61	M	H	L	**Decom**
37	Spur	0.46	H	H	L	**Decom**
38	BLM-FS	2.74	M	L	M	**NA**
39	2531-760	2.01	L	L	H	**MA**
40	2531-760	0.22	L	L	L	**NA**
41	2531-720	0.2	L	L	L	**NA**
42	2531-809	0.1	L	L	L	**NA**
43	2531-750	0.16	L	L	L	**NA**
44	2460-766	2.34	M	M	M	**MB**
45	2460-165	0.85	M	L	L	**Assess**
46	2460-461	0.39	M	M	L	**MC**
47	2460-451	0.13	L	L	L	**NA**
48	2460-Spur	0.39	M	H	L	**Decom**
49	2358-411	0.11	L	L	L	**NA**
50	2358-447	0.22	L	L	L	**NA**
51	2460-508	0.41	L	L	M	**MC**
52	2460-773	0.35	L	L	H	**MA**
53	2241	0.84	M	L	M	**MA**
54	2241-841	1.41	M	M	H	**Quandary**
55	Spur-PVT	0.12	L	L	L	**MC**
56	Spur-PVT	0.36	L	L	L	**MC**
57	Spur-PVT	0.69	L	L	L	**NA**
58	3828-175	0.64	L	L	L	**NA**
59	2241-842	0.1	M	L	L	**NA**
60	2241-748	0.06	M	L	L	**NA**

Table 4 (continued). Final road analysis category.

Road Analysis Categories

Seven distinct road analysis categories were developed in response to the road segment ratings: Maintain A (MA), Maintain B (MB), Maintain C (MC), Decommission (Decom), No Action (NA), Fix problems close road (FCR), and Quandary. They are defined below.

Maintain (MA, MB, MC)

Three different "maintenance" categories were developed. The definition of "maintenance" used here means the road would be maintained for the long term as functional in the transportation network.

"Maintain A" - Maintenance candidates with low aquatic risks where little stormproofing is expected to be necessary (combination of "high" or "moderate" human use rating with "low" aquatic risk rating).

"Maintain B" - Maintenance candidates with low, moderate or high aquatic risks where much stormproofing is expected to be necessary (combination of "high" human use rating with "moderate" aquatic risk rating).

Road segments which provide the sole access to private lands were placed in the "Maintain B" category if they had a "high" or "moderate" aquatic rating. Those that had a "low" aquatic risk rating were placed in the "Maintain A" category.

"Maintain C" - Segments that are maintained by Lane County, Bureau of Land Management (BLM), or are entirely on private land but spur off of Forest Service roads. It was assumed that these road segments will continue to be maintained over the long term. In some cases, the IDT may have recommendations for road maintenance on these road segments which would be passed on to the county, BLM, or private land owners.

BLM is currently conducting an ATM plan on land managed by the BLM. In those cases where BLM roads accessed Forest Service roads or crossed land managed by the Forest Service, a final maintenance category was deferred until the BLM plan was completed. Once again, the IDT may have recommendations on these road segments which will be passed along to the BLM.

The following table (Table 5) shows those roads segments that fell into a "Maintain" category.

