Appendix E – Air Quality

Estimating Emissions from Wildfires

Wildfire emissions are much more difficult to estimate compared to fuels treatments since there are no records of how much material any given fire consumes. Due to differences in the type of available data, BLM used two different methods for estimating particulate emissions from past and future wildfires.

Past Wildfires

The BLM downloaded records of all wildfires for the Coos Bay, Eugene, Lakeview, Medford, Roseburg, and Salem Districts from the FAMWEB site (http://fam.nwcg.gov/fam-web/weatherfirecd/), imported them into FireFamily Plus 4.1, extracted all wildfires 100+ acres in size and exported this information to an Excel Spreadsheet. Using a variety of methods, the BLM deleted as many fires as could be identified that burned in the Lakeview Field Office to select just the data for the Klamath Falls Field Office. The BLM combined the data for Coos Bay, Eugene, and Salem into one group and the data for Medford and Roseburg into another group. Over the 34-year period of record (1980–2013), 7,763 acres burned in the Coos Bay-Eugene-Salem group, 277,605 acres in the Medford-Roseburg group, and 29,447 acres in Klamath Falls Field Office.

The BLM downloaded assessments of burn severity for individual large fires that originated on BLM-administered lands between 1984 and 2012, the latest year available, from the Monitoring Trends in Burn Severity website (http://mtbs.gov/data/individualfiredata.html). The BLM averaged acres burned in the difference categories of unburned to low, low, moderate, high, increased greenness, and mask, and calculated the proportion for each category. Mask areas consist of features such as clouds, water and rock as well as missing lines of image data. The BLM combined high, increased greenness, and mask into a single high severity category; and unburned to low and low into a single low severity category. The resulting proportions of area burned were 59.1 percent low severity, 21.8 percent mixed severity (i.e., moderate), and 19.0 percent high severity. Because the documented fire severity record is sparse, the BLM used these same severity proportions across the planning area.

Since preburn fuel loadings are not known, BLM used the Fuels Characteristic Class System (FCCS) module in Fuel & Fire Tools (FERA and UW 2014) to select representative fuelbeds (**Table E-1**). Since the BLM did not know the relative proportion of each fuelbed included in each analysis group, it weighted all fuelbeds equally. In order to assess emissions from the different burn severities, BLM multiplied the total number of acres burned in each group by the proportional amount in the low, mixed, and high severity classes and created separate units in Fuel & Fire Tools. For example, the group comprised of Coos Bay, Eugene, and Salem Districts had three units labeled low, mixed, and high with assigned acres equaling the proportion estimated for each severity class (**Table E-2**). Each unit consisted of the set of fuelbeds selected through FCCS. The Consume module in Fuel & Fire Tools used this information to calculate greenhouse gas emissions for CO_2 and CH_4. Since the Consume module only uses 1000-hour and duff fuel moisture to drive the consumption algorithms, the BLM could not fully meet the intent of adjusting the amount of live fuel consumed.

Table E-1. Fuels Characteristic Classification System fuelbeds used in each analysis group to estimate particulate emissions from wildfire

District/ Field Office	Fuelbed Number	Fuelbed Name
Coos Bay – Eugene – Salem	2	Western hemlock – western redcedar – Douglas-fir
	5	Douglas-fir – white fir
	8	Western hemlock – Douglas-fir – western redcedar/vine maple
	9	Douglas-fir – western hemlock – western redcedar/vine maple
	10	Western hemlock – Douglas-fir – Sitka spruce
	11	Douglas-fir – western hemlock – Sitka spruce
	18	Douglas-fir/oceanspray
	24	Pacific ponderosa pine – Douglas-fir
	52	Douglas-fir – Pacific ponderosa pine/oceanspray
	208	Grand fir – Douglas-fir
	322	Sitka spruce – western hemlock
Klamath Falls	20	Western juniper/curl-leaf mountain mahogany
	24	Pacific ponderosa pine – Douglas-fir
	25	Pinyon – Utah juniper
	53	Pacific ponderosa pine
	55	Western juniper/sagebrush
	58	Western juniper/sagebrush
	67	Interior ponderosa pine – Douglas-fir
	210	Pinyon – Utah juniper
Medford – Roseburg	2	Western hemlock – western redcedar – Douglas-fir
	4	Douglas-fir/*Ceanothus*
	5	Douglas-fir – white fir
	6	Oregon white oak – Douglas-fir
	7	Douglas-fir – sugar pine – tanoak
	15	Jeffrey pine – red fir – white fir/greenleaf - snowbrush
	16	Jeffrey pine – ponderosa pine – Douglas-fir – California black oak
	24	Pacific ponderosa pine – Douglas-fir
	37	Ponderosa pine – Jeffrey pine
	38	Douglas-fir – madrone – tanoak
	39	Sugar pine – Douglas-fir – oak
	208	Grand fir – Douglas-fir
	215	Douglas-fir – madrone – tanoak
	239	Douglas-fir – sugar pine – tanoak

