Air Quality

Introduction

Although there are many sources that can and do influence air quality, such as stationary, area-wide, mobile and natural sources, the two that will be discussed in this section are the two that can be influenced the greatest in the Sugar Pine Adaptive Management Project; area-wide (prescribed fire) and natural sources (wildfires) and their effects.

Fire is an important part of California ecosystems, but it also produces combustion byproducts that are potentially harmful to human health and welfare. Carbon dioxide and water are the two products of complete combustion and generally make up 90 percent of the total emissions from wildfire. In incomplete combustion that occurs under wildfire conditions, smoke is composed of carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons, and other organic compounds, nitrogen oxides, trace minerals, and several thousand other compounds. Particulate matter is the principle pollutant of concern to human health from wildfire smoke for the short-term exposures typically experienced by firefighters and the public. Studies indicate that 90 percent of smoke particles emitted during wildland burning are particles that less than ten microns in size (PM10), and about 90 percent of these are less than 2.5 microns (PM2.5). Hydrocarbons and nitrogen oxides from large wildfires contribute to increased ozone formation (which causes injury to plants) under certain conditions (Ahuja 2006). Emission factors are expressed in pounds of emissions per ton of fuel consumed. This in turns means the fuel loading and the combustion stage of a fire can be used to estimate the anticipated amount of emissions produced by the wildfire, whether it is a wildfire or a prescribed fire, but fuel loading estimation is one of the parameters that can introduce a major error in estimation of the emissions (Ahuja 2006).

There are two general strategies to managing wildfire smoke: (1) emission reduction and (2) emission redistribution. All pollutants except nitrous oxide are negatively correlated with combustion efficiency, so actions that reduce one pollutant result in the reduction of all. Optimal use of reduction techniques can reduce emissions by approximately 20 to 25 percent, assuming all other factors (vegetation types, acres, etc.) were held constant and land management goals were still met. Emission reduction techniques include reducing the area burned, reducing fuel loading, reducing fuel production, reducing fuel consumption, and scheduling burning before new fuel appears and increasing combustion efficiency (Ahuja 2006).

Emission redistribution is regulated by local and State air pollution control boards/districts by the designation of “burn days” or “no burn days”. Burns are to be conducted on burn days. This is often the most effective way to prevent direct smoke impacts to the public or sensitive areas. These “burn days” are typically during periods of good atmospheric dispersion (dilution of emissions) and when prevailing winds will transport smoke away from sensitive areas (avoidance) so that air quality standards are not violated. Typical strategies applied to achieve redistribution/avoidance of emissions include burning when dispersion is good, sharing the air basins, burning more frequently, burning smaller units, especially in non-attainment areas, and avoiding sensitive areas (Ahuja 2006).

Land managers and air quality regulators have and must continue to work together to better understand the effectiveness, options, difficulties, applicability, and trade-offs of emission reduction techniques. They are the key operators that can develop strategies leading to a reduction of smoke emissions (Ahuja 2006).

Affected Environment

The Sugar Pine Adaptive Management Project is within two air basins that are regulated by two air districts; San Joaquin Valley Air Pollution Control District (Madera County) and Mountain Counties Air Pollution Control District (Mariposa County). Each are responsible for implementing and regulating sources that degrade air quality and are responsible for meeting State and Federal air quality standards. The California Air Resources Board has oversight authority to monitor performance of district programs.

The physical features (topography) and climatology surrounding the Sugar Pine Adaptive Management Project area can lead to effects from wildfire and/or prescribed burning to occur within both the San Joaquin Valley air basin and the Mountain Counties' air basin. Smoke sensitive areas in or near Sugar Pine Adaptive Management Project area include: communities (Sugar Pine, Fish Camp, Oakhurst, etc.), infrastructure (schools, hospitals, etc.) and Class I airsheds (wilderness areas or in this case Yosemite National Park). Additional concerns are focused on the status of air basins in meeting Federal, State and local air quality standards.