Road Segment Number	FS Road Number	Segment Length (mi.)	Road Analysis Category	Comments
1	2460	10.5	MC	County road almost entirely on BLM or private lands. Only 1.5 miles of this segment on FS lands.
3	2460	2.63	MC	County road on forest service and private lands.
4	2301	1.01	MA	
5	2301	3.64	MB	
8	2301-742	0.73	MB	**Evaluate and pull back oversteepened landing. This is the reason for the MB category otherwise the road is in good condition.**
14	23-767	0.59	MA	Road segment is in on private land. Low risk to aquatic and wildlife but high human use.
15	23-767	2.07	MB	**Evaluate and pull back oversteepened landing.**
18	23-805	0.75	MA	Access to private land.
22	Star Rd.	0.53	MA	Access to Star Mine. Currently, road is gated.
27	2328	0.92	MA	Low risk to aquatic and wildlife. Moderate human use.
29	2358	2.1	MB	Bohemia miners use this road for a haul route. Fill slope problems.
30	2358	0.9	MA	Primary route.
31	2358	0.73	MA	Low risk to aquatic and wildlife. High human use. Primary route.
32	2358	6.55	MA	
39	2531-760	2.01	MA	Low risk to aquatic and wildlife. High human use. Accesses private land.
44	2460-766	2.34	MB	Utopia road - Very narrow road that accesses private land and mining claims. Currently, miners maintain the road.
46	2460-461	0.39	MB	Low human use except for miners. Road accesses private land and mining claims. Road is gated and maintained by miners.
51	2460-508	0.41	MB	Low aquatic and wildlife risk. Road accesses private land and mining claims. Currently, road maintained by private land owners.
52	2460-773	0.35	MA	Low aquatic and wildlife risk and high human use. Road goes to Fairview lookout, mining claims, and private land.
53	2241	0.84	MA	
55	Spur	0.12	MC	Spur is completely on private land. Low aquatic and wildlife risk. Maintained by private land owner.
56	Spur	0.36	MC	Spur is completely on private land. Low aquatic and wildlife risk. Maintained by private land owner.
57	Spur	0.69	MC	Spur is on BLM and private land. Low aquatic and wildlife risk. Maintained by private land owner. Currently waterbarred and closed off.

Table 5. Maintained road segments.

Decommission (DECOM)

The definition of decommissioning here is elimination of any contribution from the road to most major types of aquatic risk. While this would not necessarily preclude access by foot or ATV trails, it would usually lead to elimination of any use for automobile travel. It would include any combination of the following; pullback of fills and oversteepened sidecast areas, removal of culverts, installation of water bars, ripping road surfaces and revegetation. Each road segment proposed for decommissioning is evaluated separately and individual prescriptions for decommissioning will vary among road segments.

Segments with the following aquatic and human use ratings are usually targeted for decommissioning:

Segments with “high” aquatic impact ratings and “moderate” or “low” human use ratings

Segments with “moderate” aquatic impact ratings and “low” human use ratings.

The following table (Table 6) shows those road segments which fell into the decommission category.

Road Segment Number	FS Road Number	Segment Length (mi.)	Road Analysis Category	Comments
6	2301-747	0.23	Decom	Road is intercepting ground water and rerouting it.
7	2301-746	0.26	Decom	Leave road open up to fire sump (approx. 1000’) and decommission rest of road. Remove culvert at sump.
9	2301-436	0.42	Decom	Waterbar and decommission. Low risk to aquatic and wildlife with low human use. Not a necessary road.
20	23-127	0.6	Decom	Valley bottom road. High aquatic risk, moderate wildlife risk and low human use except for mining claim. Propose decommissioning road but leave an ATV trail to give the miner access to claim. Miner has used heavy equipment in the stream. Check plan of operation.
34	23-721	1.88	Decom	Decommission after Quartzback timber sale. Analyze this segment further during Quartzback EA (to be completed during the summer of 1998).
35	23-808	0.45	Decom	Valley bottom road. Access to mining claims but claims are for “pan” and small dredge mining. Propose decommissioning road and leaving a trail to give miners access. Analyze further in Quartzback EA.
36	23-808	0.61	Decom	Currently is self-closed. Assess on the ground to check if any risks need to be dealt with.
37	Spur	0.46	Decom	Extension of segment 35 - same as 35 comments.
48	2460-spur	0.39	Decom	Accesses mining claims but the use of claims is low. No culverts but there are problem areas. Decommission but leave a trail for access. Check plan of operations.

Table 6. Road segments proposed for decommissioning.

Fix Problems Leave Road (FLR)

This category was characterized by segments that were considered to be a low risk to aquatic and wildlife habitat but were in need of immediate maintenance to minimize future risk. Low risk roads with an oversteepened landing on them would fall into this category as would those road segments that need to be waterbarred or have culverts removed. These roads may or may not be used again in the future but will no longer be maintained after being waterbarred, culverts removed and oversteepened landings pulling back. Essentially, these roads will be allowed to close.

The following table (Table 7) shows those road segments that fell into the Fix Problems Leave Road category.

