Fuels Specialist Report

to the

Boswell Creek Healthy Forest Initiative Project

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I. Purpose and Need

A. Management Priorities

In the Boswell Creek project area, fuel conditions exist which have the potential to produce flame lengths, fireline intensity and rates of spread which directly threaten the following priorities of fuels management:

1. Safety – Protection of health and safety for the firefighter and the general public must be the top priority.
2 Communities – Assign highest priority for hazardous fuel reduction to communities at risk, threatened and endangered species habitat, wildland-urban interface, and other important local features where uncharacteristically intense fires can occur.
3. Restoration – Restore healthy, resilient ecological systems to minimize large, intense fires. Restore or maintain Condition Class 1. Achieve the Desired Future Conditions as described in the Forest Land and Resource Management Plans.

B. Fuels Report Background and Objectives

In December 2002, the National Forests and Grasslands in Texas (NFGT) nominated potential activities within the Boswell Creek watershed to be included in a nationwide evaluation of new methods of moving Environmental Assessments (EAs) through the National Environmental Policy Act (NEPA) process. The Boswell Creek project area was accepted for addition to the study. A Fuels Specialist Report will be included in the final EA analyzing activities in the Boswell Creek project area.

The objectives of the Fuels Specialist Report are to:

- Describe the current fuels situation;
- Identify resources subject to negative impacts caused by wildland or prescribed fires; and
- Predict potential fire behavior in all management alternatives.

This Fuels Specialist Report will consist of three sections:

1. A Fuels Assessment which will define the purpose and need for fuels management;
2. A list of proposed actions developed during the NEPA process; and
3. An evaluation of the Environmental Consequences of the Alternatives.

C. Current Fuels Management Direction

Guidance for fuel management on federal land is found in the following documents:

1. Wildland and Prescribed Fire Management Policy, January, 2001;
2. The National Fire Plan, Managing the Impacts of Wildfires on Communities and the Environment, September 8, 2000;
3. Protecting People and Sustaining Resources in Fire-Adapted Ecosystems, A Cohesive Strategy, October, 2000;
4. A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment, A 10 Year Comprehensive Strategy, August, 2001;
5. Healthy Forest, An Initiative for Wildfire Prevention and Stronger Communities, August 22, 2002; and
6. The Revised Land and Resource Management Plan (The *Plan*) for the National Forest and Grasslands in Texas, 1996.

Using the preceding documents, a list of priorities for this Fuels Report was obtained (as stated previously):

- Protection of human health and safety;
- Hazardous fuel reduction for communities at risk, threatened and endangered species habitat, and wildland-urban interface; and
- Restoration of healthy, resilient ecological systems.

D. History of the Boswell Creek Project Area

In the mid 1980's, a Southern Pine Beetle (SPB) epidemic occurred on the Sam Houston National Forest (NF). A number of outbreaks became established in the Four Notch area of the Boswell Creek watershed, which is located approximately 10 miles southeast of Huntsville, Texas. The SPB infestations eventually impacted roughly half of the Boswell Creek watershed. Suppression efforts included chainsaw felling followed by salvage logging. The salvaged stands were site prepared and planted with loblolly pine from 1986 through 1990. The Boswell Creek project area is composed of approximately 8,650 acres of Forest Service land in Compartments 70, 72, 73, 74, 75, and 76, and portions of Compartments 69, 77, and 83. Due to the salvage activities, the project area is composed of approximately 4,300 acres of young pine stands less than 30 years of age. The remaining federal land is composed of a mix of approximately 1,200 acres of hardwood and 3,000 acres of pine sawtimber and poletimber.

E. Resource Values at Risk in the Boswell Creek Project Area

The Boswell Creek project area is composed of 8,650 acres of federal land and approximately 7,000 acres of private land. A majority of the federal land in these compartments is included in Management Area 2 (MA-2), Red-cockaded Woodpecker Emphasis. Management emphasis in MA-2 is dedicated to the restoration of the red-cockaded woodpecker (RCW). The Desired Future Condition (DFC) of these lands will feature older forest conditions and communities; pine will dominate the overstory and prescribed fire will maintain open conditions that favor grasses and grass type ground level vegetation. Other federal values in the project area include the popular Lone Star Hiking Trail, which bisects the project area.

There is a significant amount of private land adjacent to and surrounded by Forest Service land. Private land is composed of farms, residences, church camps, training facilities and managed forestland owned by both private and industrial landholders. There are an estimated 200 residences and structures adjacent to Forest Service land. Concerns for fire hazards in the wildland/urban interface have increased following the severe 2000 fire season. Numerous miles of power and communication lines exist in the project area.

F. Description of the Airshed

The Sam Houston NF is located approximately 50 miles north of Houston, Texas. Smoke produced from wildland or prescribed fires can have significant impacts on a large urban landscape. Approximately 400,000 people live in the counties adjacent to the Sam Houston NF. Many of residents of this area live in the large cities of Conroe and Huntsville, or small towns such as New Waverly, Montgomery, and Cleveland; however, a significant percentage of the populations live in the wildland/urban interface in the countryside surrounding these cities and towns. County roads and state highways are high-speed and are typically heavily traveled. Interstate 45 and Highway 59 are congested, major travel routes and are adjacent to the forest. Houston Intercontinental Airport is located approximately 30 miles south of the forest, approach and departure routes for the airport can be affected by smoke produced on the Forest. Recreation areas on Lake Conroe and Lake Livingston also lie adjacent to the Forest.