Table E-2. Acres, fuel moistures, and targeted consumption rates for live woody fuels in each severity class for past wildfires

Live Woody Fuels	Low Severity (Targeted Consumption Rate)	Mixed Severity (Targeted Consumption Rate)	High Severity (Targeted Consumption Rate)
1,000-hour Fuel Moisture	20%	10%	6%
Duff Moisture	200%	100%	10%
Shrub Black	-	50%	100%
Crown Black	-	50%	100%
District/ Field Office	**Low Severity (Acres)**	**Mixed Severity (Acres)**	**High Severity (Acres)**
Coos Bay – Eugene – Salem	1,475	1,692	4,588
Klamath Falls	5,595	6,419	17,403
Medford – Roseburg	52,745	60,518	164,065

Large fires that originate on BLM-administered lands typically burn onto other lands. However, the future wildfire acres burned applied only to BLM-administered lands. In order to provide an appropriate comparison, BLM had to adjust the emissions from past fires downward. BLM calculated the average number of acres burned using the data for fires that originated on BLM-administered lands and compared that to the average number of acres burned just on BLM-administered lands as reported in Davis *et al*. (2014, p. 7), resulting in a reduction of 62 percent.

Future Wildfires

The Woodstock harvest model included wildfire under all alternatives and the Proposed RMP, with the number of polygons affected and the type of fire held constant. The BLM modeled only high- and mixed-severity fire. To estimate particulate emissions from future wildfires, the BLM used the estimated acres burned in mixed and high severity fires each period from the Woodstock model. Using the same set of FCCS fuelbeds from **Table E-1** and the same fuel moistures and targeted consumption rates from **Table E-2**, the BLM used Consume to estimate the per acre emissions for particulate matter. Since low-severity fire was not included in Woodstock under the assumption that there was no impact to volume, BLM assumed no change in the proportional relationship between low-, mixed-, and high-severity fire and used the acres burned in mixed and high severity combined to estimate the acres burned in low severity fire. The BLM summarized the results on an average annual basis for each decade analyzed.

Estimating Emissions from Fuels Treatment

Past Fuels Treatments

The BLM based estimates of particulate emissions from past prescribed burning on estimated tons of biomass consumed as reported to the Oregon Department of Forestry (ODF) under the State's smoke management plan (http://www.oregon.gov/odf/pages/fire/smp/smkmgtannualrpts.aspx). ODF's reports include prescribed burns on BLM-administered lands in the Other Federal category, which includes U.S. Fish and Wildlife Service and Bureau of Indian Affairs, and consolidates prescribed burns for both Lake and Klamath Counties into a single number. The BLM conducts most of prescribed burning in the Other Federal category, as indicated by the harvest records. The BLM calculated the particulates emitted from

burning wood by multiplying the tons consumed with standardized emission factors for PM_{10} and $PM_{2.5}$ (Hardy *et al*. 2001, p. 100).

Future Fuels Treatments

The BLM used two different methods to estimate emissions from future prescribed burning. For pile burning (hand piles, machine piles, and landing piles), the BLM used a standard description for each type of pile (size, shape, and composition) and a standard estimate of the number of piles per acre to estimate emissions per acre using the pile utility in Consume. The BLM then multiplied these estimates by the number of acres treated by piling. The Woodstock model provided estimates of the acres treated by each type of piling method for harvest treatments and historical averages used for the hazardous fuels program. For broadcast and under burning, BLM selected a single representative fuel bed for each district that would result in the approximate number of tons consumed that had been estimated by past burning, as reported by the Interdisciplinary Team's Fuels Specialist.

Uncertainty in Hazardous Fuels Emissions

The hazardous fuels program encompasses relatively wide interannual variability in emissions due to higher variability in the fuels treated. To estimate this variability, the BLM conducted two types of analyses to evaluate pile burning and broadcast burning. To estimate the variability in both hand pile and machine pile burning, the BLM used the online pile calculator provided by FERA (available at http://www.fs.fed.us/pnw/fera/research/smoke/piles/) to explore the potential differences in emissions arising from different pile shapes, pile sizes, and number of piles per acre. To explore the variability in underburns/broadcast burns, the BLM estimated emissions by assuming that all acres were the same fuelbed as estimated for Klamath Falls Field Office (low end) and the same fuelbed as estimated for Medford-Roseburg (high end). The BLM did not change the estimated acres burned for each treatment type.

References

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