Air quality in the San Joaquin Valley (Valley) is among the poorest in the State. The Valley experiences about 35 to 40 days per year where air quality exceeds Federal health-based standards for ground-level ozone and more than 100 days per year over the State ozone standard. Levels of airborne particulates exceed the Federal standard less than five times annually. The California standard is set at a lower and more protective level. The San Joaquin Valley exceeds the California limit an average of 90 to 100 days per year (SJVUAPCD 2003).

Currently the valley is Federally-classified as in severe non-attainment for the Federal ground-level ozone and particulate matter less than 10 microns in diameter (PM10) standard. Additionally, the Valley is classified as in severe non-attainment for the State's PM10 standard. Attainment status for PM10 was requested from the Environment Protection Agency (EPA) on April 25, 2006 (www.valleyair.org, 2006). Although Mountain Counties' air basin in Mariposa County is also considered in non-attainment for ozone 8-hour Federal standard (Ahuja 2006), San Joaquin Valley Air Pollution Control District regulations and rules associated with the use of fire are much more stringent.

Alternative 1 – No Action

Under Alternative1, current management plans would continue to guide activities in the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including underburning, plantation maintenance, cattle grazing, recreation, and recreation residences.

Direct, Indirect and Cumulative Effects

No direct effects to air quality would occur under this alternative since no treatments would be completed outside of that which is already permitted or authorized.

Indirect and cumulative effects include the potential for unplanned ignitions and wildfires to occur in the area. The resultant smoke caused by these would have large amounts of emissions released and could potentially be of long duration. Values measured such as PM10 and visibility range used to determine the Health-Protective Value would be in the ranges assumed to be in the Unhealthy. Values associate with this rating are PM10 ranging from 176 to 300 $\mu g/m^3$ and visibility of 1.24 to 2 miles (considered moderate smoke conditions). This would be considered the lower of the Health-Protective Values a wildfire would produce, if it occurred in the area. It is anticipated that for short periods of time the values may rise to the levels considered Very

Unhealthy or perhaps Hazardous. The Statewide Emission Inventory in 2002 reported emissions (tons/day, annual average) from wildfires (Ahjua 2006) and is demonstrated in Table 33.

Table 1. Statewide Emission Inventory 2002 for Natural Sources-Wildfire

Emissions	Total Organic Gases	Reactive Organic Gases	Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	PM_{10}
Natural Sources: Wildfire	6,522	3,046	17,474	3,441	302	2,418

The high summer temperatures and light wind speeds that occur during the summer months, places a cap on valley air with no means for cleansing itself by dispersion or transport. Because of the poor air quality associated with the San Joaquin Valley Air Basin it does not take large amounts of additional emissions to degrade air quality into unhealthy ranges especially in the summer and fall months, where storm systems are less likely to occur and disperse smog and emissions. Emissions from a wildfire could potentially have long lasting impacts beyond the initial burning period because of this. Uncontrolled wildfires are clearly responsible for the most widespread, prolonged, and severe periods of air quality degradation (Sugihara, N. 2006).

Alternative 2 – Proposed Action

In this alternative, treatments are proposed to reduce surface, ladder fuels and some aerial fuels. This is proposed to occur through the use of mechanical methods as well as management ignited fire in the form of prescribed fires such as pile burning, understory burning and/or broadcast burning. Prescribed burn plans and smoke management plans are required prior to implementation of any type of prescribed burning. These include prescriptions or weather parameters that would provide acceptable results, including reduction in smoke impacts. Smoke management plans are written and approved by the local air districts. Prescribed burning is would occur on air district designated burn days when conditions are such that dispersal and transport are optimized. The effects analyzed are those that would result from the prescribed burning proposed by this alternative.