Road Segment Number	FS Road Number	Segment Length (mi.)	Road Analysis Category	Comments
19	23-805	0.35	FLR	100 acre LSR at end of road. Waterbar and close road.
24	2328-436	0.32	FLR	Waterbar road. **Potential oversteepened landing at end of road. Evaluate and pull back landing.**
26	2328-448	2.01	FLR	Bird Nest mining claim. Road was built for miner and is gated. Evaluate live stream crossing for stability.
38	BLM-FS	2.74	FLR	BLM road. Analyze in Quartzback EA. BLM land is in LSR along this road segment. Discuss future of road with BLM. Gate road to address wildlife concerns. One live stream crossing needs to be addressed. Only 1 mile of this segment on FS lands.
40	2531-760	0.22	FLR	Waterbar road.
41	2531-720	0.2	FLR	Waterbar road.
42	2531-809	0.1	FLR	Low risk to aquatic and wildlife. Road accesses snow down salvage unit. **Landing at end of road may be oversteepened. Evaluate and pull back landing.**
60	2241-748	0.06	FLR	Pull culverts and waterbar road.

Table 7. Fix Problems and Leave Road segments.

No Action (NA)

This category was characterized by segments that had low maintenance needs or concerns, including maintenance level I roads, that also had low aquatic and wildlife risks. It also included a small number of segments that rated out as moderate aquatic risks and moderate human use but were judged by the ID team to be low maintenance priorities. In general, "No Action" candidates were usually short spur roads (<0.5 mile). Some "No Action" candidates might be high priority for decommissioning from a road maintenance program standpoint.

In a watershed restoration program, "No Action" roads would be inventoried, primarily to assess landing failure risks and potential drainage problems. But in general, they do not have stream crossings and would be expected to be of low aquatic concern and not worthy of the financial expenditure for full decommissioning to alleviate aquatic concerns.

The following table (Table 8) shows those road segments that fell into the No Action category.

Road Segment Number	FS Road Number	Segment Length (mi.)	Road Analysis Category	Comments
16	Spur	0.22	NA	Low aquatic and wildlife risk. Low human use. No action necessary on road segment and will be allowed to close.
17	23-708	0.21	NA	
25	2328-739	0.99	NA	Most of segment is ridge-top. No live stream crossings.
28	2328-453	0.23	NA	Dead end ridge-top spur not necessary, let it close.
43	2531-750	0.16	NA	Dirt spur that is already waterbarred.
47	2460-451	0.13	NA	Low risk road used to access mining claims. Road maintained by miners.
49	2358-411	0.11	NA	
50	2358-447	0.22	NA	
58	3828-175	0.64	NA	
59	2241-842	0.1	NA	

Table 8. No Action road segments.

Quandary

These were roads where clear management recommendations were more difficult. These roads had “high” or “moderate” ratings for BOTH human uses and aquatic impacts. Final recommendations for quandary segments were made after more interdisciplinary discussions. If consensus could not be reached by the ID team, segments were left in the “Quandary” category so that they could be re-examined by a project-level ID team.

Table 9 shows those road segments that received a Quandary rating.

Road Segment Number	FS Road Number	Segment Length (mi.)	Road Analysis Category	Comments
2	2460	4.78	Quandary	County road but completely on land managed by the Forest Service. Valley bottom, riparian road. Access to recreation (Mineral Camp and Fairview trail), and mining claims. Used as haul route by miners.
10	BLM	6.3	Quandary	BLM maintained road that accesses Forest Service lands. Valley bottom, riparian road. Access route to Steamboat. Work with BLM on how to address this segment.
11	23	2.83	Quandary	Valley bottom and riparian road. Segment provides access to mining claims, private land and is a FS haul route.
12	23	1.64	Quandary	Valley bottom and riparian road. Segment provides access to mining claims, private land and is a FS haul route.
13	23	2.77	Quandary	Valley bottom and riparian road. Segment provides access to mining claims, private land and is a FS haul route. This segment has sedimentation problems from sidecast material and ditchline ravel.
21	2328	1.51	Quandary	
23	2328	3.46	Quandary	
33	23-721	0.89	Quandary	Assess further during the Quartzback EA. Possible decommission candidate.
54	2241-	1.41	Quandary	Accesses BLM land. Has not been maintained in 20

	841			years. Option would be to pull culverts or decommission road on Forest Service land.