The Sam Houston NF is considered to be in attainment of the National Ambient Air Quality Standards (NAAQS) for Class II air sheds, with the exception of ozone. Montgomery County lies within the Houston/Galveston, Texas non-attainment area. The western one-third of the forest lies within Montgomery County. However, no excessive emission producing activities have been identified on the forest. The ozone non-attainment is due primarily to industry and vehicular emissions in the greater Houston/Galveston area.

G. Fire Ecology and Current Fuels Condition

According to research, prior to 1900 pine forest types in the southern U.S. burned every three to eight years, drier sites burned every one to four years; fires were regularly set by Native Americans, settlers, hunters, ranchers, farmers or were lightning caused (USDA Forest Service General Technical Report, RMRS-GTR-42, vol. 2, 2000). The frequent, low-intensity fires created an open midstory and understory with an herbaceous groundcover. After 1900, wildland fires were aggressively suppressed. The suppression of wildland fires has allowed fuels to accumulate.

Due to the highly productive soils in the project area, the midstories and understories of stands can quickly be overtaken by species such as yaupon, American beautyberry, sweetgum, and other hardwood species. These dense growths contribute to fire behavior in a number of ways. Fire intensity, flame length and rate of spread can be increased when dense understory vegetation provides "fuel ladders", in which dead pine needles and leaf litter are held in the tops of the understory. As a surface fire burns beneath the needle-laden understories, the fire can suddenly grow vertically and carry flames into the tops of the understory vegetation or into the crowns of the overstory. Dense understories will also limit visibility and impede access and escape routes of firefighters and equipment attempting to construct firelines; therefore, the size of a fire will increase as firefighters avoid the dense vegetation and install control lines in safer locations.

In March 2003, nine photo points were located in the Four Notch area of the Boswell Creek project area. The photo points were located in stands which were representative of the typical species, ages, densities, and management activities which are found in the project area. The photo points were used to obtain current fuel model and fuel loading information. Fuel models are a collection of the descriptions of the overall fuel load, and the size and arrangement of the fuels; the models are then used to describe fire behavior which can be expected to occur under various weather conditions. At each photo point, the location was obtained using Geographic Positioning System (GPS), four digital photos were taken, and the Fire Behavior Prediction System (FBPS) fuel model and estimated fuel loading were obtained using the publication Photo Guide for Appraising Surface Fuels in East Texas (Reeves, 1988). The photo guide includes photographs and detailed descriptions of fuel loading of various forest types and conditions commonly found in East Texas. By matching ground observations with a photograph, a reasonably accurate estimate of fuel loading can be obtained.

The following table lists the photo points, the observed management activities, and the identified FBPS fuel model and the page on which the fuel loading description can be found.

Point	Recent Management	Fuel Model and Page*	Condition Class
1	Pine Plantation, no management	FM 7 page 63	3
2	Pine Plantation, burned, not thinned	FM 7 page 63	2
3	Sawtimber Pine, thinned, not burned	FM 7 page 45	2
4	Sawtimber Pine, no management	FM 7 page 45	3
5	Sawtimber Pine, no management	FM 7 page 45	3
6	Pine Plantation, no management	FM 7 page 63	3
7	Pine Plantation, no management	FM 7 page 63	3
8	Sawtimber Pine, thinned and burned	FM 2 page 79	2
9	Young Pine, thinned and burned	FM 2 page 79	2

* As described in Photo Guide for Appraising Surface Fuels in East Texas (Reeves, 1988).

Some prescribed burning has taken place in the past in Compartments 69 (250 acres burned in 2003), 70 (1,266 acres burned in 2001), 72 (820 acres burned in 2000 and 2002), 77 (200 acres burned 2001), and 83 (960 acres burned in 2001) of the Boswell Creek project area; however, due to the relatively limited use of prescribed fire, the fuel conditions were basically homogeneous throughout the project area. The young pine plantations (approximately 17 years of age) were identified as Fuel Model 7, Southern Rough, and are similar to the fuel loading description on page 63 of the photo guide. The pine sawtimber stands were also identified as Fuel Model 7 and have a fuel loading description similar to page 45 of the photo guide. In the Fuel Model 7, fires burn through the surface and shrub strata with equal ease and can occur at higher dead fuel moisture contents due to the flammability of live foliage. The shrub layer in the Four Notch area was observed to be from 2 to 10 feet in height.