Direct Effects

The direct effects from prescribed burning (production of emissions through smoke production) are generated by the number of acres to be burned and the surface fuel loading of the area being burned. In this alternative it is estimated that 35 to 40 percent of the area (approximately 250 to 350 acres) being treated through pre-commercial, commercial or biomass operations will need to have some form of post activity treatment to reduce surface fuel loading. As part of this alternative, post activity treatment would include tractor piling followed by prescribed burning of the piles or hand piling and burning (dependent on steepness of slopes) and/or broadcast burning. Also part of the treatments in this alternative includes prescribed fire use as the initial treatment of an estimated 215 acres. The table below estimates the potential emissions from the average conditions anticipated in the Sugar Pine Adaptive Management Project area. Tons per acre are associated with the existing IFSL fuel models given in the Fire/Fuels Analysis. It is assumed that the areas that are at or above 15 to 20 tons per acre surface fuel loading, prior to any treatment, would require post activity treatments such as piling and burning. Those areas at or less than 10 tons per acre would be considered appropriate for the application of broadcast and/or understory burning for maintenance of surface fuel loadings. Three hundred total acres is used for each fuel model to show the maximum emissions that would be anticipated if all of the acres were at that

fuel loading. It is anticipated that there will be a combination of fuel loadings, both at the higher levels and lower levels, throughout the project area where prescribed fire will be used as a initial treatment or post activity treatment.

Indirect and Cumulative Effects

Although prescribed burning would occur on air district designated burn days, there would be potential for short-term impacts, caused by smoke production, to sensitive areas. From past experience, it is anticipated that limits on acres per day burned, optimal transport wind direction/speed, higher mixing heights and quantity of other prescribed burns being conducted will be considered prior to air district approval to reduce these impacts. This could extend the number of days burning would occur, but would reduce the amount of emissions produced at any one time into smoke sensitive areas. Cumulative effects can be caused by outside influences not associated with the project itself. Because of the rural surroundings, many residences utilize wood burning as their main source of home heating. Hazard reduction burning is also permitted in rural communities in Madera and Mariposa counties. This can lead to cumulative impacts if prescribed burning is conducted on what is considered a marginal dispersal day when added to wood stove smoke and increased numbers of hazard reduction burns within the communities in or surrounding the project area.

Alternative 3

Direct, Indirect and Cumulative Effects

Alternative 3 would not alter the number of acres where ladder and surface fuels are to be reduced through treatments, but would alter the amount of post treatment surface fuels (lower tons/acre) in treatment area T4. It is anticipated this would not produce a significant difference in the estimated emissions produced from initial or post activity prescribed burning. Thus the direct, indirect and cumulative effects would remain the same as those under Alternative 2.

Alternative 4

Direct, Indirect and Cumulative Effects

Alternative 4 would not alter the number of acres where ladder and surface fuels are to be reduced through treatments, but would potentially lower the amount (tons per acre) of post treatment surface fuels. As in Alternative 2, prescribed burning would be utilized to reduce surface fuel loadings as either an initial treatment (understory/broadcast) or as a post activity treatment (pile burning). Dependent on the existing fuel loading, there is still a potential for surface fuel loadings to be as high as that found in an IFSL Fuel Model 12, but not in as many areas as with Alternative 2. It is anticipated that this would lower emissions produced, but not significantly since the same number of acres would need to be treated. Thus the direct, indirect and cumulative effects would remain the same as those under Alternative 2.

Table 2. Total Estimated Tons of Emissions from Initial Treatment and Post Treatment Activities

Emissions										
Fuel Type (choose one)	**Total Acres**	**Tons per acre**	**IFSL Fuel Model**	**Total tons**	**Tons PM10**	**Tons PM2.5**	**Tons Nox**	**Tons SO2**	**Tons VOC**	**Tons CO**
				0	-	-	-	-	-	-
Pile_Slash	300.00	34	12	10200	39.78	37.23	26.52	0.05	32.13	336.60
Pile_Slash	300.00	13	10	3900	15.21	14.24	10.14	0.02	12.29	128.70
Pile_Slash	300.00	10	High 9	3000	11.70	10.95	7.80	0.02	9.45	99.00
Forest	300.00	4	TU1	1050	12.86	11.55	1.84	0.05	7.61	122.33
Forest	215.00	13	10	2795	34.24	30.75	4.89	0.14	20.26	325.62

NOTE: Pile slash would be pile burning emissions and Forest would be understory/broadcast burning. PM10=Particulate matter 10 microns in size; PM2.5=Particulate matter 2.5 microns in size; NOx=Nitrogen Oxides; SO2=Sulfur Dioxides; VOC=Visual Organic Compounds (precursors to smog); CO=Carbon Monoxide.