Table 9. Road segments in the Quandary category.

Results

The Sharps Creek Watershed is approximately 42,500 acres. Land ownership within the watershed is divided between the Forest Service, BLM and private landowners. The Forest Service manages approximately 17,000 acres in the Sharps Creek drainage. Road density in the Sharps Creek watershed on Forest Service lands is approximately 2.4 mi./sq. mi. (63.0 miles of road). This includes Forest Service (53.2 miles), County, BLM and private roads.

Approximately 51% of the total road system, 32 miles, were identified for continued maintenance in the transportation network (Table 5).

Three miles of road (4.8% of the total road miles) were found to be low risk to aquatic and terrestrial habitat as well as low human use. These road miles were put into the "No Action" category. Besides those road segments in "No Action", 4.26 miles (7% of the total road miles) were also found to be a low risk to aquatic/terrestrial habitat and low human use but these roads are currently in need of some type of action to remove any future risk (FLR). These road segments will be waterbarred, culverts will be removed and oversteepened landings pulled back.

There were 5.3 miles (8.4% of the total road miles) of roads proposed for decommissioning. Although the ID team addressed decommissioning roads, it was difficult to determine the feasibility of decommissioning road segments that access mining claims. Segments 20, 34, 35, 36, 37, and 48 were all proposed for decommissioning but also provide access to mining claims. It was proposed that segments 34, 35, 36, and 37 be further addressed during the Quartzback Timber Sale Environmental Analysis (EA) which will begin in the spring of 1998. Segment 20 is located up Puddin Rock Creek and also provides access to an active mining claim. As with segments 33, 35, 37, segment 20 is a valley bottom road having a detrimental impact on the creek. The team proposed this segment for decommissioning but recommend that an Environmental Analysis be completed to address the biological and social aspects of decommissioning.

Forest Service Quandary roads totaled 19.29 miles (31% of the total road miles). Two other road segments fell into the Quandary category, segments 2 and 10, but were not included in the total Quandary mileage since the final decision on these roads lies with the County and BLM. Segment 2 is a county road on Forest Service land and segment 10 is a BLM road that accesses Forest Service lands.

One road segment was not given a recommended road maintenance category, segment 45. The ID team thought further assessment of this segment was necessary before a recommendation could be made.

Appendix K

GIS

SHARPS CREEK MAP THEMES

Map Theme	Description
Boundaries	
fs_bdy	Forest Service Boundary for Sharps Creek
fs_blm_bdy	FS & BLM Boundaries for Sharps Creek
ll_20	Sharps Creek Section Landlines
sh_crdls3	Sharps Creek Roadless Areas
sh_ma2	FS/Sharps Matrix from Forest Plan
sh_opt9 (Sharps)	Sharps Creek Allocations (matix/pvt/LSR)
sharps2_bdy	Sharps Creek Watershed Boundary
sws	Sharps Creek Watershed Drainages
sws_grps	Sharps Creek Drainage Groups
tl_20	Sharps Creek Township & Range Boundaries
Bureau of Land Management Themes	
berk_bas	Slope Stability Grid
blm_pls	Township and Section Lines (entire watershed)
blm_rr	Riparian Reserves; BLM only
esc_1936	BLM 1936 Reference Conditions
esc_1996	BLM Current Vegetaion
esc_bnd	BLM Boundary
esc_dtm	Digital Terrian Model (dem-grid for entire watershed)
esc_eea	BLM ElK Areas (Mosby Creek)
esc_foi	BLM Forest Operations Inventory; ie, timber typing
esc_lua	BLM Land Use Allocations
esc_kra	BLM Key Raptor Areas (Mosby Creek)
esc_own	Ownership for the entire watershed (WODDB/OSSCG)
esc_photo_95	BLM 1995 Photo Flight Paths
esc_soils	Soils; BLM only,and some missing there
esc_spchab	BLM Unique Wildlife Habitat Data; ie, dry site
esc_srh	Spotted Owl Residual Habitat Areas; BLM only (100ac blocks)
esc_tpc	Timber Production Capability Classification; BLM only (TPCC)
esc_trb	Roads - BLM only
esc_wol	BLM Spotted Owl Locations
Elevation/Contours	
sh_cont100	Sharps Creek Contour Lines At 100 Foot Intervals
sharps_cont (500')	Sharps Creek Contour Lines At 500 Foot Intervals
sharps_elev (1000')	Sharps Creek Contour Lines At 1000 Foot Intervals
tse_elev	FS/Sharps TSE Exams with Elevation