Photo points 8 and 9 were identified as points which are similar to the DFC of MA-2. These points were located in stands which have been thinned and burned in the past and will eventually achieve the DFC of MA-2 with the continued application of prescribed fire and thinning. Points 8 and 9 were similar to Fuel Model 2, Timber with a Grass Understory, described on page 79 of the photo guide. Point 8 was located in mature sawtimber in Compartment 72 Stand 6 and point 9 was located in immature sawtimber in Compartment 72 stand 17; these stands represent approximately 150 acres. Few areas were found in the project area with the attributes of Fuel Model 2. Points 8 and 9 represent what thinning and burning the pine plantations and pine sawtimber will eventually resemble. In Fuel Model 2, fire spread is primarily through the fine herbaceous fuels, leaf litter, and dead branchwood and is typically a surface fire only. Flame lengths, rates of spread, and fireline intensity will generally be less than that of Fuel Model 7 due to the reduced fuel loading and the absence of fuel ladders.

Current Fire Management direction includes assigning National Forest land to appropriate Fire Regime Groups and Condition Classes. The five Fire Regime Groups are:

Group I-fire frequency of 0-35 years and low severity fires;
Group II-fire frequency of 0-35 years and stand replacement fires;

Group III-fire frequency of 35-100+ years, both low severity and stand replacement fires;
Group IV-fire frequency of 35-100+ years and stand replacement fires; and
Group V-fire frequency >200 years and stand replacement fires.

The NFGT is in Fire Regime I, which should feature frequent, low intensity fires. An estimate of Condition Class was made at the time the photo points were taken. Photo Points 2, 3, 8, and 9 were located in Compartments 70 and 72 and are described as Condition Class 2 due to the previous prescribed burning which has taken place in Compartment 70 and 72. The other compartments in the project area have had no prescribed burning and are therefore in Condition Class 3 in which the stands are at high risk of overstory mortality due to fuel buildup as a result of missed fire returns. Condition Class is defined in terms of departure from the historic fire return intervals:

Condition Class 1 - Fire regimes are within an historical range, and the risk of losing key ecosystem components is **low**. Vegetation attributes (species composition and structure) are intact and functioning within an historical range. Where appropriate, these areas can be maintained within an historical range with treatments such as fire use.

Condition Class 2 – Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequency by one or more return intervals. This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.

Condition Class 3 – Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequency by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Where appropriate, these areas may need high levels of restoration, before fire can be used to restore the historical fire regime.

This photograph, taken at photo point 6, is typical of an unmanaged pine plantation in the Four Notch area of the Boswell Creek project area. The pine plantations were collectively identified as Fuel Model 7, Southern Rough, and are similar to the fuel description on page 63 of the Photo Guide for Appraising Surface Fuels in East Texas (Reeves, 1988).

This photograph was taken at photo point 5 and is typical of an unmanaged pine sawtimber stands in the Boswell Creek project area. The pine sawtimber stands were identified as Fuel Model 7 and have a fuel description similar to page 45 of the Photo Guide for Appraising Surface Fuels in East Texas (Reeves, 1988).

This photograph was taken at photo point 9 and is typical of a pine sawtimber stand in which thinning and prescribed burning have taken place. Managed pine stands such as this are similar to the Desired Future Condition of Management Area 2, Red-cockaded Woodpecker (RCW) Emphasis. The above photograph is similar to the Desired Future Condition of Management Area 2, but is not truly desirable RCW habitat at this time. Continued thinning and burning will move this stand toward the Desired Future Condition. This stand was identified as Fuel Model 2 and has a fuel description similar to page 79 of the Photo Guide for Appraising Surface Fuels in East Texas (Reeves, 1988).

H. Historic Fire Weather and Fire Occurrence

This section of the Fuels Analysis was conducted using FireFamily Plus computer model. FireFamily Plus is a software system for summarizing and analyzing historical daily fire weather observations and computing fire danger indices based on the National Fire Danger Rating System (NFDRS). Historic weather observations and wildland fire data were obtained for 1981 to 2001 for the Sam Houston NF.

Fire Danger Rating

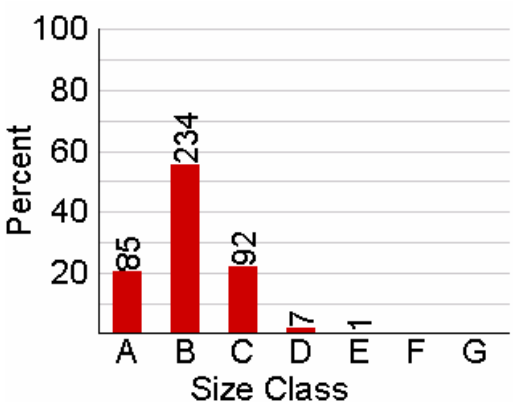
Historical Fire Danger is based on weather conditions and probability analysis using the National Fire Danger Rating System (NFDRS) fuel model D, (Southern Rough) with standard model fuel loadings. The primary carriers of a fire in this fuel type is leaf litter and shrub understory. The fire season for the National Forest in Texas has historically been from October 1 to April 10. The fire seasons from 1981 to 2001 were analyzed and the Burning Index were calculated as follows:

Fire Danger Rating*	Number of Days in season
Low	65
Moderate	31
High	66
Very High	12
Extreme	5

