3.04. Fire Fuels Management

This section focuses on analyses of the alternatives presented in this EIS and how they could affect current fire and fuels management on the Tahoe National Forest (TNF).

Affected Environment

Fire Management

Understanding past and present roles of fire in shaping TNF ecosystems is critical for managing fire. Fire, once a pervasive force in structuring and rejuvenating TNF ecosystems, is now intensively managed. Fire has been an important ecosystem process in the Sierra Nevada for thousands of years. Before the area was settled in the 1850s, fires were generally frequent throughout much of the range (Sierra Nevada Ecosystem Project 1996).

Because fire was so prevalent in the centuries before extensive Euro-American settlement (pre-settlement), many common plants exhibit specific fire-adapted traits such as thick bark and fire-simulated flowering, sprouting, seed release and/or germination (Chang 1996). In addition, fire affected the dynamics of biomass accumulation and nutrient cycling, and generated vegetation mosaics at a variety of spatial scales (Chang 1996). Because fire influenced the dynamics of nearly all ecological processes, reduction of the influence of fire through the 20th century fire suppression efforts in these ecosystem has had widespread (though not yet completely understood) effects.

Current management strategies and those of the immediate past have contributed to Forest conditions that encourage high-severity fires. The policy of excluding all wildfires has been successful in generally eliminating fires of low to moderate severity as a significant ecological process. However, current technology is not capable of eliminating the high-severity fires. Thus, the fires that affect significant portions of the landscape, which once varied considerably in severity, are now almost exclusively high-severity, large, stand-replacing fires.

Changes in Fuels

The dramatic reduction in area burned in the 20th century, combined with the effects of forest management practices and generally warmer-moister climatic conditions (Graumlich 1993; Stein 1996), has almost certainly led to substantial increases in the quantity and changes in arrangement of live and dead fuels. While data from early 20th century are not available to test this assertion rigorously, it is based on comparisons with early conditions inferred from numerous historical accounts, documented fire histories, and structures of uncut stands (Kilgore and Sando 1975; Parsons and DeBenedetti 1979; Bonnickson and Stone 1982; van Wagtendonk 1985; Biswell 1989; Weatherspoon and others 1992; Chang 1996; Skinner and Chang 1996; Weatherspoon and Skinner 1996).

Live and dead fuels have increased along with the development of denser conifer forests. These increases in stand density were concentrated mainly in small and medium size classes of shade-tolerant and fire sensitive species. Lacking fire, the natural thinning that has occurred has been due to competition (primarily water and light), diseases, and insects. The result has been a large increase in the amount and continuity of live forest fuels near the forest floor that provide a link between the surface fuels and upper

canopy layers. The lack of fire has allowed dead fuels to accumulate in excess of their presettlement levels.

Twentieth Century Fire Regimes in Perspective

The TNF has recorded wildfires since establishment of the Forest Reserves in the early 1900s. The TNF has also compiled detailed information from fire reports for the period between 1976 and the present. Conclusions about recent fire regimes come from these two information sources as well as technical papers that have analyzed these data.

Twentieth century fire regimes in the TNF are very different from pre-European contact fire regimes. Intervals between present-day fires are longer, allowing more time for fuels and vegetation to accumulate between fires. As a result, fires have more fuel to burn and become more severe. Consequently, fires today kill more of the vegetation, and are difficult and dangerous to control.

Table 3.04-1 displays how the number and size of fires on the TNF have changed over time. Most fires in the Sierra Nevada are suppressed at a very small size. Less than one percent of the fires that started on TNF system lands in the last thirty years exceeded 100 acres. Fire fighting capability and efficiency has steadily improved through the century as fire suppression technologies have improved and expenditures for fire management have increased. The total number of fires started has declined by more than 50 percent. However the total number of acres burned has increased by more the four fold. In addition, the number of fires in every size category has increased. From 1992 to 2006 there were four fires greater than 5,000 acres compared to only one during the previous 15 years.

Table 3.04-1. TNF Acres burned in by size of fire

Years	1977-1991	1992-2008
Total Fires	**2,263**	**1,248**
Total Acres Burned	**19,828**	**110,661**
Fires greater than 50 acres	12	15
Fires greater than 100 acres	11	15
Fires greater than 1,000 acres	5	10
Fires greater than 5,000 acres	1	6

Trends in Fire Causes and Sizes and Fire Suppression Capability

Human-caused fires have been declining slowly but steadily over the century, likely as a result of increased fire suppression efficiency and improved public education (McKelvey and Busse 1996). However all of the fires greater than 5,000 acres in the last 15 years were human caused. The number of lightning-caused fires has remained relatively constant over the century; however, over the last two decades the sizes of lightning-caused fires have increased.