Map Theme	Description

Fire/Fuels

fire_risk	Sharps Creek Watershed Fire Risk Areas
fuelmod_own	Sharps Creek Watershed Current Fuel Models
sh_ref1936	Sharps Creek 1936 Reference Conditions (ref veg/fuel models)

Geology

debris1946	1946 Debris Flows for FS side of Sharps Creek
debris1966	1966 Debris Flows for FS side of Sharps Creek
debris1990	1990 Debris Flows for FS side of Sharps Creek
sharps2_geo	Sharps Creek Watershed Geology (HUC Name)
sharps_geogrp	Sharps Creek Watershed Geomorphic Groups (parts of Brice)
sh_geom_sws	Sharps Creek Watershed Geomorphic
slides	Sharps Creek Landslide Areas (1946, 1966, 1990 - n,r,t)

Owls

cg_woc (esc_owlcore)	Cottage Grove District Owl Core Areas Including Sharps BLM
cg_wol_upd	Cottage Grove District Wildlife Owl Locations (like esc_wol)
sh_owlhab	Sharps Creek Watershed Owl Habitat (suitable/unsuitable)
sh_reserve	Sharps Creek Watershed Owl Rerserve Data by Ownership

Ownership

sh_own	Sharps Creek Watershed Ownership
wuh_own	Sharps Creek Watershed WUH by Ownership

Roads

fs_atm	Access Travel Management for FS side of Sharps Creek
sh_rds_yr	FS/Sharps Roads by Construction Year & Drainage
sharps_trb	Sharps Creek Watershed Road System

Soils

1_unsuit	Unsuitable Soils for Cottage Grove Ranger District
fs_sri	FS/Sharps Soil Resource Inventory
owl_suit_cg	Suitable Soils for Owl Habitat for Cottage Grove
sh_landunit	Sharps Creek Land Units (warm/dry/gentle/wet)
sh_lri	Sharps Creek Land Resource Inventories (LRI/resilience)

Map Theme Description

Streams

reachbrk	Reachbreak Locations for FS side of Sharps Creek
rosgen	Sharps Creek Rosgen Channel Classes (Historic/Current)
rr_str	Sharps Creek Riparian Reserves (by stream class)
sh_rr	Sharps Creek Riparian Reserves for Roads
sharps2_str	Sharps Creek Watershed Stream Information
strbuf_bh	Sharps Creek Watershed Stream Buffers for Browns Habitat

Vegetation

bh_rr	Sharps Creek Riparian Reserves for Brown's Habitat
fs_nonf	Non Forested Areas for FS side of Sharps Creek
pot_inthab	Sharps Creek Potential Interior Habitat
ref_inthab	Sharps Creek sh_ref1936 (ref e & f) Buffered -120 Meters
s_vegcc	Sharps Creek Current Vegetation
sh_chu	Sharps Creek Critical Habitat Units
sh_ahryr	Sharps Creek Year of Harvest
sh_avharv	Sharps Creek Available for Harvest
sh_bh	Sharps Creek Brown's Habitat (Brown's vegetation stages)
sh_harv	Harvested Areas for FS side of Sharps Creek
sh_int_hab	Sharps Creek sh_bh (current e & f) Buffered -120 Meters
sh_ref1936	Sharps Creek 1936 Reference Conditions (ref veg/fuel models)
sh_sens	Sharps Creek Sensitive Species (ROTH)
sh_series	Potential Vegetation for FS side of Sharps Creek
sharps_tse	FS/Sharps TSE Exam Areas
tse_elev	FS/Sharps TSE Exam Points with Elevation
wuh_20	Sharps Creek Wildlife Unique Habitat

Appendix L

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