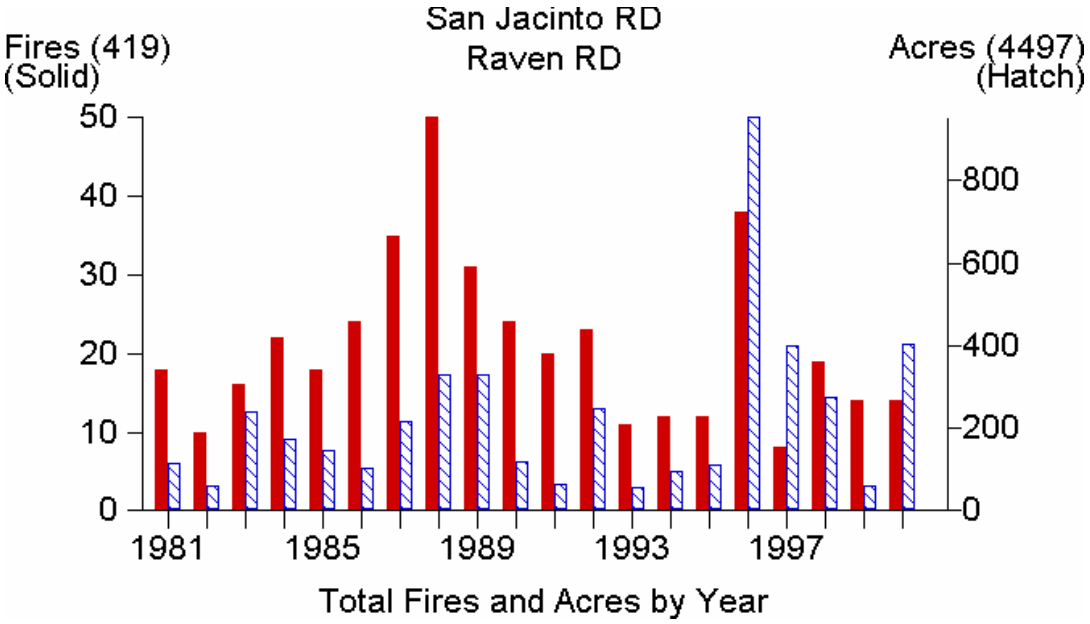
*Based on Burning Index. Burning Index (BI) is a NFDRS output which combines the heat energy of a fire with the forward rate of movement of the fire. BI is a number related to the contribution of fire behavior to the effort of containing a fire.

Fire Size

On the following fire size graph, “A” fires are 0 to .25 acres, “B” fires are .26 to 9.9 acres, “C” fires are 10 to 99.9 acres, “D” is 100 to 299.9 acres, “E” is 300 to 999.0, “F” is fires 1,000 to 3,000 acres, and “G” is fires over 3,000 acres. A vast majority of fires on the Sam Houston NF are between 0.25 and 9.9 acres in size.

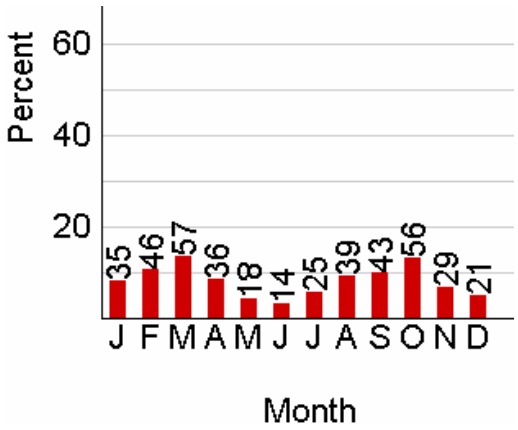


Using FireFamily Plus data for the period from 1981 through 2000, the Forest averaged 21 fires per year, burning an average of 225 acres per year. Note that the software recognizes the Sam Houston NF as the San Jacinto and Raven Ranger Districts which consolidated in the early 1990's.



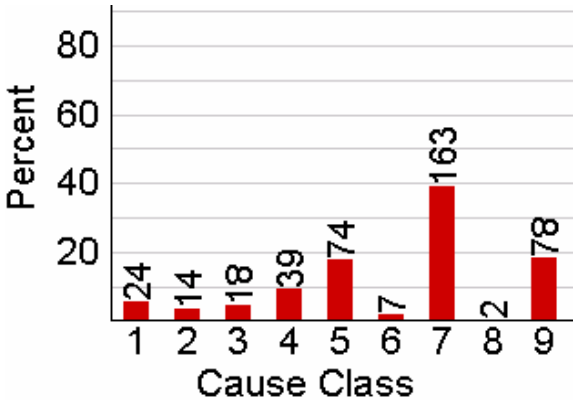
Fire Occurrence

On the following graph, peak fire occurrence is in the fall and spring, but significant numbers of fires have occurred during almost every month. During the 1981 to 2000 period of this analysis, the official fire season began October 1 and ended April 10 (for a 192 day fire season). Extreme Fire Danger Rating has occurred during the summer months due to drought conditions.



Fire Cause

Deliberate arson (Cause Class 7) is the leading cause of fire attributing to nearly 40 percent of fire starts. Other human caused fires contribute an additional 50 percent of all fire causes while lightning starts approximately 10 percent of all fires. The following graph displays the cause of fires from 1981 to 2000.