The availability of Forest Service firefighting resources and equipment has remained steady or declined over the past decade (Husari and McKelvey 1996). A similar trend has occurred in State firefighting agencies in Nevada and California. Additional resources are available through local fire departments, but these agencies are primarily dedicated to protecting lives and property in the immediate

vicinity of their jurisdictions. Human populations are projected to increase in the Sierra Nevada over the next half century (Duane 1996). Refer to Chapter 3.11 for more information on population growth. This will result in greater demands on local fire departments to provide fire protection to homes and communities during periods of high fire danger. In the future, additional firefighting resources may not be available to attack multiple lightning fires, especially during their initial stages.

Relationships between Climate and Fire Sizes and Causes

Based on 2,000-year tree ring records from giant sequoia groves, Swetnam (1993) concluded that fire activity has consistently decreased when rainfall has increased. The period from 1937 through 1986, has been the third wettest half-century in the past 1,000 or more years; it has been the fourth wettest half-century in the last 4,000 years (Stine 1996, Graumlich 1993). These wet conditions may have contributed to the success of fire suppression in limiting fire size.

Based on available records for the 20th century, McKelvey and Busse (1994) concluded that not all hot, dry years were extreme fire years; however, nearly all of the extreme fire years occurred during hot, dry periods. The greatest acreage burned coincides with critically dry years (as defined by the California Department of Water Resources) in the San Joaquin and Sacramento River Valleys. One-third of the years between 1901 and 1969, were ranked as dry or critically dry in at least one of the river valleys. Almost one-half of the years between 1970 and 1998 were ranked as dry or critically dry. Extreme fire years occurred during the critically dry years; these years reflect the correlation between lightning-caused fires, drought years, episodic events, and acres burned.

Wildland Urban Intermix Zone

The wildland urban intermix zone (WUI) is an area where human habitation is mixed with areas of flammable wildland vegetation. It extends out from the edge of developed private land into Federal, private, and State jurisdictions. There are currently 3,282.6 miles of roads useable by fire suppression equipment in the WUI. The WUI is comprised of two zones: the defense zone and the threat zone.

- The defense zone is the buffer in closest proximity to communities, areas with higher densities of residences, commercial buildings, and/or administrative sites with facilities. Defense zones generally extend roughly ¼ mile out from these areas.
- Threat zones generally extend approximately 1¼ miles out from the defense zone boundary; however, actual extents of threat zones are based on fire history, local fuel conditions, weather, topography, existing and proposed fuel treatments, and natural barriers to fire.

Environmental Consequences

Weather, topography, and fuels influence the behavior of fires. Motor vehicle access into an area can lead to an increased risk of a wildfire being started by humans. Wildfires can be started by the vehicles themselves; i.e. sparks from exhaust or hot pieces of metal such as exhaust pipes coming into contact with vegetation. In addition human activities in the back country such as camping and hunting can also lead to an increased risk of wildfires starting. Motor vehicle use provides access to larger areas for these activities and hence a larger area for potential risk of human caused fires.

Road access into an area is also a benefit for fire suppression. Road access allows for a more rapid initial attack by suppression forces increasing the chance that a wildfire may be stopped at a smaller size. In addition to quicker access, roads can also allow heavier equipment such as fire engines and bull dozers to reach the fire and thus stop the fires at a smaller size. Changes in fuels alter fire behavior and also change how fires affect ecosystem components and processes.

Measures or Factors Used to Assess Environmental Consequences

The alternatives can be compared in terms of; 1) how they increase the risk of a wildfire being started by humans based the level of access by motorized vehicles and the 2) amount of roads accessible allowing for a more rapid initial attack by suppression forces with heavier equipment such as fire engines and bull dozers.