Cause Class	
1	Lightning
2	Equipment Use
3	Smoking
4	Campfire
5	Debris Burning
6	Railroad
7	Arson
8	Children
9	Miscellaneous

I. Predicted Fire Behavior

As discussed previously, photo points were placed in nine locations in the Boswell Creek project area. At each point, the Fire Behavior Prediction System (FBPS) Fuel Model was obtained using a photo guide. The observed fuel models can be summarized into three classes:

	Pine Plantation Fuel Model 7 page 63*	Pine Sawtimber Fuel Model 7 page 45*	Thinned and Burned Pine Sawtimber Fuel Model 2 page 79*
1 hour fuels (0 to 0.25") (tons/acre)	4.18	1.61	0.18
10 hour fuels (0.25 to 1") (tons/acre)	1.26	1.26	1.54
100 hour fuels (1 to 3") (tons/acre)	0.17	0.14	0.21
Live fuel (tons per acre)	0.10	0.03	1.04
Fuel Bed Depth (feet)	2.5	2.5	1.0
Moisture of Extinction, dead fuels	40%	40%	15%

*Descriptions of the selected fuel model can be found on these pages of the Photo Guide for Appraising Surface Fuels in East Texas (Reeves, 1988). More detailed descriptions can also be found in Aids to Determining Fuel Models for Estimating Fire Behavior (Anderson, 1982).

To show fire behavior comparisons between the fuel models and fuel loads, weather inputs and topographic inputs must be consistent. FireFamily Plus was used to analyze weather observations from the Conroe weather (415109) station from 1981 to 2001. Weather observations at the 50th and 97th percentile ranking were obtained for this analysis to calculate moderate and extreme fire behavior. The 50th and 97th percentile weather observation are the weather conditions which will yield moderate (50th) and extreme (97th) fire danger ratings. Weather data used to calculate outputs for comparative fire behavior runs were:

	50th Percentile	97th Percentile
1 hour fuel moisture (%)	10	5
10 hour fuel moisture (%)	14	8
100 hour fuel moisture (%)	19	15
Midflame windspeed* (miles per hour)		
Pine Plantation	0.6	1.2
FM 7 Pine Sawtimber	1.8	3.6
FM 2 Pine Sawtimber	1.8	3.6
Temperature (F degrees)	74	89
RH	59	26

*Midflame wind speed is the wind speed which actually affects a flame front and is dependant on canopy density. In the plantation, the canopy is closed and protects surface fuels from wind more than in the pine sawtimber.

The BehavePlus computer model was used to generate fire behavior outputs such as rate of spread, flame length, fireline intensity, scorch height, and tree mortality. BehavePlus is a PC application to predict wildland fire behavior for fire management purposes. The strength of BehavePlus is the ability to compare potential fire behavior between different fuel models or between different fuel loadings of a model, and perform these comparisons at contrasting weather observations. BehavePlus uses site-specific input data to predict fire behavior for a point in time and space. The outputs reported below, describe the potential behavior of a single point ignition wildland fire free to burn and develop a headfire; all the outputs describe the behavior of the headfire. Comparison of potential wildland fire behavior outputs among the fuel models and by weather conditions are shown in the table below.

Fire Behavior Outputs	Pine Plantation FM 7		Pine Sawtimber FM 7		Pine Sawtimber FM2	
	50 Percentile Weather	97 Percentile Weather	50 Percentile Weather	97 Percentile Weather	50 Percentile Weather	97 Percentile Weather
Rate of Spread (chains per hour)	7.8	18.8	15.1	45.7	1.1	10.5
Fireline intensity (BTU/ft./sec)	192	549	146	515	2	79
Flame Length (feet)	5.1	8.2	4.5	8.0	0.6	3.4
Scorch Height (feet)	32	83	26	77	1	18
Probability of Mortality*	36%	96%	14%*	61%	14%*	14%*

*The BehavePlus model calculates overstory mortality based on a number of coefficients, however the model would not recognize mortality less than 14 percent; the 14 percent mortality figures listed here will almost certainly be closer to 5 percent than 14 percent.

Fireline intensity is a measure of the heat produced at the flaming front per unit length of fire front. Fireline intensities 0-100 btu/foot/second generally means a fire can be attacked at the head or flanks by firefighters with handtools. Fireline intensities 100-500 btu/foot/second are too intense for direct attack with handtools; indirect attack or equipment such as dozers must be used. Fireline intensities greater than 500 btu/foot/second indicate serious control problems and the likelihood of torching and spotting will occur. As fireline intensities increase, firefighters must move further from the flaming front, and the size of the fire will be increased. The fireline intensities of Fuel Model 7 preclude direct attack.

Flame lengths of 0 to 4 feet indicate that a fireline constructed by hand should be sufficient to contain a fire. Flame lengths 4 to 8 feet will overwhelm handline, therefore dozers or engines will be needed. Flame lengths greater than 8 feet indicate that long range spotting and torching will occur and control efforts at the head of the fire will be ineffective. Flame lengths of Fuel Model 7 will prevent the use of handline.

J. Fire Suppression

Fire suppression will be directly affected by the change in fuel loading. The fireline production capability of initial attack crews will be affected by the fuel model which is directly determined by fuel loading. The changes in production rates were compared by fuel models based on tables contained in the Fireline Handbook (NFES #0065). The table below demonstrates the relationship between changes in the fuel model (change in fuel loading) and the resistance to control (slowing of fireline construction rate). Fuel Model 7 has a dense shrub layer and a heavier fuel load, therefore fireline production will be significantly slower.

Fireline Production Rates Table

FUEL MODEL	Crew of Four Firefighters Total chains/hour (Initial Attack)	Engine 2 Person Crew chains/hour	Engine 3 Person Crew chains/hour	Dozer Type 3 0 to 25% slope chains/hour
FM 2 – Timber with grass understory	12	7	15	90
FM 7 – Southern Rough	2.8	5	12	55

Note: 1 chain equals 66 feet

The following table displays the amount of time it will require to contain a one acre fire and the final total acreage of the fire if the fire were attacked at the 50th and 97th percentile weather.

Time to Contain a Fire Approximately One Acre in Size Upon Arrival (hours)

	Crew of Four Firefighters	Engine Crew (2 person)	Engine Crew (3 person)	Type 3 Dozer
	50th / 97th	50th / 97th	50th / 97th	50th / 97th
Fuel Model 7 Young Pine Plantation				
Containment Time (Hours)	* / *	* / *	* / *	0.3 / 0.8
Final Fire Size (Acres)	* / *	* / *	* / *	2 / 11
Fuel Model 7 Pine Sawtimber				
Containment Time (Hours)	* / *	* / *	* / *	0.5 / *
Final Fire Size (Acres)	* / *	* / *	* / *	5 / *
Fuel Model 2				
Containment Time (Hours)	1.2 / *	2.5 / *	0.9 / *	0.1 / 0.2
Final Fire Size (Acres)	1 / *	2 / *	1 / *	1 / 2

*Fireline production rate is not high enough to contain the fire.

In many of the entries in this table, the rate of spread of the fire is greater than the ability of the various firefighting resources to build firelines to contain the spread of the fire. In these situations, direct attack on the fires will not be successful. When direct attack is not successful, indirect attack methods are used. For indirect attack, firefighters will use natural or manmade barriers some distance from the fire and either burn out the fuel between the barriers and the fire or will allow the fire to burn out the remaining fuel. Indirect attack will lead to larger fires.

Direct attack will be more successful in Fuel Model 2 than in Fuel Model 7, though not totally successful in the 97th percentile weather.

K. Fire Behavior Summary

As stated previously, there are three guiding priorities for fuels management in the Boswell Creek project area:

1. Safety – Protection of health and safety for the firefighter and the general public must be the top priority.

   Safety for firefighters and the general public will be significantly improved by achieving and maintaining Fuel Model 2 conditions. The fire behavior as described by flame length, fireline intensity, and rate of spread will be greatly reduced if the current Fuel Model 7 were converted to a Fuel Model 2 by a consistent fuel reduction program. Access into fires and escape routes for firefighters will be significantly improved with Fuel Model 2. Currently, firefighters seldom enter the young pine plantations to conduct direct attack fires due to safety concerns.

2. Communities – Assign highest priority for hazardous fuel reduction to communities at risk, threatened and endangered species habitat, wildland-urban interface, and other important local features where uncharacteristically intense fires can occur.

   Two communities are at risk in the Boswell Creek project area, the ecological community of the RCW and the wildland/urban interface community which is adjacent to Forest Service land. The project area is in MA-2, RCW Emphasis which has a DFC of older mature pine with a grass understory (Fuel Model 2) for the perpetuation of the RCW. Fuel Model 7 includes heavy fuel loads which can lead to larger, more intense fires which in turn increase mortality of the trees the RCW depends on. There are an estimated 200 privately owned residences or other structures in the project area, as well as many miles of utility lines. Fuel Model 2 will have significantly less rate of spread, shorter flame lengths, and lower fireline intensities than will Fuel Model 2. Fires in Fuel Model 2 will not be as large or as difficult to control as in Fuel Model 7.

3. Restoration – Restore healthy, resilient ecological systems to minimize large, intense fires. Restore or maintain Condition Class 1. Achieve the DFCs as described in the Forest Land and Resource Management Plans.

   Currently, Condition Class 1 (low risk of losing key ecosystem components) does not exist in the Boswell Creek project area. However, there are two pine sawtimber stands currently in Condition Class 2 which have been thinned and burned in the past and are similar to the DFC MA-2, RCW Emphasis. These stands are identified as Fuel Model 2 and can be used to analyze the fire behavior differences between Fuel Models 2 and 7. The majority of the project area is in Condition Class 3 (risk of losing key ecosystem components is high) and is

described as Fuel Model 7. Fuel Model 7 has a significantly higher risk of contributing to a large, intense fire which kills large amounts of timber than does Fuel Model 2.

II. Proposed Action and Alternatives

In May 2003, the Interdisciplinary Team developed a Proposed Action for the Boswell Creek project area and conducted public scoping. The Proposed Action, as shown in the scoping letter dated May 9, 2003, included:

- Conduct dormant and growing season prescribed burning on approximately 8,650 acres every two to five years to reduce risk from destructive fires. We anticipate that about 2,000 to 4,500 acres of national forest land in the watershed would be burned in any year. The season and cycle of burning would be managed to provide the most efficient combination of fuel reduction and protection of the forest.