Risk of Human Caused Wildfire

Although the amount of human caused fires has been decreasing over time, motor vehicle access into an area can lead to an increased risk of a wildfire being started by humans. Wildfires can be started by the vehicles themselves; i.e. sparks from exhaust or hot pieces of metal such as exhaust pipes coming into contact with vegetation. In addition human activities in the back country such as camping and hunting can also lead to an increased risk of wildfires starting. Motor vehicle use provides access to larger areas for these activities and hence a larger area for potential risk of human caused fires. To assess the changes in potential risk the density of open routes accessible by the public was used a potential indicator. Table 3.04-2 displays the categories used to assess this risk.

Table 3.04-2. Risk Assessment Categories Used For Human Caused Fire

Density of Roads and Trails Open for Motor Vehicles by Watershed	Degree of Potential Risk
0 Miles/Square Mile	Lowest Risk
0-2 Miles/Square Mile	Lower Risk
2-4 Miles/Square Mile	Moderate Risk
4-6 Miles/Square Mile	Higher Risk
6 Plus Miles/Square Mile	Highest Risk

Table 3.04-3 displays the level risk of human caused wildfire by alternative. The greatest level of risk is associated with Alternative 1, the No Action Alternative. All of the action alternatives reduce the level of risk. Of the action alternatives, the least reduction in risk is associated with Alternative 5. Alternatives 2, 3, 4, 6 and 7 all have similar reductions in risk of human caused wildfire.

Table 3.04-3. Changes in Risk of Human Caused Wildfire by Alternative

Risk of Human Caused Wildfire		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
Motorized Route Density (Percent of Forest Total)	**Lowest Risk** (0 Miles/Square Mile)	.6%	.6%	.6%	.6%	.6%	.6%	.6%
	Lower Risk (0-2 Miles/Square Mile)	17.2%	26.6%	27.7%	26.6%	25.0%	27.2%	26.6%
	Moderate Risk (2-4 Miles/Square Mile)	44.0%	57.7%	56.6%	57.7%	58.2%	57.0%	57.7%
	Higher Risk (4-6 Miles/Square Mile)	31.4%	11.5%	11.9%	11.5%	12.6%	11.5%	11.5%
	Highest Risk (>6 Miles/Square Mile)	6.9%	3.5%	3.1%	3.5%	3.6%	3.5%	3.5%

Access by Suppression Forces

Road access into an area is also a benefit for fire suppression. Road access allows for a more rapid initial attack by suppression forces increasing the chance that a wildfire may be stopped at a smaller size. In addition to quicker access, roads can also allow heavier equipment such as fire engines and bull dozers to reach the fire and thus stop the fires at a smaller size.

Access by these vehicles is particularly important in the wildland urban intermix zone (WUI). The wildland urban intermix zone is an area where human habitation is mixed with areas of flammable wildland vegetation. It extends out from the edge of developed private land into Federal, private, and State jurisdictions.

Table 3.04-4 displays the miles of roads useable by heavier equipment such as fire engines and bull dozers to reach the fire and thus stop the fires at a smaller size within the wildland urban intermix zone (WUI) as well as within the total forest.

Table 3.04-4. Access for fire suppression equipment by alternative

Access for Fire Suppression Equipment		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
Roads useable by fire suppression equipment (miles)	**Wildland urban intermix zone** (WUI)	3,282.6	2501.1	2499.2	2500.3	2523.2	2503.8	2499.2
	Forest Total	**6,450.6**	**4,757.3**	**4,752.3**	**4,756.0**	**4,836.7**	**4,768.1**	**4,753.3**

The greatest level of access is associated with Alternative 1, the No Action Alternative. All of the action alternatives reduce the level of access and all similar reductions in access to allow heavier equipment such as fire engines and bull dozers to reach the fire and thus stop the fires at a smaller size.

Summary of Effects Analysis across All Alternatives

The following table summarizes the effects analysis for fire and fuels by ranking each alternative regarding how well it provides for each of the indicators. The following rankings were used: A score of 7 indicates the alternative has the least impact for fire and fuels related to the indicator. A score of 1 indicates the alternative has the greatest adverse impact to fire and fuels. This information is to be used to fill out the alternatives summary at the end of Chapter 2 of the EIS.

Table 3.04-5. Comparison of Effects to Fire and Fuels

Indicator	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
Changes in Risk of Human Caused Wildfire by Alternative	7	5	1	3	6	2	4
Access for Fire Suppression Equipment by Alternative	1	4	7	5	2	3	6
Average	**4**	**4.5**	**4**	**4**	**4**	**2.5**	**5**