- Thin approximately 4,800 acres of pine stands to reduce SPB hazard. About 3,360 acres of the thinning would be in young (about 15 to 20-year old) forests that were established after the mid-1980s SPB epidemic. The remaining thinning, about 1,440 acres, would be done in older, dense pine-dominated stands.

Following the Public Scoping Period, the Interdisciplinary Team analyzed the public comments and added one alternative, the No Action Alternative. In the No Action Alternative, no new actions would be undertaken in the project area - no new thinning or prescribed burning would take place.

III. Environmental Consequences of the Alternatives

Alternative 1: No Action

Direct and Indirect Effects

The proposed prescribed burning will not be conducted in the No Action Alternative. Fire behavior similar to that described on page 14 of this report can be expected to occur in existing stands; damage from this fire behavior will increase as fuel loads in all stands continue to increase in the future. Increasing dead fuels, ladder fuels and closer canopies increase the potential for overstory mortality. Fuel loads will continue to move toward high intensity, stand replacement type fire regime. Acres of Condition Class 2 (moderate risk of losing key ecosystem characteristics due to wildland fire) will be replaced by Condition Class 3 (high risk of losing key ecosystem characteristics due to wildland fire). The potential for a fire to move off the forest and into the urban interface (or vice versa) will increase as the rate of spread of the fires increase, and as fires burn with greater intensity, have larger flame lengths, and become more difficult to suppress; as potential

flame lengths and fireline intensities increase, resistance to control increases. Private land, residences, and improvements will continue to be adjacent to federal lands which have high fuel loads. Acres previously identified as potential RCW habitat (MA-2) will not be developed into quality habitat without a consistent prescribed burning program. Firefighter safety will continue to be jeopardized by intense fires with fast rates of spread.

Cumulative Effects

Activities have taken place and continue to occur in the Boswell Creek project area which could have cumulative effects with the No Action Alternative. Prescribed burning has occurred as described on page 5 of this report. Commercial thinning on 1,364 acres has taken place in the project area within the past eight years in compartments 70, 72, 73, 75, 76, 77, and 83. In 2001, midstory removal for RCW habitat was conducted on 174 acres in Compartments 70, 72, 75, and 76.

With the No Action Alternative, there will be some prescribed burning taking place in the future in the Boswell Creek project area under decisions signed in the past. In 2004, approximately 2,986 acres will be burned in compartments 70 (1,266 acres), 72 (820 acres), and 83 (900 acres). In 2005, approximately 500 acres will be burned in Compartment 69.

The thinning and midstory removal which have taken place, tend to open the canopy slightly and allow more sunlight to reach the forest floor which encourages development of a dense understory. Without prescribed fire to reduce fuel loads and maintain an open understory, benefits of thinning and midstory removal may be short-lived as shade tolerant species take over the growing spaces provided by the openings.

The past and future prescribed burning activities listed above will continue the process of fuel reduction and moving the project area toward a Condition Class 1 (low risk of losing key ecosystem characteristics due to wildland fire) in very limited areas; however, due to the few acres burned, the overall fuel load in the project area will not be reduced and resources in the area will continue to be at risk for intense, difficult to control fires. Fuel Model 7, with the potential for extreme fire behavior, will continue to dominate the project area.

No Action Conclusions

Ignitions will continue to occur. Under the No Action Alternative, fuel loads will continue to increase. Resistance to control will increase while the ability to provide for firefighter and public safety in the case of wildland fire will continue to decrease. Significant mortality of existing overstories can be expected.

Proposed Action

Direct and Indirect Effects

The goal of the proposed prescribed burning is to reduce the risk of destructive fires. By conducting a consistent prescribed fire program, the acres of hazardous Fuel Model 7 can be replaced with Fuel Model 2, which has reduced fuel loads and milder fire behavior. Refer to the Fire Behavior Summary on pages 14 and 17 of this report for the comparison between Fuel Models 2 and 7.

Prescribed burning activities are typically conducted at weather conditions similar to the 50th percentile weather (reported on page 13 of this report) or at slightly higher percentiles. Weather conditions near the 97th percentile will be avoided due to the increased likelihood of killing a significant percentage of trees. The outputs reported below, describe the potential behavior of a prescribed fire which is ignited under 50th percentile weather. A majority of prescribed burning is accomplished using backing fires, flanking fires, or strip head fires. Uncontrolled head fires (fires which run indefinitely in the direction of the wind) are generally avoided for prescribed fire. Due to the high intensity at which they can burn, they can build up substantial intensity and increase overstory mortality (an analysis of the effects of an uncontrolled head fire can be found on page 14 of this report). A strip head fire is a fire which runs for a very short distance in the direction of wind; it differs from an uncontrolled head fire in that the intensity can be controlled by limiting the distance the fire travels. Backing fires are fires which back into the wind and burn at the least intensity, rate of spread, and flame length. Flanking fires burn perpendicular to the direction of the wind and burn with effects intermediate of head fires and backing fires.

The BehavePlus computer model was used to generate potential fire behavior outputs of the proposed prescribed burning at 50th percentile weather. The outputs for Fuel Model 7 will reflect the current fuel loading. As future prescribed burns are conducted, fire behavior will decrease as the fuel loads decrease with each successive burn. As time progresses, the acres of Fuel Model 7 will take on the characteristics of Fuel Model 2, fire behavior will decrease. As the young pine plantations mature into sawtimber stands, thinning and prescribed fire will encourage the development of an herbaceous ground cover, developing conditions consistent with Fuel Model 2.

Fire Behavior Outputs	Pine Plantation Fuel Model 7	Pine Sawtimber Fuel Model 7	Pine Sawtimber Fuel Model 2
Rate of Spread (chains per hour)	3.9	4.2	0.3
Fireline intensity (BTU/ft./sec)	97	40	1
Flame Length (feet)	3.7	2.5	0.4
Scorch Height (feet)	20	10	0
Probability of Mortality*	*	*	*

*The BehavePlus model would not recognize mortality less than 14 percent. Based on past experiences with prescribed burning in fuel types and fuel loads similar to the conditions found in the Boswell Creek project area, the actual mortality of pine sawtimber under prescribed burning conditions in the Fuel Model 7 will be negligible due to the superior fire survivability of large pine; actual mortality of pine sawtimber in Fuel Model 2 will be even less than in fuel model 7 due to the overall reduction of fire behavior in Fuel Model 2. Mortality in the young pine plantations will be controlled by selecting cool, moist conditions to conduct the prescribed burns until the fuel loads have been reduced to manageable levels. Plantations on this Forest have been prescribed burned with little or no significant mortality.

In the short term, direct effects to the fuels profile will be seen in the reduced fuel loads, fireline intensities, flame lengths, and rates of spread. In the long term as a consistent prescribed fire program is applied, Fuel Model 7 will be replaced by Fuel Model 2 and grass/forb type understories will become more common. As fuel loads decrease, fire behavior will also decrease.

As fuel loads decrease and Fuel Model 2 becomes more common, the indirect effects of the Proposed Action will address the priorities of fuels management for the project area (as summarized on page 1). Protection of health and safety for the firefighter, the local community, and the general public will be significantly improved through the reduction of fuel loads and fire behavior. Acres of Fuel Model 2, which closely resembles the DFC for MA-2, RCW Emphasis, will be increased. The Proposed Action will restore Condition Class 1 fuel conditions (low risk of losing key ecosystem components due to intense wildland fires).

Cumulative Effects

Activities have taken place and continue to occur in the Boswell Creek project area which could have cumulative effects with the Proposed Action. See the discussion above in the No Action Alternative for a description of past activities in the project area.

In the Proposed Action, thinning and prescribed fire would be conducted throughout the project area. Prescribed burning would be conducted on a two to five year cycle on approximately 8,650 acres of the project area. Thinning would take place on 3,360 acres of young pine stands and 1,440 acres of mature pine stands.

The actions listed above will be instrumental in fuel reduction and progressing the project area toward Condition Class 1 (low risk of losing key ecosystem characteristics due to wildland fire). The Proposed Action insures that all acres in need of fuels treatment will be prescribed burned on a consistent basis in order to develop a Fuel Model 2 in the pine and pine/hardwood forest types. Models of Fuel Model 2 have shown significant decreases in fire behavior over the existing Fuel Model 7. Thinning will be utilized in much of the project area; thinning will allow sunlight to the forest floor to encourage an herbaceous groundcover to develop and be maintained by prescribed fire.

Proposed Action Conclusion

Ignitions will continue to occur. Under the Proposed Action prescribed burning will reduce fuel loads which will reduce fire behavior in terms of flame lengths, fireline intensity and rates of spread. The prescribed burning will also aid in the restoration of potential RCW habitat and fuel Condition Class 1 characteristics. Fire behavior in the wildland-urban interface will be considerably reduced.

Literature Cited

Anderson, Hal E., 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service General Technical Report INT-122. Intermountain Forest and Range Experiment Station, Ogden, Utah.

Reeves, Hershel C., 1988. Photo Guide for Appraising Surface Fuels in East Texas: Grasses, Clearcut, Seed Tree, Loblolly Pine, Shortleaf Pine, Loblolly/shortleaf pine, Slash Pine, Longleaf Pine, and Hardwood. Center for Applied Studies, School of Forestry, Stephen F. Austin State University, Nacogdoches, Texas, 75962.

USDA, Forest Service. 2000. Wildland Fire in Ecosystems: Effects of Fire on Flora. General Technical Report RMRS-42, vol. 2. Rocky Mountain Experiment Station. Pages 53-59.

The following table lists the locations of the photo points discussed in this report:

Photo Point	Lat./Long	
1	30.65349	95.41535
2	30.66898	95.41914
3	30.65590	95.41682
4	30.63508	95.40645
5	30.62454	95.37975
6	30.63190	95.37469
7	30.64439	95.37438
8	30.68724	95.38810
9	30.68912	95.39979